IT EXPRESS '23

KATHMANDU UNIVERSITY

Department of Computer Science and Engineering

Dhulikhel, Kavrepalanchowk, Nepal

Prof. Dr. Manish Pokharel

Dean, School of Engineering

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It is my immense pleasure to know that the Department of Computer Science and Engineering is going to publish the annual magazine 'IT Express' with the effort of our departmental club KUCC. A substantial amount of work has been performed in developing this magazine and I believe that the audience will observe the effort reflected in this new edition.

As we look at IT Express, it is crucial to consider that it represents the collective thought of a group of innovative faculties as well as students who are able to make considerable contributions in the field of IT to this magazine. I am proud of the entire editorial team and happy to be able to draw upon their individual and collective knowledge, talent, judgement, and disciplinary backgrounds to advance engagement. I am excited about what the magazine will add to our ability to communicate with broad audiences on matters of different areas of IT innovations and scholarly works.

I would like to thank our students, advisors and faculties who supported publishing this magazine. I look forward to our journey together as we develop the Technical Magazine into a grand success.

Prof. Dr. Janardan Lamichhane

Dean, School of Science

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I am extremely delighted to welcome you to the latest edition of our IT Express. As the power of information technology continues to transform businesses, communities, and our everyday lives in today's rapidly expanding tech universe, this publication serves as a testament to our unwavering dedication to staying up-to-date with cutting-edge changes, promoting thought-provoking debates, and building a community of IT specialists and enthusiasts.

To breathe life into the IT Express, our contributors have invested countless hours compiling research results, professional judgments, and valuable insights that not only highlight the most recent trends in technology but also offer a glimpse into the possibilities of the future. With that, it becomes clear that our students as to-be IT professionals, transcend beyond mere coding and network management. They manage the complex interactions between technology and the human experience establishing a moral, welcoming, and opportunity-rich future for everyone.

In the end, I invite you to explore the pages of the IT Express, engage in discussions around the presented topics, and carry on the dialogue beyond what has been published as IT Express is more than just a repository of articles; it's also a hub for the exchange of knowledge, the articulation of innovation, and the fusion of ideas.

Dr. Bal Krishna Bal
Head of Department, DoCSE
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It gives me great pleasure as the HOD of the Department of Computer Science & Engineering to announce the unveiling of our annual magazine IT Express, released by the Kathmandu University Computer Club (KUCC). For years this magazine has served as a valuable platform to showcase our activities, share news from our research labs, and explore contemporary computing topics. This magazine is a valuable asset of our Department, and its release has always been an awaited event.

As we prepare for the latest edition of IT Express, I am excited to reaffirm our commitment to upholding its tradition of excellence. This new venture is expected to mark a major milestone, particularly for research-oriented students and faculties involved in the publication of research and academic articles.

On behalf of the Department of Computer Science & Engineering, I extend my best wishes to IT Express and its entire team. May this magazine continue to serve as a source of inspiration and pride for our department, fostering a sense of community and innovation among us all.

Pankaj Raj Dawadi
Assistant Professor, KUCC Advisor
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I am delighted to share the news that the Department of Computer Science and Engineering (DoCSE) and the Kathmandu University Computer Club (KUCC) are gearing up to unveil the latest edition of our esteemed departmental magazine, IT Express 2023. This year's launch follows the success of our renowned departmental event, IT MEET 2023.

Anticipation fills the air as we prepare to witness another volume of IT Express, a publication known for its tradition of delivering engaging and informative articles across a spectrum of technical subjects and practical applications. This magazine has established itself as a pivotal platform for learning and sharing knowledge, showcasing the diverse perspectives of our students and faculty members across various domains of expertise.

The collective efforts of our contributors have significantly enriched IT Express by delving into topics ranging from artificial intelligence (AI), web technologies, databases, cloud computing, and beyond. Their contributions have elevated the publication, fostering a deeper appreciation among readers for the valuable insights shared within its pages.

The dedicated team behind IT Express 2023 has tirelessly embodied the magazine's core values and principles. From the diligent editorial and volunteer teams to the creative minds shaping its design, each member has collaborated seamlessly to make this year's edition more captivating and enriching for our audience.

As the eagerly awaited magazine approaches its release, I am personally excited to explore the latest advancements and research spanning various realms of information technology it will present. My sincere gratitude extends to every individual involved, including the faculty, advisers, and students, for their invaluable contributions to the creation of this magazine.

I express my heartfelt appreciation to the IT Express team for their unwavering dedication and hard work. With their efforts, I am confident that IT Express 2023 will be an outstanding success.

Looking ahead, I hold firm belief that our division will continue the cherished legacy of IT Express, enriching minds and fostering knowledge exchange in the years to come. I eagerly anticipate the forthcoming launch and the valuable insights IT Express 2023 will undoubtedly bring to our community.

Ayush Aryal
President, KUCC
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At KUCC, we believe in pushing boundaries and not settling for the ordinary. To achieve this, we collaborate with national and international organizations to organize workshops, seminars, hackathons that thrust you into the real world of technology. Through our sister wing KUOSC, we champion open-source culture, fostering innovation both within and beyond the university.

Our annual flagship event, IT Meet with its pre-events like KU Hackfest and AR Treasure Hunt, brings together diverse minds to celebrate the magic of technology. And this annual magazine, IT Express isn't just a collection of articles; it's a testament to the vibrant energy, boundless creativity, and relentless pursuit of knowledge that defines our community.

The experience you get by participating in the events of KUCC are more than just lines on a resume; they're the fire that ignites your passion, sharpens your skills, and reveals your hidden potential. Every workshop, every hackathon, every interaction is a chance to break free from your comfort zone and build the confidence to conquer new challenges. Remember, every opportunity carries the potential for growth and every experience shapes you into the tech champion you're destined to be.

As you delve into the pages of IT Express, let the stories within inspire you to explore, to experiment, to chase your dreams. Enjoy the magazine, embrace the opportunities, and never forget — in the world of technology, there's only one way to fail: by refusing to try.
Onwards and upwards.

MEET THE TEAM

COORDINATOR

Angelina Ghimire
Computer Science 2020

EDITORS

Ishan Panta (Lead)
Computer Engineering
2020

Adhishree Acharya
Computer Engineering
2020

Prabesh Timilsina
Computer Engineering
2020

Shubhashish Karki
Computer Engineering
2020

DESIGNERS

Reewaj Khanal (Lead)
Computer Engineering
2020

Diwas Parajuli
Computer Engineering
2021

Shashinoor Ghimire
Computer Engineering
2021

Rista Shrestha
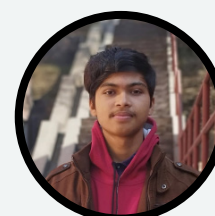Computer Engineering
2021

Abhiyan Dhakal
Computer Engineering
2021

Aayush Pokhrel
Computer Engineering
2021

VOLUNTEERS

Ashwini Subedi
Computer Science 2022

Sanjay Pahari
Computer Engineering 2022

Message From The Team
IT Express 2023

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has.

- Margaret Mead

With great pleasure and anticipation, we present to you "IT EXPRESS 2023", a culmination of boundless creativity, unwavering dedication, and collective effort. This edition of our annual magazine serves as a vibrant tapestry woven by the diverse threads of our team members, each contributing their unique colors to the canvas of our publication. Our team has collectively yearned for excellence, resulting in the creation of IT EXPRESS as a testament to our shared aspirations.

As we release this edition to the world, we reflect on the wisdom of Helen Keller:

Alone we can do so little, together we can do so much.

The synergy of different talents and skills within our team has been the driving force behind the creation of a magazine that we hope will not only inform but also inspire. The relentless efforts of each team member coupled with effective communication, meticulous planning, and collaborative problem-solving, has ensured not only a timely delivery but also a publication of exceptional quality.

In curating this year's magazine, we celebrate the diversity of perspectives and topics, crafting a mosaic that reflects the richness of thought and insight in our student body and faculty.

We extend our heartfelt gratitude to all who have contributed to this endeavour and invite you to immerse yourselves in the pages of "IT EXPRESS 2023", where our collective passion shines through each page.

Meet the Faculty

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Area of Interests

Digital Governance, SMART City, Cloud Computing, Internet of Things (IoT), Artificial Intelligence (AI), Big Data, Software Technology

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Area of Interests

Internet of Things, Neutrosophic theory and Neutrosophic Soft Set System

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Area of Interests

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Chandika Oli

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President

Angelina Ghimire
Vice President

Aayush Pokharel
General Secretary

Kabin Bhandari
Treasurer

Aadarsha Dhakal
KUOSC Coordinator

Dilasha Upadhyay
Club Secretary

KUCC Board 23/24

Executive Members

Priyanshu Sharma

Reewaj Khanal

Roshan Sahani

Nilotpal Dhakal

Shreya Khatiwada

Abhiyan Dhakal

Rista Shrestha

Rishad Baniya

Bigyan Kumar Piya

KUOSC Community 23/24

Bikraj Shrestha
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Nirjal Bhurtel
Entrepreneurship & Outreach

Bibushan Saakh
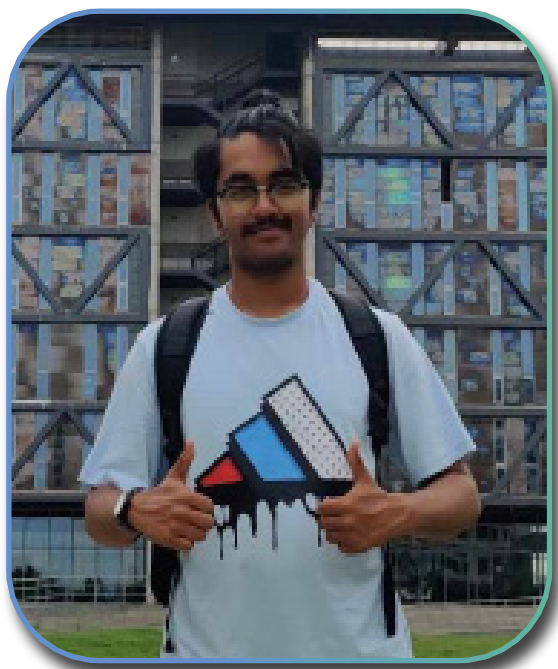Design

Saskar Khadka
Dart

Ashish Thapa
Rust

KUOSC Community 23/24

Anish Manandhar
ML & DS

Anurag Timilsina
ML & DS

Ishan Panta
Documentation

Dipen Khatri
Health & Informatics

Labs Under DOCSE

Information and Language Processing Research Lab

Established in the year 2004, the Information and Language Processing Research Lab (ILPRL) under the Department of Computer Science & Engineering, Kathmandu University has a continuous track record of Research and Development in the Language Technologies Domain. Until recently, the lab's focus was predominantly on the Nepali language. However, of late we are also prioritising the works on other languages spoken in Nepali like Tamang and Newar among others. We have developed some basic proof-of-concept of some very useful language technologies like Optical Character Recognition (OCR), Text-to-Speech (TTS), Automatic Speech Recognition (ASR), and Machine Translation (MT) to name a few.

Digital Learning Research Lab

The DLR Lab, established in 2016, is dedicated to promoting research culture and digital innovation in higher education within Nepal. Through projects funded by organizations such as the University Grants Commission and the International Development Research Centre of Canada, the lab focuses on integrating knowledge management techniques and HCI principles to enhance online learning experiences. Additionally, it explores topics such as student retention, data mining in online learning systems, and the usability of platforms like MOODLE. By developing MOOCs and collaborating with international partners, the lab contributes to the advancement of education in Nepal and beyond, striving to empower educators and learners alike through digital learning initiatives.

Active Learning Lab

Established in 2019 with the backing of the Department of Computer Science and Engineering and the ALIEN project funded by Erasmus+, the Active Learning Lab focuses on pioneering active learning methodologies, particularly utilizing Project/Problem-Based Learning (PBL) supported by simulators and games. With a mission to address real-life challenges related to math, science, and engineering concepts, the lab aims to foster research and innovation in Teaching-Learning Technologies. Among its notable projects are ALIEN and ICT-INOV, alongside initiatives analyzing the effectiveness of project-based learning and exploring Learning Management Systems (LMS) through the KU high-performance computing cloud. By actively engaging in pedagogical research and collaborating with international partners on MOOCs and educational initiatives, the Active Learning Lab plays a pivotal role in advancing educational practices and technologies within Kathmandu University and beyond.

NEWS AND EVENTS

Linux Talk and KUOSC Orientation

The "Linux Talk" organised by Kathmandu University Open Source Community (KUOSC) on March 9, 2023 aimed at highlighting the significance of Open-Source Software (OSS). The main focus of this event was Linux, a major OSS operating system. This session introduced students to Linux and the benefits of Open Source Software for developers, covered command-line navigation for Linux, Vim text editor, and also entertained the students with engaging games. This event also served as an orientation program for KUOSC which was facilitated by Rishikesh Khakurel, Abhiyan Dhakal, Rishad Baniya, and Aadarsha Dhakal.

Python And Django Bootcamp

Addressing the growing demand for Python and Django expertise, Python Community took a proactive step by organising a virtual Python and Django BootCamp spanning for a length 5-6 weeks. The event commenced on the 31st of March and was led by the Python Community Co-ordinator, Ranjan Lamsal. It was hosted every Friday and Saturday to help participants master the basics of Python in the initial phase followed by building a backend server with the help of Django. The series also included hands-on projects to test the knowledge of the participants. In the end, a few of the participants showcased their projects as a testament to the success of comprehensive and hands-on bootcamp.

Email Writing Workshop

On May 5th, the Documentation Community hosted an online "Email Writing Workshop" aimed at guiding participants through the essentials of composing effective emails while introducing them to various useful AI tools for email writing. Led by Ishan Panta, the Documentation Community Coordinator, the session provided valuable insights into structuring an email and introduced various AI tools for writing proper emails. This workshop not only equipped participants with contemporary communication techniques but also demonstrated the potential of AI in our various day-to-day activities.

April Design Community Meetup

On April 4, 2023, the Design Community hosted a meetup featuring Aadarsha Dhakal's presentation on KUOSC. This insightful event connected Aadarsha Dhakal and Bibhushan Saakha, encouraging knowledge-sharing and collaboration within the design community.

Localization 101

To familiarise students with the concept of localization, three sessions of "Localization 101" were conducted every Sunday from April 2nd to April 16th, 2023. This event helped to guide developers in adapting the language, look, and feel of their software for users from various backgrounds. The event took place online, where participants discussed the prospects of localization, steps in software localization, Nepali Vyakarana rules, the necessity of a style guide, how to prepare a style guide, the importance of a glossary, and guidelines for creating one. Additionally, assignments were given to students to implement what they learned during the sessions. The event was organised by the Kathmandu University Open Source Community (KUOSC), with invaluable support from Saroj Dhakal, a Senior Software Product Manager renowned for his contributions to localization and internationalisation efforts.

Cyber Security Roadmap

To provide a spotlight on the critical issue of cyber-attacks and highlight the significance of Cyber Security in today's digital landscape, Kathmandu University Open Source Community organised a virtual event "Cyber Security Roadmap" on the 10th of May. The event featuring Prasant Adhikari, an Offensive Security certified professional as a keynote speaker not only emphasised the robust cyber security practices but also stressed adopting proactive measures to protect digital assets and personal information. In summary, the event empowered participants to navigate through the digital realm more securely.

30 Days of learning JS

On April 9th, 2023, the Java Script Community conducted a month-long workshop titled "Learning JS for 30 days" with the objective to assist novice learners in acquiring the fundamentals of JavaScript while reviewing their current knowledge on the topic Throughout the course, participants explored the essentials of web development and enhanced their JS expertise, all the while sharing their daily learnings and newfound insights with the world via Twitter. Overall, the event was a huge success, as a substantial number of participants expressed their gratitude through blogs, highlighting the community's outstanding achievement.

April JS Community Meetup

On April 6, 2023, the JS Community hosted a meetup titled "Let's Talk About JS." The attendees, including Aadarsha Dhakal, Jamyang Gelek, Bikraj Shrestha, and 15 others, engaged in discussions covering topics such as introducing KUCC and KUOSC, discussing JavaScript's past, present, and future, and exploring its potential and the surrounding community. They also discussed their plans for collaboration and enjoyed a fun JavaScript quiz. This meetup enhanced participants' knowledge of JavaScript, facilitated networking within the JS community, contributed to community growth, and provided a positive educational experience for those interested in JavaScript and web development.
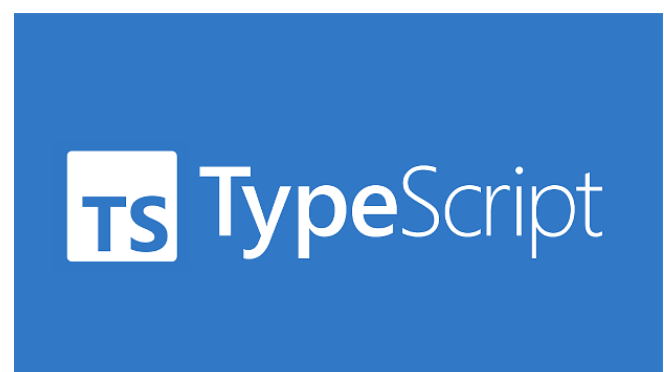
Welcome Programme

University students eagerly anticipate welcome parties as the highlight of their academic journey. These gatherings, hosted by senior students, serve as a warm introduction for newcomers joining the university. In the case of the DoCSE seniors, they organised a welcome party featuring diverse performances, speeches, and the Mr./Mrs. Freshers Competition. The event was characterised by enjoyable concerts and dance performances, showcasing the wholehearted participation of students. The organising team demonstrated professionalism and creativity, putting in special efforts to ensure the function was a memorable experience for all attendees.

TypeScript Workshop

On May 3rd, 2023, the JavaScript community, together with Kathmandu University Open Source Community, organised a workshop to help students understand the intricacies of Typescript. JavaScript does not provide details about function parameters and variables. Therefore, to tackle this, TypeScript was created as a more robust version of JavaScript that allows you to specify your desired data type. The workshop delved deep into the significance of TypeScript, exploring the concept of static typing and its importance. The event also highlighted how TypeScript helps in maintaining robust and less error prone code. Participants also engaged in coding exercises led by Aashish Thapa, Rust Community Coordinator, and Mahip Adhikari.

OOP with Javascript

To explore Object-Oriented Programming using Javascript , KUOSC hosted a workshop titled "OOP with JavaScript" on April 27, 2023. OOP uses the concept of objects to implement real-world entities. Starting with the principle of OOP, the event transitioned into concepts of prototype-based inheritance and concluded with the concept of mixin. Conducted by Saurav Ghimire, the event significantly strengthened the participants' confidence to tackle real-world programming challenges with the help of OOP.

Python Workshop

Spanning six immersive days, this workshop was specifically designed to cater to master's students specialising in Health and Informatics at Kathmandu University. The comprehensive curriculum began with an introduction to the course, including setting up the Python environment. It then proceeded to cover essential Python topics, including a study of Python's data types and structures, followed by an exploration of comparisons, logical statements, and loops. The program then delved into methods and functions, teaching students about Python's function and module concepts. Object-Oriented Programming (OOP) principles were introduced, explaining the key components of OOP and how they relate to Python. The workshop concluded with a practical project presentation, allowing students to apply their knowledge by creating a Python project relevant to health data. By the end of this well-structured course, students were well-equipped with a strong foundation in Python programming and its practical applications in the healthcare domain.

Machine Learning Bootcamp

A 7-day training event "Machine Learning Bootcamp", led by the ML community coordinators Anish Manandhar and Anurag Timilsina, was initiated on April 9, 2023. The event was designed for both beginners and intermediate-level students to include machine learning in their skillset. The course focused on ML techniques implemented in analysing large datasets in the business and data analytics field. The event witnessed a good number of participants who were introduced to the basics of Python and progressed to ANN classifier by April 17, 2023. A few quizzes to test the participants' progress and finally an online talk show with professionals concluded the bootcamp.

Session on Academic Opportunities -EOC

On Saturday, April 8th, 2023, the Entrepreneurship & Outreach Community (EOC) organised the "Academic Opportunities after Bachelors" webinar. The event aimed to provide clarity and guidance to students interested in pursuing further studies after completing their bachelor's degree. It featured experienced graduates from Kathmandu University who shared insights and experiences, including Santosh Sir, a Research Scientist at Meta, and Dipendra Sir, a Master's graduate from Kathmandu University with experience in the IT sector. This interactive session allowed participants to ask questions, and the speakers addressed queries submitted in advance via the registration form. The webinar attracted 118 participants and served as a valuable resource for those exploring academic prospects beyond their bachelor's degree.

OSM 19th Anniversary Celebration

On August 9, 2023, Kathmandu University Open Source Community (KUOSC) hosted the "OpenStreet-Map 19th Anniversary Celebration". It was a gathering of mapping enthusiasts, students, and community members. The event featured a welcome address from Aadarsha Dhakal, a keynote speech by Mr. Suraj Thapa, and opportunities for networking and collaboration. A special cake-cutting marked the occasion, symbolising unity within the OpenStreetMap community. Gratitude was extended to all attendees, volunteers, and speakers, with a special mention of the KUCC for their support in encouraging community

Tech2Empower's Day for University Women 2023

WAKE organised Tech2Empower's Day for University Women in partnership with KUCC in the Nepal Technology Innovation Center, Dhulikhel. The day of dynamic cross-cultural learning provided university women studying STEAM, both in KU and other colleges across the valley, the opportunity to attend innovative and creative workshops led by Tech2Empower Advisors. Tech2Empower Advisors are professionals from top tech companies, and twenty-two advisors came together and devoted their expertise, time and resources to lead thoughtfully curated technical and non-technical workshops for the 70+ female participants. Topics included artificial intelligence, leadership, overcoming imposter syndrome as well as personal branding and marketing. An unwavering sense of community and support was palpable throughout the day, and served as a powerful reminder of the remarkable things that can happen when women come together to uplift and inspire one another.

Proposal Writing Workshop

On the 15th of August, the Documentation Community conducted a successful "Proposal Writing Workshop," as a pre-event for the IT MEET 2023.This insightful event aimed to enhance participants' proficiency in crafting compelling project proposal which was facilitated by Ishan Panta and Priyanshu Sharma. They shared invaluable strategies and practical insights into effective proposal structuring. Through engaging interactive sessions, participants had the opportunity to apply these techniques firsthand, refining their skills. As a dynamic prelude to the IT MEET, this workshop not only fostered skill development but also built excitement for the forthcoming main event.

Exploring Freelancing with Upwork

On April 26, 2023, an event titled "Exploring Freelancing as a Student" was held featuring Shailesh Dahal, an accomplished alumnus of Kathmandu University. As a top-rated freelancer on Upwork since student life, he shared invaluable strategies and insights for students interested in freelancing. Practical advice like creating a Freelancer profile, strategies for effective communication, avoiding mistakes in the competitive freelancing landscape, understanding the payment process, utilising connections, and much more was covered during the event. Attendees were captivated by the speaker's inspiring journey and interacted with him through a Q&A session seeking to excel in the world of freelancing.

IT MEET 2023

The highly anticipated tech festival, "IT MEET 2023," was organised on December 3rd and December 4th after a series of 30 exciting events all throughout September to December. Organised by the Kathmandu University Computer Club (KUCC) and the Department of Computer Science and Engineering, this non-profit event is a major highlight in Nepal's IT scene. It helped in offering the students a unique platform to showcase their talents, stay updated on industry trends, and bridge the gap between academia and the professional world. Since its inception in 1997, KUCC has fostered tech education, with "IT MEET" becoming one of Nepal's premier tech fests. The latest edition, IT MEET 2023," with its theme of "Tech Unleashed, Ideas Ignited," successfully attracted many enthusiastic students.

KU Hackfest 2023

An event aimed to inspire, innovate in the realm of problem-solving in technology , KU Hackfest a 48 hour hackathon was organised on 29th September - 1st October. This event brought almost 200 programmers, developers, designers, and enthusiasts, making it the largest physical hackathon ever conducted in Nepal. This event helped to increase networking and mentorship opportunities for the highly enthusiastic participants. KU Hackfest 2023 was the third iteration, building upon the success of previous years. With an emphasis on diversity and collaboration, KU Hackfest 2023 turned out to be an exciting platform for participants to make an impact through cutting-edge tech solutions.

Software Freedom Day

On September 16, 2023, Kathmandu University Open Source Community hosted a lively event celebrating Software Freedom Day at the NTIC Building Hall. With an agenda spanning six hours, attendees were treated to a variety of activities including enlightening speaker sessions, engaging localization workshops, invaluable networking opportunities, and the release of noteworthy FOSS projects. The day culminated in an award ceremony recognizing the remarkable contributions to FOSS projects. The event left attendees feeling inspired to continue championing the core values of FOSS, such as honesty, teamwork, and community involvement. Participants, including students, teachers, and professionals, were encouraged to persist in their efforts to advocate for an equitable digital future filled with creative solutions and collaborative endeavours.

HacktoberFest

On October 5-6, Kathmandu University Open Source Community (KUOSC) organised the highly anticipated KUOSC Hacktoberfest 2023, a two-day virtual event. The event aimed to immerse participants in the world of open source and collaboration. On the first day, attendees were introduced to Hacktoberfest and the significance of open source, receiving guidance from experts to accommodate both beginners and seasoned contributors. The following day focused on demystifying Git and GitHub, equipping participants with essential tools for open source participation. Whether attendees were making their first contribution or honing their skills, the event served as a gateway to the vibrant world of open source. Through this event participants gained access to a global community of developers and celebrated the spirit of open source which fostered collaboration, innovation, and a deeper understanding of the open-source ethos.

Libreoffice Localization Sprint

In October, Kathmandu University Open Source Community (KUOSC) and The Document Foundation collaborated to host the highly anticipated LibreOffice L10N Sprint 2023. This event aimed to engage participants in translating English to Nepali, thereby enhancing LibreOffice's accessibility and usability for Nepali speakers. With support from the community and esteemed mentors like Saroj Dhakal, Aadarsha Dhakal, and Suraj Bhattarai, the sprint provided a platform for new contributors and students to immerse themselves in the world of open-source localization. The event, which lasted for an hour each day, saw over 50 enthusiastic students joining in. The orientation day on October 11th, 2023, marked the beginning of this exciting journey. The winners from KUOSC, Ashwini Subedi, Razat Dahal, and Manoj Bhattarai, showcased their dedication to the cause. This collaborative effort during Hacktoberfest undoubtedly strengthened the FOSS community and contributed to the global movement of open-source software development.

Q & A with
Dr. Bal Krishna Bal

Dr. Bal Krishna Bal

Department of Computer Science and Engineering

Areas of Interest: Software Localization, Natural Language Processing, Language Specialization, Social Computing

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Interviewed by Adhishree Acharya and Ashwini Subedi

Introducing Dr. Bal Krishna Bal, Associate Professor and Head of the Department of Computer Science and Engineering at Kathmandu University. In this insightful interview conducted by Adhishree Acharya and Ashwini Subedi, Dr. Bal shares his expertise in software localization, natural language processing, and social computing. From enhancing NLP models for low-resource languages to discussing the significance of machine translation in education, Dr. Bal provides valuable insights into the intersection of technology and language preservation. Join us as we explore Dr. Bal's journey and vision for language technology in Nepal.

Given your expertise in NLP, what methods have you found most effective in enhancing the accuracy of NLP models for low-resource languages like Nepali?

One of the biggest challenges we have been facing, especially when dealing with low-resource languages, is that we don't have adequate datasets. Saying that we cannot just wait until all the required datasets are collected because it would be a lengthy process. In our lab, we try to fine-tune the pre-trained models that are doing well for some resourceful languages with our limited datasets.

This semi-supervised approach is one of the most popular approaches in machine learning and deep learning, in which we have very few labeled datasets and mostly unlabeled datasets. With this trending approach, we start with a very small dataset of our own and build additional datasets over time using the pre-trained model and the small datasets.

When working in Natural Language Processing, it would not be a good idea to develop a model from scratch because, no matter how meticulously we develop these models, there'll always be problems like memory leaks and optimization issues. Therefore, we should rather opt for the most effective method, i.e., take the state-of-the-art model and customize it in our language domain. Given the current open-source nature of these models, finding them isn't a challenge; it's more about refining them to align with our specific data and language needs. We would surely develop a better model with ample datasets in our language if we could accomplish this.

One of your research topics is "Enabling a Multilingual Teaching Learning Environment through Machine Translation Technologies", could you highlight the significance of developing a Machine Translation System for multilingual education and discuss your plans to improve its accuracy and dataset size for better translation quality?

I first got into machine translation in 2005, so it's been a while since we have been working on this topic. Back then, we didn't have such advanced models and ML was also in its early stages. We primarily focused on rule-based approaches, particularly a lexicon-based method that was rule-driven. But soon, the paradigm of machine translation shifted to statistics, which demanded more data. Over time, deep learning and neural learning also became popular. This shift somewhat addressed the previous data limitations, as these models could be adapted and fine-tuned for specific language requirements. Now, with the advancement of technology, we are in a better position, at least in terms of the effort required for implementation.

The primary reason for choosing multilingual education is the diversity of languages in Nepal. With over 123 languages spoken, the Nepali language does not serve as the mother tongue for the entire population. For the majority of people residing in Nepal, it is more like a lingua franca or link language.

In rural areas, few people speak Nepali, and English is a distant language for them. The irony is that most knowledge sources found online are written in English. We cannot deny that there are some resources available in Nepali as well. However, it is still ineffective in such areas, where people have difficulty speaking or even understanding Nepali, making it hard for them to grasp the material. Language is a crucial teaching tool, and when educational content is in one's mother tongue, perception and understanding significantly improve.

However, the whole concept of multilingual education transcends beyond the mother tongue. Given that most educational materials are in English, Nepali, or other languages, machine translation becomes crucial.

Machine translation translates the source language into the target language. For example, English is the source language and Nepali is the target language if we translate a paragraph written in English to Nepali. Machine translation plays a vital role in translating the material available on the internet into the mother tongue or any other required language for better understanding.

To do this, we need to provide labeled parallel datasets to the system model. For example, if we want to translate English to Nepali or Tamang language, then we need to gather a substantial amount—let's say around 100K units of English text alongside their corresponding translations in either Nepali or Tamang. This collection, known as a parallel corpus, serves as training material for systems. By exposing the system to these paired texts, it learns to accurately translate between English and the chosen language (Nepali or Tamang). Once the model is trained with a parallel corpus, we can work to improve its accuracy either by adding more datasets or fine-tuning the different parameters involved.

Currently, I've been working on Tamang-Nepali language translation with my team, and we have also published papers that aim to promote multilingual education in Nepal. This initiative aims to support children in villages who struggle with understanding, ensuring they benefit from accessible educational resources.

When developing language technologies, ethical considerations are crucial. How do you approach ethical concerns, especially in handling sensitive data or potential biases in language models, and how do these considerations influence your research and development process?

Biases are present in every domain, and the language domain is no exception. However, as researchers, we need to actively work on minimizing all these biases. One of the most effective ways to mitigate these biases is to make the research more participatory, ensuring inclusivity regardless of gender. It might seem unconventional, but even during data collection, different perspectives may arise depending on whether data is collected by females or males during the collection stage. Therefore, we need to create balance in our team. Moreover, there should be guidelines for datasets and data collection so that such biases or discriminations do not creep in. The next thing is that we need to respect the privacy and confidentiality of the respondents. If somebody does not want their credentials to be disclosed, then we should ensure it. Nowadays, there is a lot of stress on developing ethical systems. It's not merely about creating systems but ensuring their ethical development. We have been trying to adhere to these standards and norms so that whatever our research outcomes are, they are developed ethically.

Having traversed between academia and industry in NLP and software localization, how has this dual experience shaped your approach to teaching and research at Kathmandu University?

I joined Kathmandu University in 2009 as a full-time faculty member. Before that, I had worked in the industry, specialising in Nepali language Computing, and Software Localization. Upon joining KU, I noticed a gap between industry and academia. Academic projects seemed disconnected from real-world issues; they were more like dummy projects. Later, I took the initiative to change that particular approach by integrating practical elements.
As I was working in the industry, I had the opportunity to interact with a wide range of people from different backgrounds and collaborate across academia and various societal areas. I am glad that I could share the

knowledge and skills gained from industry with Kathmandu University.

I'm still in touch with the organization that is now referred to as the Language Technology Kendra. It is the consortium of Kathmandu University, the Department of Computer Science and Engineering, Tribhuvan University, the Central Department of Linguistics, and Madan Puraskar Pustakalaya.

I believe academia is still the powerhouse of all research activities due to the continuous flow of students - when one batch graduates, the other batch joins. Therefore, academia fosters an environment for incubating new ideas. Considering this, there should be a forced collaboration between academia and the industry. It's a win-win situation as academia possesses what the industry might lack and vice versa, forming a symbiotic relationship. As someone who has spent a considerable amount of time in the industry and is currently working in academia, I see ample opportunities for collaboration. We, from academia, have skilled students, and in the industry, they encounter real issues. This creates an opportunity for both of us to benefit mutually.

Your work seems to have a significant societal impact, especially in preserving and enhancing Nepali language technologies. How do you envision these advancements shaping Nepali society in the next decade?

I believe that language should be the pride and identity of any community. Yet, without its significant presence in the global language resource map, we cannot preserve the language and pitch things forward. Nowadays, big giant companies like Google, Facebook, and even Microsoft have been showing interest in developing language technologies for the languages of Nepal, particularly Nepali. While doing so, they also look at how much market we have.

As I mentioned earlier, Nepal has more than 123 languages. However, all these languages don't have a prominent presence in the market like Nepali, leading big tech companies to focus less on them. Therefore, as Nepalese citizens, it is our responsibility to uplift not just Nepali but also other languages of Nepal, even with zero or nominal little resources like corpus, dataset, and grammar, on the language resource map.

To advance in technologies, particularly in language technology, a balanced approach is necessary. Nepali is considered an under-resourced language, yet it is relatively more resourceful compared to other languages. Therefore, we should continue our efforts for Nepali and simultaneously replicate these strategies for other languages. This approach will uplift the status of languages and language technologies in the context of Nepal, making us more visible to the outside world.

Could you share some of the challenges you have encountered throughout your career in language technology? How did you effectively address and overcome them?

Previously, the major challenge was that we didn't have an adequate dataset and corpus, and without that, we couldn't move forward. We would just sit and wait. Now, the scenario is different. With these large language models that have evolved, we have a good proof of concept. We could largely benefit from these large language models like ChatGPT. We could even develop such technologies for languages like ours with fewer resources. Yes, it may require time and perseverance, but things don't appear as impossible as they did a few years ago.

Now, the challenge is to identify our problems along with the module that works best for us. Our contribution should be in terms of tuning the parameters that best serve as a model for our language. The next challenge we have encountered lately is the high demand for computing resources because of the substantial need for

large language models. However, I believe we can seek support from international philanthropic communities, like Nvidia, known for assisting less privileged communities by donating computing resources to academic and research institutions.

Today, the internet is an open library for everyone. The resources developed by Stanford or MIT can be accessed by us living in Nepal. But at the same time, as developing countries, one of the biggest challenges is to effectively manage these computing resources. Most of the resources are open, and it has indeed helped us to leap forward in a short period. Moreover, We are also working on different language technologies, including the latest cutting-edge technologies like automatic speech recognition, voice-based search, machine translation, and text-to-speech. So, I believe we still have a long journey to go, but I don't perceive our progress as poor. To sustain this momentum, we need to generate interest among students while exposing them to opportunities that lie ahead.

When we look at the present scenario, we have so many resources. You've been involved in this field for so long. But when you were just approaching, were there any challenges you faced?

Back then, the Internet was not as accessible as it is today. We had to pay at cyber cafes to browse and quickly download the files on a floppy disk. There were instances where we discovered the files were not saved upon returning home. This led to numerous challenges and limitations. Since then, significant changes have occurred. Now, you can save everything in the cloud. With time, challenges are also evolving. Things aren't the same as they were 20 years ago. Now, we have different sets of challenges, and the next generation is likely to face their own unique set of obstacles.

Q&A with
Dr. Rabindra Bista

Dr. Rabindra Bista

Department of Computer Science and Engineering

Areas of Interest: eHealth, IoT, wireless sensor networks, and software engineering

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Interviewed by Prabesh Timilsina and Sanjay Pahari

Introducing Dr. Rabindra Bista, Associate Professor at Kathmandu University's Department of Computer Science and Engineering. In this enlightening discussion led by Prabesh Timilsina and Sanjay Pahari, Dr. Bista delves into his extensive experience in digital health, IoT, and software engineering. From his pivotal role in securing significant research grants to his mentorship of Master's and Ph.D. students, Dr. Bista offers valuable perspectives on the future of technology in Nepal. Join us as we uncover Dr. Bista's contributions and aspirations in shaping the landscape of computer science and engineering.

What ethical principles and guidelines are essential for the collection, utilization, and dissemination of healthcare data, especially within the realm of Health Informatics, to safeguard patient autonomy, privacy, and uphold ethical standards?

We are obligated by the Constitution of Nepal to prioritize the security and privacy of patients' data. Sensitive medical information, such as conditions like AIDS or TB, must be handled with utmost confidentiality to protect patients from societal stigma and discrimination. Therefore, we must ensure that medical data remains confidential and accessible only to the relevant medical professionals, as mandated by Nepal's constitution.

Within hospital settings, access to patient data should be strictly regulated, limited only to relevant medical professionals.. In some cases, certain data cannot be shared between hospitals, such as your name, age, date of birth, and parents' names. Regulations like the HIPAA compliance are necessary to specify attributes that cannot be disclosed without authorization, yet such regulations are currently lacking in Nepal's healthcare landscape.

A critical aspect of patient autonomy is granting individuals access to their own health data. Currently, our health data is stored within the hospital's database, but patients do not have access to it, which is a concerning issue. Personalized healthcare can significantly benefit from patients having access to their medical history, aiding in diagnosis and treatment decisions, particularly in cases of allergies or adverse reactions to medications. However, ensuring secure access to such data is a complex task, requiring adherence to stringent privacy guidelines such as those outlined by the WHO and regional standards like the European Union's regulations.

Emerging technologies, such as blockchain, offer promising solutions for securely sharing medical data between healthcare facilities, yet implementation challenges persist. Cryptographic technology can play a pivotal role in safeguarding patient information while facilitating data sharing for improved healthcare outcomes.

Our goal must be to protect the identity of the patient while sharing their diagnosis and treatment information without revealing personal details. To achieve this, we can use system-generated IDs to identify patients instead of sharing personal information. Ultimately , any application that fails to safeguard a patient's details is essentially useless.

How do you envision Digital Health Technology changing the way healthcare services are delivered in a developing country like Nepal?

For good digital health care service, we need a national digital health platform. This platform would centralize all health services provided by the government, ensuring systematic storage of health data. To maintain standards and adherence to guidelines, the government would monitor health-related applications, emphasizing data collection methods, technical frameworks, and the use of HL7 FHIR as a standard format. Application creators would need to follow a specific pattern for various aspects, such as coding, storing medicine names,

patient information, age, vitals, and image file types.

HL7 FHIR technology serves as a middle layer, facilitating seamless data sharing between healthcare facilities when developing health-related applications. Currently, there are issues where one health application cannot communicate with another, resulting in a patient's data being scattered across different formats, making it challenging to compile all the data in one place.

Establishing a national-level digital health platform would address this challenge by providing infrastructure, privacy and security tools, cloud services, and database management, thus promoting innovation and alleviating developers' infrastructure concerns.

Through this centralized platform and the utilization of FHIR middleware, all health-related applications would be easily accessible to individuals in Nepal. This approach would streamline data transfer and contribute to more efficient and integrated healthcare services, ultimately benefiting patients and healthcare providers alike.

Considering your significant research experience in IoT, what do you believe are the most critical challenges today that need to be addressed to ensure a secure IoT ecosystem?

While my research journey has just begun in IoT, I've identified significant challenges in ensuring a secure IoT ecosystem. I initially focused on spatial databases and then shifted my research towards conserving energy in wireless sensor networks. Gradually, I transitioned into software engineering. Around 2013, I started researching healthcare services because it's a constantly evolving field with challenges like Ebola and COVID-19. My journey into IoT came as I began exploring these diverse areas.

IoT devices play a role in data generation and transmission, making security a crucial concern. As technology advances, so do hackers, emphasizing the need for security. IoT devices have evolved beyond data collection to become communication tools, further highlighting the importance of security. Data sharing has moved from conventional networks to computer networks and sensor networks. Protecting personal data is crucial to prevent unauthorized access, safeguarding against potential risks such as theft or damage.

As we embrace smart devices, trust, data security, and reliability become imperative. Various attacks, including botnets and DoS attacks, threaten the IoT landscape. Security measures must be implemented at both application and network levels to mitigate vulnerabilities exploited by attackers.

Distinguishing between valid and invalid data is essential, ensuring messages originate from authorized sources. Geographical limitations can bolster security, restricting access to data beyond specified areas. Security measures should be integrated into hardware and operating systems, with iOS devices often considered more secure than Android counterparts due to their closed ecosystem.

However, increasing technology diversity can introduce vulnerabilities, making systems more flexible but potentially weaker in terms of security. Restrictions, like limiting downloads and external drive usage in certain work environments, are necessary to protect data. There's no one-size-fits-all security approach; we must address the various types of attacks hackers can employ using machine learning.

Your academic history has taken you to various parts of the world: a bachelor's degree in India, followed by master's and PhD studies in South Korea. Now that you are pursuing an academic career in Nepal, what differences have you observed in the approaches to teaching and learning in these distinct parts of the world?

My undergraduate studies in India occurred over two decades ago, a time when educational technology hadn't yet revolutionized learning. Information acquisition was significantly more laborious compared to today's instant access through the internet. Indian bachelor's programs heavily relied on traditional textbooks during that era. Upon transitioning to South Korea for my master's degree, I enrolled in a research-intensive MS program.

Nepal's education system has been historically influenced by the British model, emphasizing textbook-based learning, even at the master's level. Conversely, South Korea embraced a research-oriented approach, emphasizing the analysis of papers from prestigious organizations like IEEE, Elsevier, and Springer, particularly in fields such as AI and machine learning.

In Nepal and throughout Southeast Asia, textbooks, though often outdated, provided foundational knowledge, while current issues and advancements were explored through research papers. In South Korea, professors incorporated lists of research papers into the curriculum, encouraging critical analysis and discussion instead of mere memorization. This approach facilitated a deeper understanding of technical concepts and kept students abreast of the latest developments.

Upon completing my master's in South Korea, I pursued a Ph.D. focusing on computer networking. My research delved into Spatial Network Databases, addressing challenges not yet tackled by leading tech companies at the time. This proactive research culture was a departure from my experiences in Nepal.

In South Korea, the structure of master's programs involved intensive coursework and exams, culminating in a comprehensive understanding of the subject matter. Ph.D. programs followed a similarly rigorous schedule, with exams covering multiple subjects in a single sitting. Adherence to strict timelines for admissions, coursework, and exams was the norm, ensuring efficiency and accountability.

Contrastingly, graduation timelines in Nepal can be less predictable due to various factors. Additionally, while achieving a perfect GPA is commendable, the societal impact of contributing to research that advances even a small facet of life holds greater significance. In South Korea, access to government funds for research is more accessible, with many companies operating dedicated research labs that actively engage students in practical applications, thus fostering a seamless integration of education, research, and career development.

Your research portfolio covers a diverse array of topics ranging from healthcare prediction to wireless sensor networks. Could you please tell us about the driving force that motivates you in your exploration of such a broad spectrum of subjects?

As I mentioned earlier, a research-based education system begins with the study of research outcomes. Technologies and domains emerge, peak, and evolve, but their fundamentals persist and continue to develop. For example, around the year 2000, there was significant research in wireless sensor networks, and today we are witnessing the rise of blockchain technology. In the mid-2000s, MIT's business magazine identified wireless sensor networks as one of the top 10 technologies that could change the world. WSN technology is now widely used in various applications, from smartwatches to environmental monitoring. These technologies gave rise to

the concepts of Big Data, Data Analysis, and Machine learning.

As technology evolved, so did the challenges, leading to the growth of technologies like Big Data, IoT, cybersecurity, and cloud computing. Currently, blockchain, a distributed secure database system, is at the forefront. In the future, quantum technology may mark a significant shift in technology development. Sensor nodes that started as simple devices, such as shoe sensors, have evolved to communicate with brain neurons. Technology is continually progressing, and to thrive in this evolving world, one must adapt.

This adaptability has driven me to engage in research across various technologies. In a decade or so, there will be new challenges to address. Sticking to a single technology is not a smart move in today's rapidly changing landscape. For example, the field of databases began with tools like Excel and has now evolved to include NoSQL databases. As a researcher, staying updated is crucial because these new technologies garner excitement.

Regarding the health sector, regardless of the domain we choose to pursue, it's essential to consider how we can contribute to society with our knowledge. As long as humanity exists, health problems will exist too. We must invest in technologies that allow us to gather information on patient care, health, and pollution monitoring. We can extract patterns and utilize Machine Learning to predict diseases. Through early detection, individuals can take preventative measures. Access to high-quality healthcare is vital for a country's prosperity. A nation where individuals must spend a significant portion of their income on healthcare cannot achieve the same level of productivity. Moreover, technology can significantly impact remote areas, where patients often travel long distances for basic check-ups. Pregnant women, for example, face challenges traveling on poorly maintained roads, which can pose risks to their health. If we can remotely monitor their vital signs and transmit the data to health facilities for analysis, these women may not need to travel unless medical attention is necessary.

Technology has the potential to revolutionize the healthcare industry in multiple ways. That's why, with my IT expertise, I have chosen to contribute to the healthcare sector. By developing highly skilled human resources in this domain, we can improve the overall health of our country.

What are some of the challenges you have encountered during your research career, and how have you overcome them?

This is a vital question for anyone interested in research. Publishing a paper with a good idea earns you appreciation from everyone, which is a strong incentive to continue your work. Research requires access to resources, such as the most recent technologies and academic journals. I've had to seek help from my foreign friends to access research papers that I couldn't obtain here.

The absence of a vibrant research culture is one obstacle to research here. For instance, when students research topics like IoT botnets or risk management in software engineering and graduate, their work often doesn't persist. Ideally, new students should build upon the previous research, creating a continuous cycle that can yield significant results over time. This exemplifies a strong research culture. Students have limited time, so we must find ways to make it easier for them to engage in research. This, I believe, is one of the most significant challenges we face in advancing our research. With the right approach, students can focus on their core ideas rather than getting distracted by miscellaneous tasks.

Elevating Semester Projects: The Need for Research Integration

Dr. Sushil Shrestha
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Semester projects at Kathmandu University stand as the cornerstone of every student's academic experience, threading through the 2nd to the 6th semester. These projects are more than mere academic exercises; they represent a dynamic fusion of theoretical knowledge and hands-on implementation. However, a critical element is often seen missing from these projects: a robust research component. As per KU's curriculum, students progress from learning fundamental programming to more intricate concepts like databases, system architecture, and software engineering. Semester projects are expected to be the students' implementations of these acquired theories into a tangible product that reflects on their academic journey.

Diversity in project scopes is a hallmark of KU's approach. From web-based and mobile applications to API development, database projects, and ventures into data science and UI/UX design, students engage in a broad spectrum of technological domains. A noticeable trend emerges in the third year, where a majority gravitates towards machine learning and data science, experimenting with diverse datasets.

Despite the technical brilliance showcased in these projects, there is a conspicuous absence of thorough research. The conventional project cycle involves ideation, coding, presentation, and conclusion, often leaving little room for in-depth exploration of existing literature and best practices.The proposition is simple but transformative — integrate research into semester projects through comprehensive literature reviews. Take, for example, the development of an e-commerce mobile app. Instead of jumping straight into coding, students can embark on an extensive study of renowned e-commerce platforms. A comparative analysis reveals the strengths and weaknesses of each, providing a solid foundation for the project.

This research-driven approach empowers students to build upon existing knowledge, incorporating the positive aspects identified during the literature review. The result is not just a semester project; it's a research project. The same methodology can be applied to data science endeavors. Before diving into algorithms and coding, students can explore existing literature to understand what works and what doesn't for specific types of data.

Considerations for ethical implications, impact assessments and exploration of future trends enrich this transformative approach. Furthermore, emphasis on proper citation and academic writing practices ensures students develop essential research skills. This multifaceted strategy not only elevates the research component but also equips students with a broader understanding, preparing them for future academic and professional pursuits.

The transformative power of incorporating research into semester projects extends beyond the classroom. By infusing innovative and creative research methodologies, projects can transcend traditional boundaries and evolve into full-fledged research endeavors. The outcomes can be documented in the form of research papers, providing students with opportunities to present their work at conferences and submit to peer-reviewed journals.

The impact on academic and professional futures is profound. A published paper resulting from a semester project can open doors to better opportunities for Master's and Ph.D. programs. It enhances the quality of internships and careers, setting students apart in a competitive landscape.

In conclusion, the suggestion to think of semester projects as research endeavors is not just a tweak in approach but a paradigm shift. It aligns academic exploration with professional innovation, ensuring that our students not only excel in technical skills but also contribute meaningfully to the broader discourse in their respective fields. It's an invitation to think beyond the project cycle, embrace research, and pave the way for a future where academic excellence and research innovation go hand in hand.

Inter-disciplinary Alchemy: Unleashing Innovation through Research

Dr. Sudan Jha
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Research is the driving force behind the advancement of knowledge and societal progress, fostering breakthroughs in various disciplines and playing a pivotal role in shaping societies through informing policies and addressing social issues. It represents a transformative force that propels the boundaries of knowledge and inspires a culture of curiosity and critical thinking. Research is a powerful catalyst for intellectual and personal development, offering a unique platform for exploration, discovery, and contribution to the broader body of knowledge. Research nurtures curiosity, critical thinking, and personal growth within oneself.Therefore, it can be concluded that research involves the practice of cultivating resilience and applying knowledge practically.

Now, since I have aimed this article towards my young scholars, all throughout my research journey I have come to realize that engaging in research provides students with an immersive experience, deepening their understanding of theoretical concepts and practical applications beyond traditional coursework. Through literature reviews, experiments, and data analysis, students gain hands-on expertise, fostering independent thinking and intellectual curiosity. This approach connects theory with real-world challenges, contributing to knowledge and preparing students for academic and professional success.Therefore, we can conclude that research plays a pivot role for students in their academic journey through the following two ways:

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1. Real-world Impact

Research plays a pivotal role in driving real-world applications and making a tangible difference in various fields. For instance, in the field of medicine, extensive research efforts have led to the development of vaccines, novel treatments, and medical technologies, improving healthcare outcomes globally. Scientific research on renewable energy has paved the way for sustainable solutions, such as solar panels and wind turbines, addressing environmental concerns and promoting cleaner energy sources. Additionally, social science research contributes to policy development, addressing societal issues like poverty, inequality, and education. Technological advancements, driven by research in computer science and artificial intelligence, have transformed industries, leading to innovations such as self-driving cars and smart devices. Agricultural research has resulted in improved crop varieties and farming practices, addressing food security challenges. These numerous examples illustrate how research acts as a catalyst for positive change, driving innovation, and addressing pressing global challeng-

2. Interdisciplinary Opportunities

Interdisciplinary research fosters collaboration across diverse fields, enabling a holistic approach to complex problems. By combining expertise from various disciplines, this collaborative approach enhances understanding, promotes innovation, and offers comprehensive solutions to real-world issues. Embracing interdisciplinary research can lead to transformative outcomes, driving groundbreaking discoveries and contributing to a more nuanced understanding of the world.

Interdisciplinary collaboration drives innovation by combining diverse perspectives, methodologies, and insights from different fields. This synergy fosters creativity, generating novel ideas and solutions to complex problems that may not emerge within a single discipline. The integration of knowledge across disciplines not only sparks innovation but also addresses the multifaceted nature of challenges, inspiring transformative breakthroughs with real-world impact.

In today's fast-paced digital age, staying ahead in research requires more than just traditional methods.

Embracing digital tools and resources is essential for young researchers to navigate the ever-evolving landscape of academia and innovation. To aid in this journey, it's imperative for them to equip themselves with a diverse array of digital tools and resources. Below are some key ones to consider for your research journey:

Digital Tools and Resources

Digital tools and resources play a pivotal role in facilitating seamless communication, data sharing, and collaborative efforts among researchers from diverse fields. Platforms such as online collaboration tools, project management software, and virtual communication platforms enable researchers to collaborate in real-time, regardless of geographical distances. Digital repositories and databases provide a centralized space for sharing and accessing research data and findings, fostering transparency and accessibility. Moreover, advanced data analytics tools empower interdisciplinary teams to analyze vast datasets, uncover patterns, and derive meaningful insights. Online research networks and forums provide avenues for researchers to connect, share expertise, and explore potential collaborations. Overall, these digital tools and resources create an interconnected and efficient environment for interdisciplinary research, enhancing the collective capacity to address complex challenges and drive innovation.

Here's a comprehensive list of digital tools and resources for doing research, categorized by function:

1.Literature Review and Search:

Search engines: Google Scholar, Microsoft Academic, Semantic Scholar, Scopus, Web of Science
Citation managers: Zotero, Mendeley, EndNote, RefWorks
Library databases: Access through your university library, offer specialized databases depending on your field
Open access repositories: arXiv, PubMed Central, Directory of Open Access Journals (DOAJ)
Subject-specific resources: Various databases and platforms dedicated to specific research areas

2.Data Collection and Analysis:

Surveys and questionnaires: SurveyMonkey, Typeform, Google Forms, Qualtrics

Interview platforms: Zoom, Microsoft Teams, Skype, Discord

Data analysis tools: SPSS, R, Stata, SAS, Python libraries (pandas, NumPy)

Visualization tools: Tableau, Power BI, Google Data Studio, R packages (ggplot2, ggvis)

3.Collaboration and Communication:

Project management tools: Trello, Asana, Monday.com, Jira

Cloud storage and file sharing: Google Drive, Dropbox, OneDrive, Box

Reference management tools: Zotero, Mendeley, EndNote, RefWorks

Collaboration platforms: Slack, Microsoft Teams, Discord, Google Docs

4.Writing and Publishing:

Citation managers: Zotero, Mendeley, EndNote, RefWorks

Grammar and style checkers: Grammarly, ProWritingAid, Hemingway Editor

Plagiarism checkers: Turnitin, Grammarly Premium, Copyleaks

Formatting tools: LaTeX, Overleaf, Microsoft Word, Zotero Bibliography Builder

Journal submission platforms: ScholarOne, Editorial Manager, Manuscript Central

5.Other Useful Tools:

Mind mapping tools: XMind, Miro, Coggle

Presentation software: Microsoft PowerPoint, Google Slides, Prezi

Time management tools: RescueTime, Todoist, Forest

Reference management tools: Zotero, Mendeley, EndNote, RefWorks

Academic communities and networks: ResearchGate, Academia.edu, Mendeley

Remember, the specific tools you'll use will depend on your research field, personal preferences, and other parameters (like budget). Explore different options and see what works best for you!

Availability of digital tools and online resources for research:

The tools and resources I mentioned are generally readily available with varying levels of accessibility and price

Freemium:

- Most search engines (Google Scholar, Microsoft Academic)
- Some citation managers (Zotero, Mendeley)
- Many library databases (access depends on university affiliation)
- Open access repositories (arXiv, PubMed Central, DOAJ)
- Some survey and questionnaire platforms (SurveyMonkey, Google Forms)
- Several data analysis tools (Python libraries, R packages)
- Collaboration platforms like Discord and Slack (basic features)
- Grammar and style checkers (limited in free versions)
- Mind mapping tools (XMind, Coggle)
- Reference management tools (Zotero, Mendeley)
- Some academic communities and networks (ResearchGate)
- Here's a comprehensive list of digital tools and resources for doing research, categorized by function:

Paid:

- Advanced features in citation managers (Zotero Premium, Mendeley Premium)
- Specialized library databases (depending on content and publisher)
- Premium survey and questionnaire platforms (Qualtrics)
- Powerful data analysis software (SPSS, RStudio, Stata)
- Advanced visualization tools (Tableau, Power BI)
- Project management tools (Trello, Asana, Monday.com, Jira)
- Cloud storage and file sharing (Google Drive, Dropbox, OneDrive, Box)
- Plagiarism checkers (Turnitin, Grammarly Premium, Copyleaks)
- Formatting tools (LaTeX, Overleaf)
- Journal submission platforms (ScholarOne, Editorial Manager, Manuscript Central)
- Some academic communities and networks (Academia.edu, Mendeley)

Overall:

A wide range of valuable digital tools and resources are available for research, with options for various budgets and needs.

Combining free and paid resources can be an effective way to access necessary tools while managing costs.

Explore and compare different options before investing in paid versions.

Don't hesitate to utilize institutional resources and inquire about library subscriptions and research support programs.

Remember, the most important factor is choosing tools that fit your specific research workflow and budget constraints. With some research and exploration, you can find the perfect digital toolkit to power your research endeavors!

Now you should also keep in mind the fact that embarking on a research journey requires a solid foundation built upon thorough literature reviews, robust data collection, and rigorous analysis. These tasks serve as the cornerstone of any meaningful investigation, shaping the credibility and reliability of your research findings. To navigate this intricate process effectively and ensure the integrity of your work, it's imperative to approach each step with precision and diligence. Some steps that you can follow are given below:

Tips for Effective Literature Review, Data Collection, and Analysis in Research:

Literature Review:

Focus and Scope:

Define your research question/topic: This guides your search and ensures relevance.
Set clear inclusion/exclusion criteria: Avoid irrelevant sources and maintain consistency.
Use multiple databases and search engines: Expand your reach and avoid bias.

Critical Analysis:

Evaluate source credibility and quality: Consider author expertise, publication reputation, and methodological rigor.
Identify key gaps and research opportunities: Don't just summarize; highlight missing pieces or unexplored perspectives.
Synthesize findings and build arguments: Connect different sources and demonstrate your understanding of the research landscape.

Organize and Document:

Utilize reference management tools: Zotero, Mendeley, or EndNote streamline citation management.
Take detailed notes and annotate sources: Capture key points, interpretations, and potential critiques.
Maintain a clear research trail: Document search strategies and decisions to ensure transparency and repeatability.

Data Collection:

Plan and Design effectively:

Choose appropriate data collection methods: Consider research goals, feasibility, and potential biases.
Develop clear sampling strategies: Ensure your sample represents the target population for valid inferences.
Pilot test your instruments or tools: Refine data collection methods before full implementation

Ensure Data Quality:

Implement quality control measures: Standardize data collection procedures and train personnel.
Validate and clean data: Identify and address missing values, outliers, and inconsistencies.
Document data collection procedures: Ensure transparency and replicability of your results.

Data Analysis:

Data analysis is more than just crunching numbers. We begin by diving into the heart of the data, using descriptive statistics and striking visuals like charts and graphs to uncover its secrets. Each trend, each pattern whispers clues, guiding us to choose the right statistical tests to unlock deeper insights. We translate

them into clear, concise language, acknowledging limitations while drawing powerful conclusions. Ultimately, we weave our findings back into the fabric of the research question, showing how our analysis illuminates new knowledge and contributes to the ever-evolving tapestry of our field. Data analysis is not just a technical exercise; it's a hop between precision and storytelling, a quest to translate the whispers of numbers into a resounding message that resonates with the world.

With all this being said, it should be noted that one of the major aspects of doing research is to collaborate with peers or mentors, because sharing ideas and expertise can enhance your research and learning. You should maintain a critical and open mind; and be willing to revise your research questions and hypotheses as you learn more.

Now, I have mentioned some other skills that are good to know while you trying to write your research paper.

Other Essential Skills for Research:

1) Indexing and Abstracting:

First is indexing and abstracting. Let's have a brief insight about indexing and abstracting:

Journals are often indexed in various databases, and these indexes play a role in determining the perceived quality and impact of a journal. Here are some common indexing services and a brief explanation:

PubMed: PubMed is a database primarily for life sciences and biomedical literature. Journals indexed in PubMed are often associated with reputable research in medicine and related fields.

Scopus: Scopus is a comprehensive abstract and citation database covering various disciplines. Journals indexed in Scopus are recognized for their academic influence and global reach.

Web of Science: Explanation: Web of Science is another citation database that covers a wide range of academic disciplines. Journals included here are often considered for their scholarly impact and citation influence.

Google Scholar: Explanation: Google Scholar is a freely accessible search engine that indexes scholarly

articles. Journals listed on Google Scholar are widely accessible and cited in academic works.

Impact Factor (IF): Impact Factor is a measure calculated based on the average number of citations received by articles in a journal. Journals with higher Impact Factors are generally considered more influential in their field.

Eigenfactor: Eigenfactor is a ranking that considers not only the number of citations but also the quality of the citing journals. It aims to measure a journal's overall importance in the academic community.

H-Index: The H-Index measures both the productivity and impact of a scientist or journal. A higher H-Index indicates a higher impact or influence in the academic community.

DOAJ (Directory of Open Access Journals): Journals listed in DOAJ are open access, meaning their content is freely accessible online. This index promotes accessibility and transparency in scholarly publishing.

i10-index: Developed by Google Scholar, the author i10-index is the number of articles published by an author that have received at least 10 citations.

SCI (Science Citation Index): SCI is a part of the Web of Science database. It indexes high-quality, peer-reviewed scientific journals across various disciplines. If a journal is listed in SCI, it means the articles published in that journal are considered reputable and are often cited by other researchers.

SCIE (Science Citation Index Expanded): It's an expansion of SCI. It includes a broader range of journals compared to SCI, covering more subject areas. Being indexed in SCIE indicates that a journal is recognized for its scientific impact and contributes to the global scientific community.

ESCI (Emerging Sources Citation Index): ESCI is the Emerging Sources Citation Index, also part of the Web of Science. Journals in ESCI are considered promising and have the potential to be included in the more established indices like SCI or SCIE. It's like a stepping stone for journals on their way to gaining broader recognition.

Transaction Journals: "Transaction" typically refers to a series of academic journals published by various professional societies or organizations. These journals

often focus on specific fields or disciplines and are known for publishing high-quality, in-depth research. Transactions are a way for these organizations to share valuable knowledge within their respective communities.

2) Knowing the difference between publishing in Journals and in Conferences:

Second is the distinction between publishing in journals and conferences. Students have frequently queried with me about the difference and impact about the publication of their works in conferences and journals. In my view, publishing in a conference and a journal involves sharing research findings, but they serve different purposes and have distinct characteristics. Here are some of the glimpse from my perspectives and experiences:

Conference: Conferences are like big gatherings where researchers meet to exchange ideas and present their latest work. It's more about discussion, interaction, and quickly sharing what you've discovered. Presentations at conferences are usually shorter, like giving a summary of your research to a large audience. It's like showing a trailer of a movie. Conferences happen more frequently, and you get to know what others are working on in your field quickly. You also receive immediate feedback from other researchers, helping you improve your work

Journal: Journals are like books where researchers publish detailed, comprehensive versions of their work.

It's about providing a complete story of your research, like reading a full novel. Journal papers are longer and more detailed, allowing for an in-depth exploration of the research. It's like writing the entire script of a movie. Journal publications take longer because they go through a thorough review process to ensure quality. It's like the time it takes to make a high-quality movie. The feedback in journals is usually more detailed and focused on improving the paper for a broader audience.

Conferences are like quick, interactive showcases where researchers present snippets of their work to a broad audience for immediate feedback. Journals, on the other hand, are like in-depth novels where researchers provide a thorough exploration of their work, aiming for a more lasting and detailed contribution to their field.

To sum it up, as we delve into the intricate realm of research, it becomes evident that it is not merely a pursuit of knowledge but a transformative journey that shapes both individuals and societies. Through rigorous exploration, critical analysis, and interdisciplinary collaboration, researchers not only expand the frontiers of human understanding but also contribute to tangible solutions of current global challenges. As we embrace the multifaceted nature of research, let us continue to cultivate resilience, curiosity, and a spirit of collaboration, for it is through these endeavors that we truly unlock the boundless potential of human ingenuity and advance towards a brighter future.

Matej Kastelic/Shutterstock

5G: The Next-Gen Network

Saroj Poudel
Computer Engineering 2021

It might sound like I'm exaggerating, but I firmly believe that 5G will revolutionize cellular technology. As a child, people used to promise me a future with flying automobiles, but although they still haven't materialized, we can already witness a variety of self-driving cars on the road today.

In order to understand 5G, it's important to go back and show you how cellular technology changed our lives. People were able to call anyone from anywhere in the world thanks to the First generation (1G) of cellular technology. Texting was invented in the Second technological generation (2G) and has since spread throughout society, especially among younger generations. Applications from the Third generation (3G), such as GPS and mapping tools, have transformed people's lives. Video, including Video Chat and Streaming Services, was driven by the fourth generation (4G).

With the introduction of the Fifth generation (5G) network, Wireless technology has advanced significantly. With a theoretical peak speed of 20 Gbps, 5G surpasses its predecessor, 4G, which only achieved a peak speed of 1 Gbps. With a gigabit speed of 1000 megabits and the low latency provided by 5G, it seems like smart automobiles, self-driving cars, robotics, virtual reality, augmented reality, and advancement in the medical industry will all become possible.

Benefits of the 5G Network

Enhanced Performance for Business Applications:

One of the key benefits of the 5G network is its lower latency, which dramatically improves the performance of commercial apps. Lower latency ensures quicker data transfer and reaction times, allowing businesses to operate more efficiently and deliver better customer experiences.

Seamless Roaming and Connectivity:

5G not only offers faster speeds and better performance but also enables smooth open roaming between cellular and Wi-Fi connections. This allows mobile users to easily switch between indoor wireless networks and outdoor wireless connections without the need for re-authentication. Such persistent connectivity guarantees a hassle-free user experience and eliminates the need to switch networks when users travel between different venues.

Connectivity in underserved areas with 5G:

The potential for 5G to enhance connectivity in underdeveloped rural areas and densely populated cities is one of the technology's major promises. The growing demand for data can be handled by 5G networks, enabling them to process data more quickly thanks to their dense, distributed-access architecture. 5G makes it possible for quicker response times and more effective data transfer by relocating data processing closer to the edge. With the use of this technology, connections are revolutionized, enabling users to access the internet and other digital services effortlessly from both urban and rural locations.

Healthcare:

5G in the healthcare industry creates new opportunities for telemedicine, robotic surgery, and remote patient monitoring. Healthcare experts are now able to give remote treatment and make quick judgments thanks to the real-time transfer of crucial medical data made possible by 5G's low latency and great reliability. Additionally, the higher

bandwidth of 5G enables the use of virtual and augmented reality in medical education and training, improving the learning experience for healthcare practitioners.

The Personal Connection: A Story of 5G Impact

Let's look at a personal story that demonstrates the impact of the 5G network that I discovered in an article while researching 5G.

Introducing Sarah, a proprietor of a boutique clothing store. Before the introduction of 5G, Sarah had trouble properly managing her inventory and providing her clients with a flawless shopping experience. However, with the implementation of 5G, Sarah experienced a significant improvement in her business operations. She says she was able to immediately update her inventory management system thanks to the faster speed and lower latency of 5G, making sure she always had up-to-date knowledge on the stock levels. Additionally, Sarah was able to give her clients personalized recommendations in real time thanks to the improved connectivity provided by 5G, making the shopping experience more interesting.

5G network in Nepal

Minister of Communication, Information, and Technology Ms. Rekha Sharma has said that NTC will start its commercial 5G trial from FY 2080/81 as the trial continues to expand. Currently, the state-backed operator has been running internal tests of its fifth-generation cellular network in Kathmandu, Pokhara, and Birgunj. The delay in public access has been blamed on the lack of compatible devices; however, the minister's new statement could relieve the eager 5G smartphone users across Nepal.

For its initial 5G trials, NTC will start with Non-Standalone (NSA) architecture and then gradually implement Standalone Architecture (SA). The former allows the Telco to switch on its fifth-generation network on existing 4G LTE infrastructure with updated software on the core. The company has already installed two sites in Babarmahal and Sundhara, ready for the 5G network. They are currently testing available 5G devices at these locations. It has also set up all the necessary equipment at the two sites.

According to a management information system (MIS) report of Nepal Telecommunications Authority, Nepal Telecom had 22.52 million voice Telephone Service users till mid-November 2021, up from 20.63 million at the same time in 2020. Nepal Telecom had 10.16 million 3G users till

November 2021 which was 8.43 million in the same period in 2020. It had 7.48 million 4G users till mid-November 2021 which was 2 million in mid-November 2020.

Conclusion

This article illustrates the emergence of 5G, its evolution from 1G to 5G mobile networks, applications, the key features of 5G, and the current situation of 5G in Nepal. 5G has the potential to disrupt many industries and change how we live and work, from healthcare to transportation and even manufacturing.

5G technology is expected to bring faster internet speeds, lower latency, and higher capacity to Nepal, which could benefit various sectors such as education, health, agriculture, and tourism.

However, there are also challenges and risks associated with 5G deployment, such as high costs, spectrum allocation, cybersecurity, and environmental impacts. Therefore, Nepal needs to adopt a comprehensive and inclusive strategy to ensure that 5G is accessible, affordable, secure, and sustainable for all. As we embrace the era of 5G, we can look forward to a future of enhanced connectivity, improved efficiency, and endless opportunities for innovation.

Generative Art : Code in Art Out
Unlocking Creativity Through Technology

Prasiddhi Dahal
Computer Science 2020

Art has always been the ground where creativity forms its voice, expressing the most piercing and deep-seated feelings and thoughts. But what if we could infuse the same creative process with the power of technology? The result is generative art, a hypnotic blend of code and artistic expression that sets out to change how we create and interact with art. In this article, we will explore the peculiar world of generative art and learn how a piece of code can be transformed into intricate and mesmerizing master pieces.

Generative art is a powerful synergy between technology and artistry. It is an innovative process of generating artworks processed by lines of code to produce visual and auditory creations, often resulting in unpredictable, one-of-a-kind works. This concept breathes new life into the old traditional way of developing artwork in this age ruled by technology. Generative art is where codes become a canvas, and creativity flows through the algorithms.

This revolution in creativity is driven by two technological powerhouses: p5.js and React. p5.js is an open-source versatile JavaScript library that allows artists and developers to create exciting visuals and interactive experiences. It is the toolkit that translates lines of code into vibrant and dynamic art. The other powerhouse- React, far from being just another graphic tool, is a popular JavaScript library for building user interfaces. On top of this, it takes this art further by turning code-generated art into customizable templates.

Imagine sitting at your computer and typing the code that creates your imaginative vision of life. With the help of p5.js, your code becomes a canvas with endless possibilities. React inserts the picture to transform this canvas into editable templates, but that's not all. You can change dimensions, select colour schemes according to your mood, and even add effects to make your design more beautiful. Thanks to a harmonious fusion of technology and imagination, you may now influence the creative process in a way that has never been possible before.

Customization and personalization lie at the heart of generative art. Generative art is like a breath of fresh air in an environment where mass-produced works dominate the art landscape. You are the conductor of your artistic orchestra, free from restrictions imposed by pre-established patterns. To create a work of art that embodies your vision, adjust the dimensions that match your vision, choose colour schemes that arouse strong emotions, and then add effects that give depth to the work. Your ingenuity and uniqueness shine in this work of art.
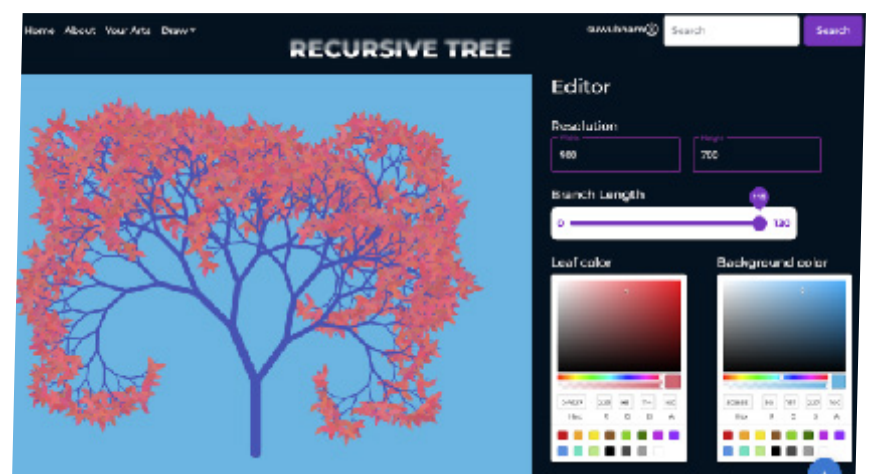
Generative art has the potential to overcome the constraints of conventional art production. Artists are no longer limited to their tools as they have access to the entire digital universe. However, this idea is not just applicable to artists. The future holds much promise as this concept gains momentum. Teachers can incorporate generative art into their curricula, illustrating to pupils that technology and art are not mutually exclusive but rather complementary forces.
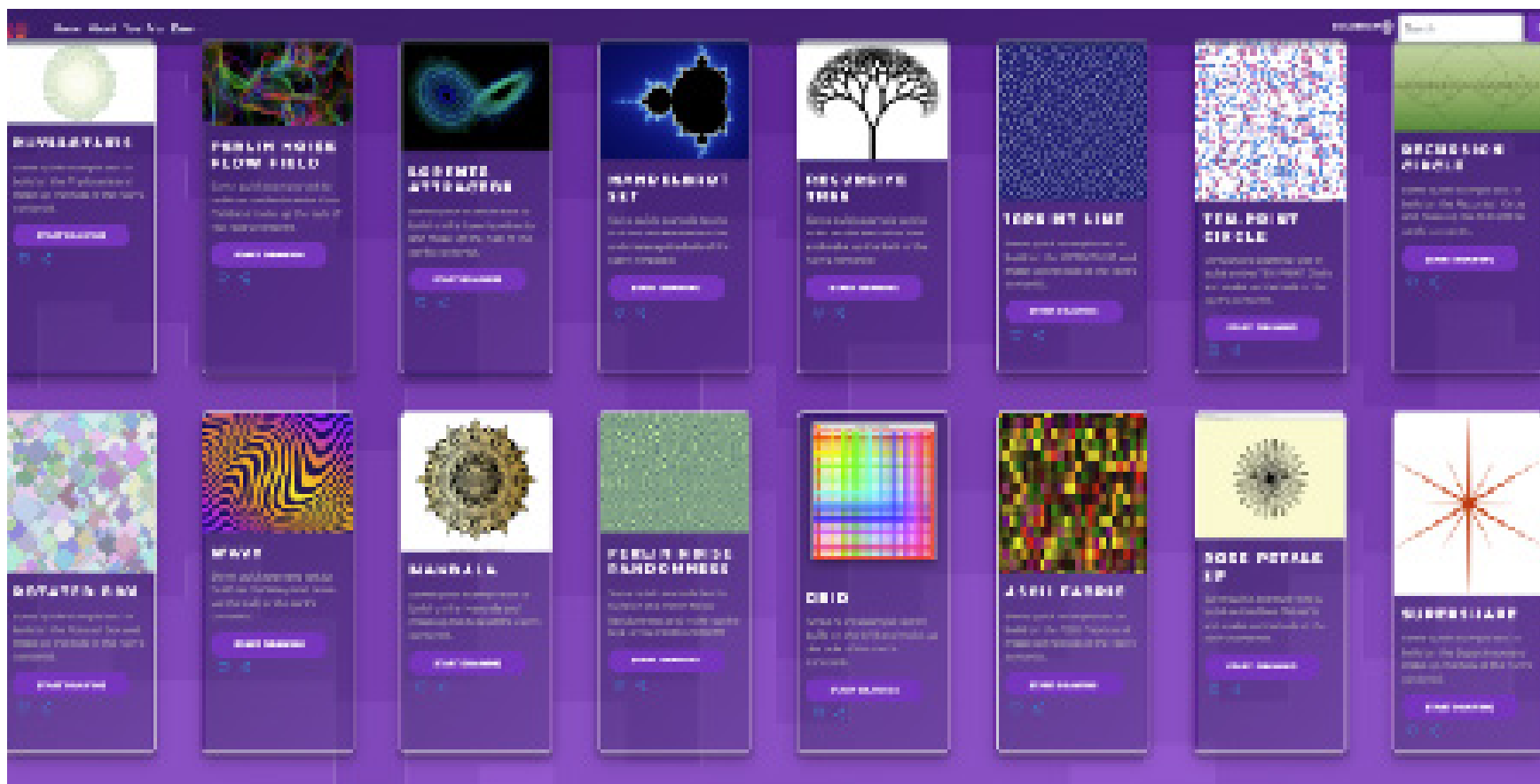
This could inspire a generation to explore the relationship between code and creativity through success stories of generative art.

Innovation inevitably breeds skepticism. Some people may wonder if generative art compromises the originality of artistic creativity. However, this idea challenges conventional ideas on how art is produced and invites us to reexamine what it means to be an artist.

Lines of code and creative thinking come together to create amazing artworks in the field of "generative art." The trip starts with a straightforward code and finishes with a canvas teeming with colour, dimension, and life. The idea invites us to investigate, experiment, and question how differently an art can be created. We will continue to understand artw differently as technology advances.

Through my personal project, I immersed myself in the field of generative art and witnessed the beauty that comes when code meets canvas. Now, through my article, I want to encourage all readers to embrace the fascinating nexus between creativity and technology.

Fuzzy Logic: Advancing Beyond Boolean Logic

Ishan Panta
Computer Engineering 2020

Before I begin with Fuzzy Logic let's take a brief look at what Boolean Logic is and how it works. Boolean Logic deals with all things binary. Things that are either "On" or "Off" i.e. either a 0 or 1. By employing several "Boolean Operations" such as "AND", "OR" etc. a lot of complex calculations can be easily done and this in turn has led to a highly widespread usage of Boolean Logic in the tech industry.

But here's the catch: while Boolean Logic works great for many things, it fails to precisely determine a correct output for the things that are somewhat "vague" or even "fuzzy".

Introduced by Professor Lotfi Zadeh in the 1960s, Fuzzy Logic has been making waves ever since its conception. Fuzzy Logic has made it easier for a lot of people to build proper control systems and various other utilities.

The reason for its overarching popularity is that the outputs produced by Fuzzy Logic are not only limited to 0 and 1 but can vary between these numbers. In essence, Fuzzy Logic excels in scenarios where precision isn't the sole determinant of success. It thrives in the presence of vagueness, allowing systems to make more nuanced and context-aware decisions, much like what humans do in the real world.

Understanding the Mechanisms of Fuzzy Logic

Okay, now let's get down to business. Let's try to understand the inner mechanisms of Fuzzy Logic and how it employs linguistic terms and membership functions to make nuanced decisions that Boolean Logic fails to do.

## Linguistic Terms: Expressing Human Understanding
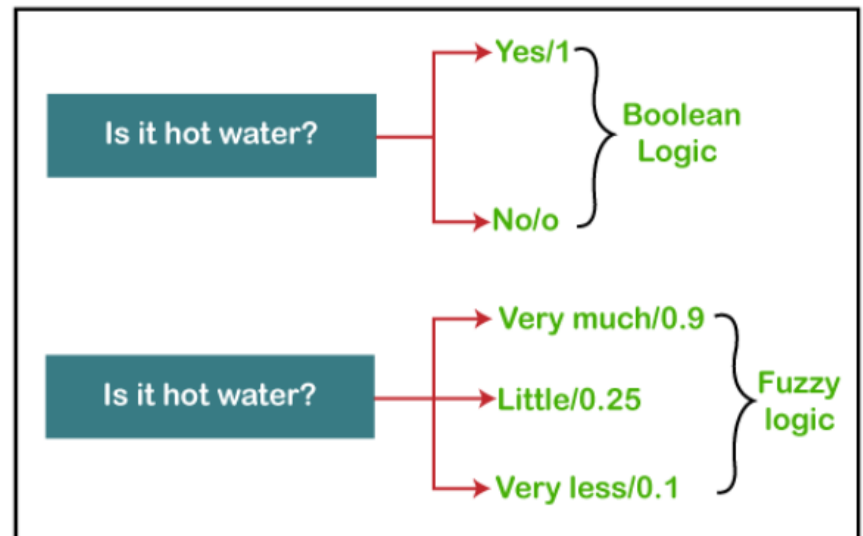
Let's imagine a scenario where we want to maintain a comfortable water temperature while showering. Traditionally, a simple on-off system i.e. a Boolean system might aim for a fixed temperature, say 100°F. One major flaw of such systems based on Boolean Logic is that it fails to accurately model human needs which is a complex and dynamic concept governed by numerous variables. Because on different days the same temperature can feel different to us.

Instead of setting a single, rigid temperature threshold, Fuzzy Logic allows us to use terms like "hot" and "cold" to describe water temperature.

"Hot" might signify a condition where we expect the water to be comfortably warm for a shower, but it's not tied to an absolute, fixed value like 100°F. On different days the same temperature can feel significantly different. Linguistic terms, in this context, serve as intuitive labels for the different states of water temperature. "Hot" doesn't refer to an absolute value but signifies a condition where we expect the water to be comfortably warm for a shower. With its help, we can make the computer "understand" that what feels "hot" on a chilly winter morning may be dif-

ferent from the same temperature on a scorching summer day. This linguistic flexibility allows Fuzzy Logic systems to be highly flexible and adaptable.

Linguistic Terms: Expressing Human Understanding
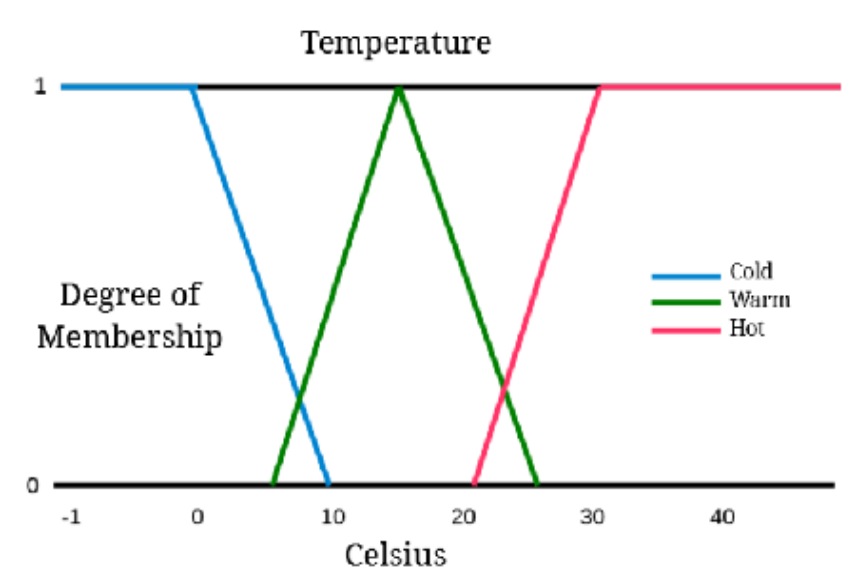
Well, how do we quantify these vague words or these linguistic terms so that our computers understand them and produce some desirable results?

We use something called Membership Functions.

They map the linguistic terms to degrees of truth, represented as values between 0 and 1. In a way, they act as the gateway between human ambiguity and computer understanding.

Here, the membership function for "hot" could resemble a curve, with its peak at a temperature generally considered warm for a shower. As the water temperature deviates from this peak, the degree of truth assigned to "hot" gradually decreases. The same goes for "cold". Therefore "warm" will be somewhere between cold and hot as shown by the membership function graph above. This helps systems to somewhat accurately model such vague terms.

Recent Trends in Fuzzy Logic

Now, let's talk about recent trends in Fuzzy Logic and how this concept has helped to build various systems. One such area where Fuzzy Logic shines through is Control Systems. Going back to the previous example of showering, fuzzy logic helps control the temperature even if the input is somewhat vague.

Fuzzy Logic helps in contributing excellent decision support systems, assisting individuals in making informed choices in intricate and uncertain situations. Examples include financial planning, medical diagnosis, and risk assessment tools that benefit from fuzzy logic's ability to handle imprecise data.

Conclusion

Fuzzy Logic is a wonderful tool you can use whenever you need to build systems that mirror human desires. They are a wonderful way to deal with the "vagueness" that simple binary boolean logic finds hard to decipher. There's a lot that can be said about Fuzzy Logic but this article merely served as an introduction to the topic. I encourage you all to go through the topic and find out how amazing it is.

Kripesh Adikari

Saswat Khadka

Hyper-realism in Video Games

Computer Science 2020

M imicking reality in a virtual environment has been an ambitious goal for many people in the field of computer science. Back in the day 'bad hardware' used to limit that possibility. But as chips have gotten smaller, the hardware using such chips have become bigger and more powerful than ever. We are now in the future where claims of achieving hyper-realism have become really common. Hyper-realism, when it comes to video games, is all about trying to simulate real-life visuals. Realistic physics, like sounds generated during interactions of objects, also comes up in the hyper-realism discussion. For example, different types of footwear on different surfaces need to make different sounds. But for this article, we shall be focusing mostly on visuals. The lucid movement of grass, water, and hair, the way light refracts and reflects off surfaces is visually more influential in determining whether a game is 'hyper-realistic' than how an object sits (For eg : In many games, visual tricks are used to make it seem like an object is sitting somewhere even if it is floating).The movement of grass and water pretty much depends on Physics, more specifically 'Collision', but that realism is only experienced by the player through visual stimuli. We are thus going to assume that this hyperrealism is still 'visual'. When discussing hyperrealism, we have to look at two parts. The first part has to do with the technical aspects while the other relates to the subconscious perception of reality through a screen. The former may seem straightforward, but it is affected by the latter, which itself is affected by 'culture'.We're not here to debate whether stylized or hyper-realism is better for the future of the video game industry. That is a tiring debate which is, frankly, pretty worthless, since they can AND have co-existed till now. We're only going to discuss hyper-realism in video games, with some insight from a video game artist who has worked on a very successful project before.

How is hyper-realism 'achieved' technically?

The ever increasing capability of computer hardware has led to more and more advanced techniques being commonplace in video games. For example, in the early 2000s, a realistic lighting technique called "Physically Based Rendering" used to require hours to process a single frame for a CG movie. Today, it has become the standard lighting model for video games,

### Why 30 frames per second (FPS)?

Go any lower, and the perception of smooth motion is lost. It is the bare minimum (acceptable) threshold. This requirement has always limited graphics programmers from going all in with hyperrealism.

which process at least 30 frames every second!However, just faster hardware is not the sole reason for improved visuals in video games. Much of the credit also goes to clever algorithms. To keep our focus on the most modern techniques, let us take a recent example: Cyberpunk 2077, from CD Projekt Red. This game received a major visual upgrade recently, referred to as "Ray Tracing: Overdrive Mode". Before we can discuss this mode, let us learn about ray tracing. We're not here to debate whether stylized or hyper-realism is better for the future of the video game industry. That is a tiring debate which is, frankly, pretty worthless, since they can AND have co-existed till now. We're only going to discuss hyper-realism in video games, with some insight from a video game artist who has worked on a very successful project before.

Ray tracing is the most accurate way of rendering virtual worlds, and conceptually it is very simple. The general idea is to compute light rays, starting from the lights in a scene and tracing each ray as it bounces from surface to surface until the camera is reached. However, it requires a tremendous number of rays, which means lots of computation power. While it has been used for a long time in CGI scenes in movies, it has been only 5 years since it became feasible in video games. This is not only thanks to the dedicated "RT Cores" that are part of Nvidia, AMD, Intel, and now even Apple GPUs, but also very complex denoising algorithms that convert fuzzy renders into clean images.

The image on the right can be made cleaner by just

Note that PBR is used in traditional lighting approaches as well. However there is no real-time bouncing of rays in older approaches. Much of the lighting is pre-calculated, and stored in the level files of a game. This lighting pre-calculation step (also called baking) can take hours, much like the CG Movies approach. Unfortunately, even this has its limits as we cannot store lighting data for all surfaces, for any possible camera position. As a result, cuts are made and the lighting is inaccurate. However, when done right, it can still look convincingly realistic, while only needing modest hardware. Games like Naughty Dog's "The Last of Us Part 2" or Rockstar Games' "Red Dead Redemption 2" are great examples of this.
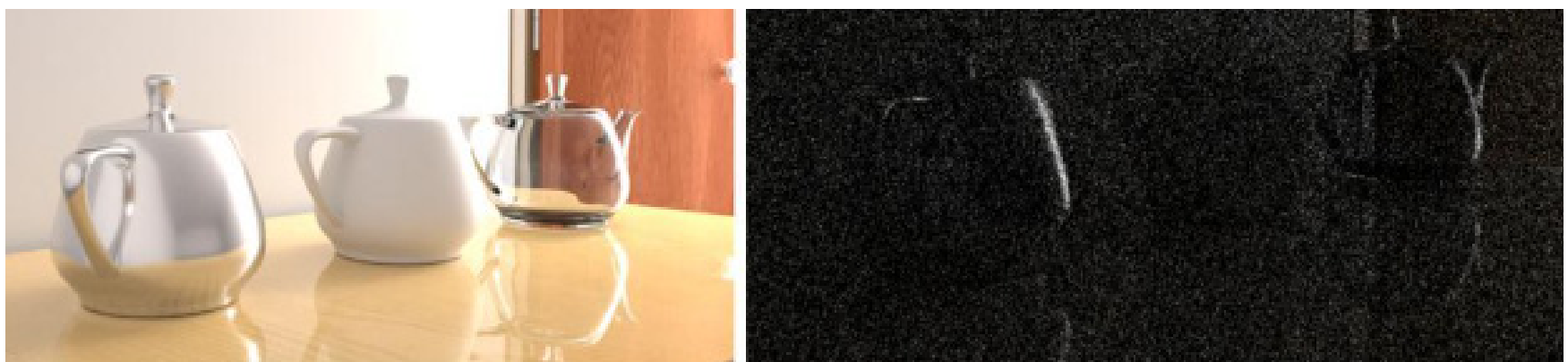

Left: Denoised image | Right: Unfiltered output from ray tracing
Taken from: Real-Time Path Tracing and Beyond | Nvidia Research

tracing more light rays, but remember we have a 30 FPS minimum target to meet. So, much more efficient and clever approaches, like denoisers and upscalers are used instead of a brute force approach.

However, even with all these tools, ray tracing in modern games remains more of a flourish rather than an essential part of the rendering. Only certain features, like shadows and certain reflections are done using ray tracing, with much of the scene using traditional approaches. "Ray Tracing: Overdrive Mode" in Cyberpunk 2077 is a rare exception to this, as Ray Tracing is used for everything in that mode. Rays bounce from surface to surface, shifting in color based on the material properties of the surfaces. Material properties in ray tracing are modeled using the "Physically Based Rendering" (PBR) approach, where each surface has various attributes like diffuse color, roughness, specular highlights, etc. These values can even vary from point to point on a surface. This particular model is quite advanced, representing everything from rough carpets to reflective smooth metallic surfaces.

Cyberpunk 2077 also looks quite good even without "RT Overdrive '', but the improvements in indirect lighting and the removal of unrealistically lit surfaces with "RT Overdrive'' enabled are easy to notice in a comparison. Today, the "RT Overdrive" mode is barely feasible for only the very best hardware, so this mode is a glimpse into the future.
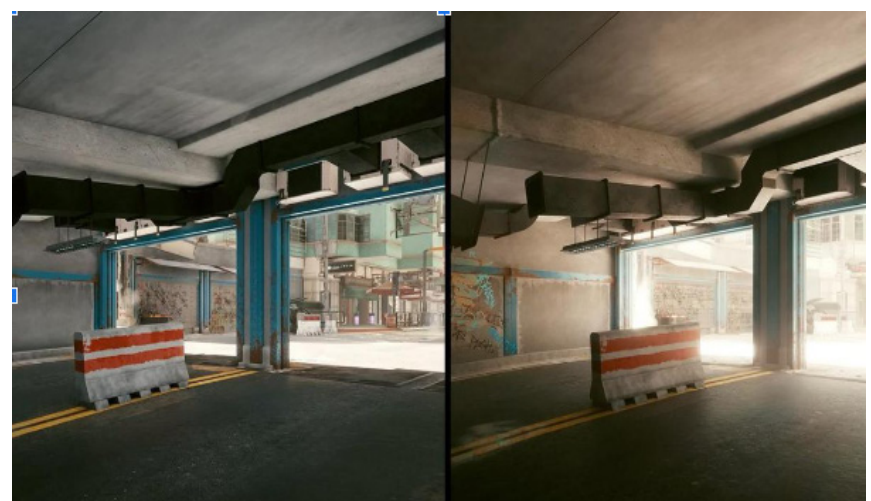

RT OVERDRIVE OFF   RT OVERDRIVE ON

Notice how aspects like the sun's warm glow are now apparent even on the ceiling of the tunnel!
Taken from: Cyberpunk 2077 Ray Tracing: Overdrive Technology Preview on RTX 4090 (2:07) | Digital Foundry -YouTube

So far we have only discussed lighting for hyperrealism. However, there is another major aspect to consider - meshes. Meshes are a collection of triangles that define any object in a game.
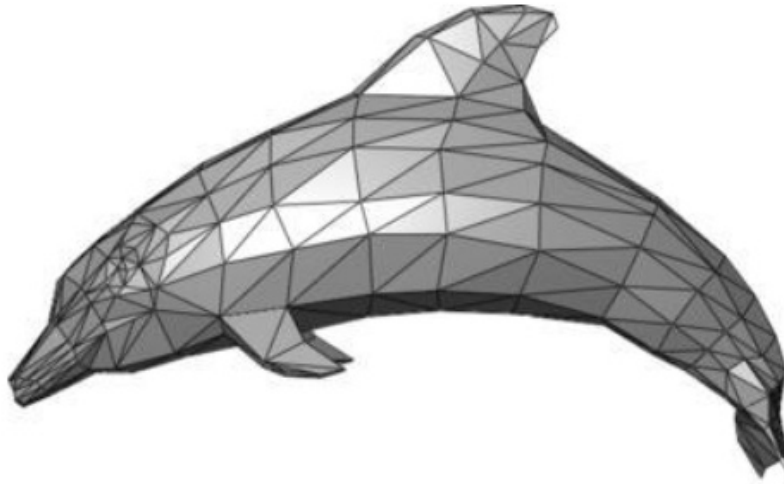
A Dolphin mesh consisting of many triangles

Once again, due to the 30 FPS target and hardware constraints, we cannot just put an infinite amount of triangles on a mesh. Triangle meshes are quite challenging to incorporate in the quest for hyperrealism, as edges in most real objects are not hard edges, they are smooth. Representing smooth edges in such meshes requires significantly more triangles, which

A traditional approach involves storing high quality meshes, but not rendering them until the camera is very close to the object. When the camera is further away, simpler meshes (with fewer triangles) are used. This is called Level of Detail (LoD). The downside of this is that an artist is now responsible for creating and maintaining not just one high quality smooth mesh, but multiple simpler meshes for optimization. Every time changes need to be made on a mesh (like its shape), the simplified meshes also need updating. Yet another issue is that the transition from one detail to another is very noticeable to a keen eye.

Unreal Engine 5's Nanite introduces a much more flexible approach where a high quality mesh is dynamically simplified using clever algorithms. Think of it like being able to reduce the resolution of an image, but now we can do the same for a mesh.

It is very important to point out that we have only discussed a small subset of the approaches that are used for achieving the visual aspect of hyperrealism.

Discussion and conclusion

(Twiranux is the online alias of a videogame artist who worked on the hit game 'Vampire Survivors' and is currently working on Indie titles)

Saswat: How do you feel about Hyper-realism in video games as a video game artist?

Twiranux: I think hyper-realism can work in games. For example, a horror game can feel more realistic (and therefore creepy/horrific) if it mirrors reality that much more accurately. Real-time shadows or physics can deepen the game environment. I think rooting a game in realism can make it more effectively surreal since the fictitious parts can pop out against that backdrop. With Unreal Engine 5 for example, it can render realistic sun shafts and shadows; that would be super useful with games about exploration.

But with that being said, it can be a detriment as well. From a technical perspective, using hyperrealism can pump up the download space the game takes. But, what if people can't afford to support the graphics on their computer/console? What if the resolution is too small for hyperrealism to really be effective? We don't need every blade of grass to react to a gust of wind on a mobile/tablet game. An arcade racing game doesn't need every window pane and crowd reaction to be simulated if it's restricted to one camera angle. Humans in video games can be rendered as realistically as possible, but it won't win any favors if their writing/motions are not realistic. There have already been game demos that mimic police brutality (body cam games), and for what? Just a veil of old-school shock value, just to get people's attention. But realistically, would people even play that game? It's the equivalent of a 360 degree YouTube video or Google Maps (GeoGuessr). It's a simulated hyper realistic space where real, terrible things could be done without consequence.

Saswat: I've noticed that a video game feeling realistic doesn't always mean that the video game has hyper-realistic physics. For example, when we're walking, our eyes completely stabilize our vision, when we enter a dark corridor, our eyes adjust to it and we start seeing clearly. Now imagine that in a video game, if we have our cameras not move at all while walking if dark corridors don't appear as dark, it feels fake despite it mimicking what happens in real life.

Twiranux: I think that's a good way to put it, camera reality versus real perception. Our eyesight automatically filters out our own motion blur. We can always close our eyes if the sun shines too bright on our faces. Our eyes adjust to the dark if we're in it. When all of that is simulated, our eyes don't have to do the work. It's auto-adjusted, first as a base standard so everyone can later change it in the options (gamma, bloom, motion blur, etc), and it's further adjusted by the individual's monitor too. My personal contrast and brightness are lower because I suffer from photosensitivity. There's no true depth in video games either. It's not really a three-dimensional space (excluding VR). Depth of light and physics can't be gauged by walking around like one would in real life. Going back to the horror game example, one of the staples of the genre is the most unrealistic depiction of flashlights. It's rare to get a strong, wide-beamed flashlight in a horror game because it would take away from the atmosphere. Or the idea that a room could be pitch black without one.

There's something I learned in college about global illumination in setting up 3D scenes. If you want a moody atmosphere, you would manually set up the lighting; you would not usually use the global "sun" and assume it will all work out. Lighting in itself can have a lot of intention. If it was all set to be realistic, a lot of games would be a lot brighter than they currently are indoors.

Saswat: I think there has to be a distinction made between real life and what we perceive through the media. We experience reality in many ways through the camera like YouTube videos or cinema. And of course, camera-captured reality is different from real life. I think we ourselves get confused between 'real reality' and 'camera reality'.

(This is only an excerpt of a discussion relevant to the article)

This conversation made something noticeable, and that is how the culture you are brought up with can affect the sense of reality in Video Games. Let's look at cinema for an example. We'll notice that the way they set the atmosphere visually is very selective and artistic. The director, oftentimes, has trees, bushes, the ground, and even the camera shaking violently in an action sequence to show the sheer chaos taking place. For many of us, this chaos is only realized through the consumption of that media. If we see a video of the same action scene taking place

without the environmental artistic effects, it would seem unrealistic. There is no natural law that states that during a thrilling experience in real life, the ground, or our vision has to shake the way they do in the movies, but we somehow expect it.

Another thing is the way randomness works in real life and how we experience it. We can go outside and touch grass and we'll realize that there are many different types of bushes and trees. Some light-looking bushes don't move at all, while some trees sway in a rhythmic pattern. The randomness of this, we think, can't be successfully emulated in video games. Imagine playing a video game where a shrub is not moving while the tree next to it is swaying, if that happens in real life, it's realistic, of course, but in a video game, it seems weird, it seems like the developers didn't think about it. What if video game developers make all the bushes and trees still? That's not realistic at all! That would make the developers look lazy. What if they made all the bushes and trees move? That would be too visually stimulating, a very familiar criticism known to anyone who has been in the space of shaders and graphics mods.

This whole thing is very similar to when Apple had to make iTunes' shuffle feature less random by adding different parameters because when it was actually random, it didn't feel random to the users.

So we've learned that to achieve a sense of hyper-realism, of course, we need realistic physics. But, sometimes we need to make things unrealistic too, we need to add effects that would mimic 'camera reality' more than reality itself. Adding camera sway while walking, adding motion blur, and working with different exposure or contrast settings to make the game seem like it's a 'camera capture of reality' can have a pretty significant influence on the feeling of 'realism' for the player.

The Tech Playground:
Exploring the field of Virtual Reality

Mission Shrestha
DoCSE 2019

Hey there, tech enthusiasts! Have you ever wondered what it's like to step into a different world without leaving your room? Well, that's precisely what Virtual Reality (VR) offers. In this article, we're diving headfirst into the immersive universe of VR and how it's shaping the way we play, learn, and connect.

Strap in. It's VR Time!

Imagine this: You put on a sleek headset, and suddenly, you're not in your dorm room anymore. You're on top of a mountain, soaring through the skies, or exploring ancient ruins. Welcome to the world of Virtual Reality, where the line between the physical and digital realms blurs.

Gaming Like Never Before

Gaming in VR isn't just playing a game; it's living the game. With motion controllers and head-tracking technology, you can swing swords, cast spells, and dodge bullets with your own movements. The adrenaline rush is real, and with the intensity of virtual battles, you'll find yourself breaking a sweat.

Learning Beyond Boundaries

But VR isn't limited to gaming. It's a game-changer in education as well. Imagine studying the solar system by flying through it or understanding complex molecules by interacting with them. VR turns textbooks into immersive experiences, making learning more

The Social VR Revolution

VR is also bringing people together in entirely new ways. In the virtual world, you can meet friends from across the globe, attend concerts, or even host virtual meetups. It's like having a digital hangout space where distance is no barrier. The virtual campfire is where stories are shared and connections are made.

The Challenges of VR

Of course, VR isn't all fun and games (well, it mostly is fun). There are challenges to overcome. VR headsets can be expensive, and motion sickness can be a real issue for some users. Moreover, there's the question of privacy in a world where your digital self is as real as your physical self.

Creating the Metaverse

Have you ever heard of the metaverse? It's a buzzword in the tech world, and VR is a big part of it. The metaverse envisions a shared virtual space where people can live, work, and play. Companies like Facebook (now Meta) are heavily investing in making this dream a reality. It's a concept that could redefine our online existence.

The Future Beckons

As we venture further into the realm of VR, the possibilities seem limitless. From healthcare simulations to architecture and design, VR is revolutionizing industries across the board. It's a field ripe for innovation, and as students in the tech world, we have a front-row seat to witness the VR revolution.

Strap On Your Headset and Dive In!

In conclusion, virtual reality is not just tech; it's an adventure waiting to be explored. It's the future of entertainment, education, and social interaction. So, if you haven't tried VR yet, it's time to strap on that headset and dive into a world of endless possibilities.

So, who's ready to embark on a thrilling journey through the boundless realms of the virtual universe?

Zero Knowledge Proof

Adhishree Acharya
Computer Engineering 2020

If somebody tells you a secret without telling you what the secret is about, would you consider the information to be valuable or worthwhile? The majority of you would perceive the information as nothing but a piece of garbage, while some of you would be skeptical. If you struggle to see the worth in such information, you're not alone. Early reviewers faced a similar challenge when assessing the groundbreaking paper titled "THE KNOWLEDGE COMPLEXITY OF INTERACTIVE PROOF SYSTEMS". Consequently , they rejected it multiple times. However, when it was eventually published in 1985, it introduced the world to the concept of "Zero Knowledge Proof", catalyzing significant advancements in both the tech as well as the non-tech industries.

So, what exactly is a Zero Knowledge

"A zero-knowledge proof is a protocol by which one party (the prover) can prove to another party (the verifier) that something is true, without revealing any information apart from the fact that this specific statement is true."

Suppose a policeman wants to verify your age during a routine traffic checkup. What's the authentic source of verification?
Driving License, right?

But it holds a lot more personal information than just your age. This can raise privacy concerns.

But what if there were a way to only reveal your age without giving unnecessary personal details? That's where Zero Knowledge Proofs come into play. It allows you to prove your age to the officer without giving away extra bits of information.

Let me clarify with another example. For instance, Ada has two balls and she wants to prove to her colorblind friend Robert that the balls are distinct without disclosing their actual colors. Here's how she does it. She simply hands those balls to Robert. Upon receiving the balls, he either switches their positions or keeps the original arrangement, hidden behind his back, before presenting them to her again. Ada, observing the balls, simply responds with "switched" if she detects the change in their positions or "not switched" if she does not. To Robert, who is oblivious to the fact that the balls are not identical, her response in the first trial may appear as a mere 50-50 guess. In the second trial, the probability of this being a fluke is reduced to ¼. However, if Ada correctly guesses in successive trials, it strongly implies the existence of a distinguishing cue enabling Ada to ascertain whether he has performed swaps or not, ultimately providing evidence for balls to be of different colors. In this case, Ada demonstrated Zero Knowledge Proof as she never mentioned the colors of the balls but still delivered the information that they were not the same.

But what if Ada were bluffing all the time and wanted to misguide her friend?

What if Robert already knew that the balls were distinct? These two scenarios can undermine the credibility of Zero Knowledge Proof and sometimes lead to incorrect results. Therefore, to ensure Zero Knowledge Proof, it is essential to satisfy three properties:

Completeness: It entails that when the statement is true,

a truthful verifier adhering to the protocol will be persuaded of its truth by an honest prover. In the above scenario, Ada truly possessed balls of different colors and provided the correct response whenever Robert swapped the balls in consecutive trials. Similarly, Robert, as a verifier, never misled her when her response was correct. As a result, Robert was persuaded that the statement was true because both of them followed the protocol honestly.

Soundness: It means that if the statement is false, the dishonest prover cannot convince an honest verifier that it's true, except with a small probability. Let's consider an instance where Ada decided to be dishonest, claiming that the balls have different colors when, in reality, they are of the same color. When she hands the balls to Robert, if he hides them behind his back and presents them again, she would not be able to accurately determine whether the balls were swapped or not as there would not be a distinguishing feature. Hence, she would not be able to deceive him and prove the false statement to be true and even if she does, the probability of success is very low.

Zero Knowledge: It implies that if the statement is true, the verifier gains no additional information except from the fact that the statement is true. In the above example, Robert only learned the fact that the balls differed in color without being aware of their specific colors. Zero Knowledge Proof(ZKP), equipped with these three fundamental properties, extends its dominion to a myriad of applications. Some of these are listed below:

Blockchain: It is the cutting-edge decentralized system evolving every single day. While it champions transparency and the sharing of data among all stakeholders, it still grapples with a pressing privacy concern. To address this concern, some of its projects like Zcash, zkRollups, etc., have implemented ZKPs to validate transactions without exposing sensitive details, ensuring a delicate balance between transparency and privacy in the digital age.

Banking System: ZKP has found its application in Banking sectors too. The Dutch bank ING has built a variation of this concept called Zero Knowledge Range Proof which proves the range of numbers without revealing the actual number. This technique can be used to verify if the employee is eligible to get the loan without disclosing his/her actual salary.

Nuclear Disarmament: In 2016, the concept of ZKP was implemented at the Princeton Plasma Physics Laboratory and Princeton University. It enabled inspectors to verify whether or not an object is a nuclear weapon without documenting, sharing, or disclosing what may be confidential internal work.

These real-life examples vividly illustrate how Zero Knowledge Proof (ZKP) can be a game-changer, providing the key to ensuring security, safeguarding privacy, and fostering trust across a spectrum of vital applications. In an era where digital interactions define our daily lives, ZKP emerges as a beacon of privacy and security, inviting us to embrace a future where our data remains genuinely ours.

Cookies and Cybersecurity: What You Need to Know

Dikshya Lamichhane
Computer Engineering 2022

Ah, cookies — not the kind your grandma bakes, but those sneaky little files that make your online life more convenient. They remember your preferences, keep you logged in, and basically act as your digital butler. But just like in real life, not all cookies are trustworthy. Let's dive into the sweet world of cookies and cybersecurity!

Cookies are innocent little text files, kind of like a fluffy puppy. Websites use them to remember your preferences. But, watch out! Cybercriminals see these cookies as tasty treats. They can pretend to be you, grab your money, or sneak into your accounts. It's like inviting the Cookie Monster into your online cookie jar!

Picture this: guarding your secrets online is like safeguarding your grandma's top-secret cookie recipe. You wouldn't just spill the cookie beans to anyone, right? So, when it comes to your personal information, be cautious and selective.

Now, think of your browser as a cookie jar; if you let it overflow, things could get messy. Just like cookies can go stale, your browser can become outdated. Keep it fresh and updated to stay ahead of the ever-evolving cyber game.

Imagine tidying up your online world like you're decluttering your closet with Marie Kondo. Delete cookies regularly to keep your digital space neat and tidy.

Now, consider this: just as you wouldn't tolerate uninvited guests at a private event, why should you allow third-party cookies into your digital world? It's time to firmly shut the door on these intruders and keep cybercriminals at arm's length.

Think of your online presence as a formidable fortress. Strengthen its defenses by employing a VPN — think of it as constructing a virtual moat around your stronghold. This additional layer of protection renders it exceedingly difficult for digital adversaries to breach your digital defenses.

Lastly, when those cunning digital pests attempt to disrupt your online activities, enlist the aid of the anti-malware guardians. Regard them as your digital security detail, tirelessly safeguarding your virtual domain, ensuring it remains secure and tranquil.

In today's ever-connected digital world, it's essential to understand that while cookies can make our online experiences more convenient, they also pose privacy risks. Beyond managing your cookies and utilizing cybersecurity measures, it's crucial to stay informed about the evolving landscape of online threats.

Keeping up to date with the latest cybersecurity news and staying vigilant can be your strongest defense. By educating yourself and practicing good online hygiene, you can better protect your digital presence from potential intruders.

Your active participation in maintaining a secure online environment is just as crucial. The internet can be a wonderful place, filled with opportunities and adventures, but, like any other field, it requires mindfulness and caution.

So, as you savor the sweetness of your online cookies, also savor the satisfaction of knowing you're taking the necessary steps to safeguard your digital pantry and enjoy your internet journey securely.

Cookies are the unsung heroes of the internet, adding sweetness to your online adventures. But beware, not all cookies are friendly! Treat your online activities like a treasure hunt, protecting your gems from cookie-snatching pirates. Follow these tips to enjoy your online cookies without cyber-crumbs.

Stay safe, stay vigilant, and let cookies be a delightful addition to your online life, not a security concern.

Blockchain Technology & Healthcare: Ensuring Data Integrity and Security

Sanjay Pahari
Computer Engineering 2022

The healthcare sector is constantly evolving to address the challenges it faces and is exploring novel approaches such as analyzing patient data to detect diseases before they manifest and implementing telemedicine, artificial intelligence, and blockchain technology to improve patient outcomes, reduce costs, and enhance the overall quality of healthcare services. Health data security and integrity are, needless to say, crucial to the success of these approaches. Healthcare providers must ensure that patient data is collected, stored, and transmitted securely and that only authorized personnel have access to it. This requires robust security measures that can ensure that healthcare providers overcome obstacles and accomplish their aim of providing high-quality healthcare services to patients.

Integrating blockchain technology into healthcare systems can be a prominent solution for challenges that can arise in this field. Let's explore blockchain technology and its significance for better data security, integrity, and administration in the healthcare industry.

Understanding Blockchain Technology

At its core, blockchain is just like a physical ledger but a digital one that consists of interconnected blocks. Each block contains data and records, which can also be compared to a safe, digital version of a traditional ledger or a ledger of transactions, but with better data security and transparency. Encryption and decryption methods are the secret to its robustness, which protects sensitive information.

Challenges in Healthcare Data Management

In many developing countries, including Nepal, personal health data is predominantly stored in hardcopy formats. Digital health records are a rarity, and even when they do exist, there are still issues with data accuracy and protection. The stakes are high when it comes to health data, as people's lives often depend on the accuracy and accessibility of this information. Data hazards in the form of flaws, hacks, data breaches, insider threats, human employee errors, etc. are some security issues that complicate data management. Security and integrity are more important, especially when using IOT devices to collect and record sensitive health data.

The Importance of Health Data

Health data encompasses a wide range of information, from vital signs like sugar levels and blood pressure to more complex indicators like Thyroid-Stimulating Hormone (TSH) levels. Such data plays a critical role in providing effective healthcare and tailoring treatments to individual patients. The integrity and security of sensitive data must be guaranteed above all, as these findings help to better understand early disease prediction accuracy.

How Does Blockchain Technology Ensure Data Integrity and Security?

Blockchain technology has emerged as a powerful

solution to address data integrity and security concerns in a lot of fields, including healthcare. The worldwide landscape is riddled with data security concerns, including vulnerabilities, cyberattacks, data breaches, insider threats, and human errors, even in the context of healthcare. Therefore, it's very important that healthcare systems put data integrity as their first priority if they are to reduce these risks and avoid potential harm.

Blockchain technology provides a multi-faceted approach to safeguarding health data. At its core, it relies on robust encryption and security measures to protect sensitive information. By doing so, it significantly raises the bar for unauthorized parties attempting to gain access to or tamper with this data.

One fundamental aspect of blockchain technology is its ability to create immutable records. Once data is written into a block, it becomes locked in place, unchangeable, and permanent. This immutability of data ensures that medical information remains accu-

rate and trustworthy over time. Any attempt to alter or remove data would leave a clear and traceable trail, which enhances the security and integrity of medical records.

Decentralization is another key feature of blockchain systems. Unlike conventional centralized systems where data is stored and managed in a single location, blockchain operates on a distributed network of computers. This decentralized architecture spreads data and processing power across multiple nodes, reducing the risk of a single point of failure. This makes it

considerably more challenging for malicious actors to compromise the system or gain unauthorized access to sensitive health data.

Moreover, blockchain's transparency adds an additional layer of security. Authorized individuals can securely access data while having the ability to monitor any changes or access attempts. This transparency not only ensures data integrity but also provides a robust audit trail, making it easier to track any unauthorized activity and maintain the confidentiality of health records.

Thus, Blockchain technology provides a reliable solution at a time when the confidentiality and integrity of health data are crucial. It is the best option for encrypting sensitive health data due to its immutability, decentralization, transparency, and encryption capabilities. Although there are still difficulties, the advantages of implementing blockchain technology in healthcare are significant and might ultimately result in better patient care and data security. Adopting cutting-edge technology like blockchain will be essential to guarantee the safety and integrity of vital health data as healthcare systems throughout the world continue to change.

Cybersecurity Trends: Adapting to the New Normal

Bibek Adhkari
Computer Engineering 2021

With advancing time, technology has become an indispensable aspect of both our personal and professional lives. With laptops and mobile devices as our trusted companions, it's hard to imagine getting through all day without them. This reliance on technology is sure to intensify in the future. As technology blooms further, threats in this landscape are sure to emerge eventually. In this ever-expanding digital realm, some individuals seek to exploit it for their gain through malicious activities. Such individuals or cybercriminals leverage various sophisticated techniques and emerging technologies to target individuals, businesses, and critical infrastructure systems.

Let's go into some of the cyber attacks that are constantly challenging our lives :

Ransomware Threats

At its core, blockchain is just like a physical ledger but a digital one that consists of interconnected blocks. Each block contains data and records, which can also be compared to a safe, digital version of a traditional ledger or a ledger of transactions, but with better data security and transparency. Encryption and decryption methods are the secret to its robustness, which protects sensitive information.

The Colonial Pipeline attack in 2021 demonstrated the potential havoc ransomware can cause on vital fuel supply chains, leading to widespread panic. As ransomware-as-a-service models proliferate on the dark web, the expenses linked with these attacks will only escalate if preliminary actions are not taken. To counter this growing threat, companies must focus on prevention through cybersecurity awareness training, implementing robust backup and disaster recovery solutions, regularly patching systems, and developing rapid incident response plans.

Social Engineering

Hackers apply social engineering tactics to obtain sensitive information and covertly set up malware on users' devices without their knowledge. Phishing emails and texts impersonating trusted brands or government agencies attempt to steal login credentials and infect devices. Well-crafted phone scams also trick employees into transferring funds or giving remote access to "support technicians."

Research has shown that weak security at a single vendor can expose the entire supply chain. The SolarWinds, Kaseya, and Microsoft Exchange Server breaches demonstrated how determined adversaries can infiltrate through third parties to access larger targets down the line. Conducting thorough due diligence on vendors handling important data and implementing network segmentation can help limit the fallout from these increasingly sophisticated intrusions.

Data Breaches

As more data is collected, stored, and shared online, the risk of data breaches increases. However, proactive security measures like data encryption, access controls, anomaly monitoring, and limiting data retention can help curb the business impact and reduce the risk of fines or litigation.

Companies should also implement robust incident response plans and be prepared to promptly notify affected individuals of a breach as required by data privacy laws in different jurisdictions. With the right precautions, businesses can maintain privacy and address reputational risks in the event of an inevitable breach.

Malware Evolution

Malicious software adapts faster than ever, leveraging new techniques like file-less infections, living off-the-land attacks that abuse legitimate operating system tools, and weaponizing vulnerabilities in widely used software. To outpace these evolving threats, security teams must invest in dynamic solutions that can detect and block both known and unknown malware based on behavior analytics rather than just signatures.

User awareness also remains critical to identify and report suspicious programs or unexpected system behavior. With cybercriminals continuously improving their tactics, techniques, and procedures, defenses require constant adaptation and advanced preventative strategies to defeat modern attack methods.

Lack of Proactive Security in Emerging Technologies

While new technologies present opportunities to drive innovation, they also introduce novel attack surfaces and vulnerabilities that threat actors quickly exploit. Whether it's cloud infrastructure, internet-connected IoT devices, mobile applications, or operational technology systems, proper security safeguards must be integrated from the design phase for each new challenge.

Therefore, conducting risk assessments and following good security practices specific to emerging technologies will help secure emerging innovations from the beginning. Organizations should also monitor for vulnerabilities and patch them promptly to minimize exposure from potentially immature initial security implementations. With proper development and management, businesses can continue to harness new technologies safely.

Conclusion

The cyber threat landscape will continue evolving rapidly alongside emerging innovations. However, maintaining vigilance, training employees, and adapting controls proactively can help organizations navigate modern cyber risks and the new normal of sophisticated attacks. With awareness of trends, prudent security practices, and continuous improvement, businesses can strengthen their resilience against such evolving threats.
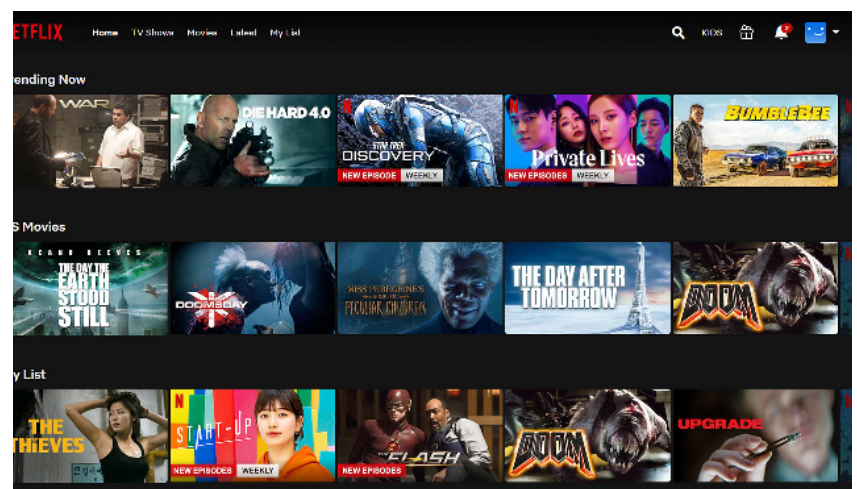
How Computer Science Altered Our Life

Mandira Sharma
Computer Engineering 2022

The ever-evolving field of computer science has profoundly reshaped our perception of life. Think about how much your daily life has changed in the last few decades. It's not just about gadgets or apps that you see on TikTok; it's about something bigger — Computer Science.The Information Process has transformed how we learn, make decisions, and solve problems. In a world flooded with information, we've evolved into constant learners, always open to new knowledge. The way we make decisions, the way we pass the decision has become data-driven, relying on algorithms and analytics. Also, problem solving is equipped with such technical tools offering solutions at such speed which was unimaginable in the past. Starting with basic computers and moving to today's complex algorithms and artificial intelligence, computer science has made a lasting impact on how we live our lives.Computers today are incredibly fast due to advancements in processor

technology, solid-state drives (SSDs) for faster data access, powerful graphics processing units (GPUs), and parallel computing. Additionally, technologies like quantum computing are on the horizon, promising even greater computational spee1d in the future.

And right now, if you were to watch a video about shoes, next hour, your phone would be flooded with shoe advertisements. It might annoy you a bit, but it shows how clever algorithms can be, don't you think? tisements. It might annoy you a bit, but it shows how clever algorithms can be, don't you think?

Once, knowledge was limited to only a privileged few. Today, in the digital era, that limit has burst wide open. The internet is our library which we have access 24/7 from all over the world.
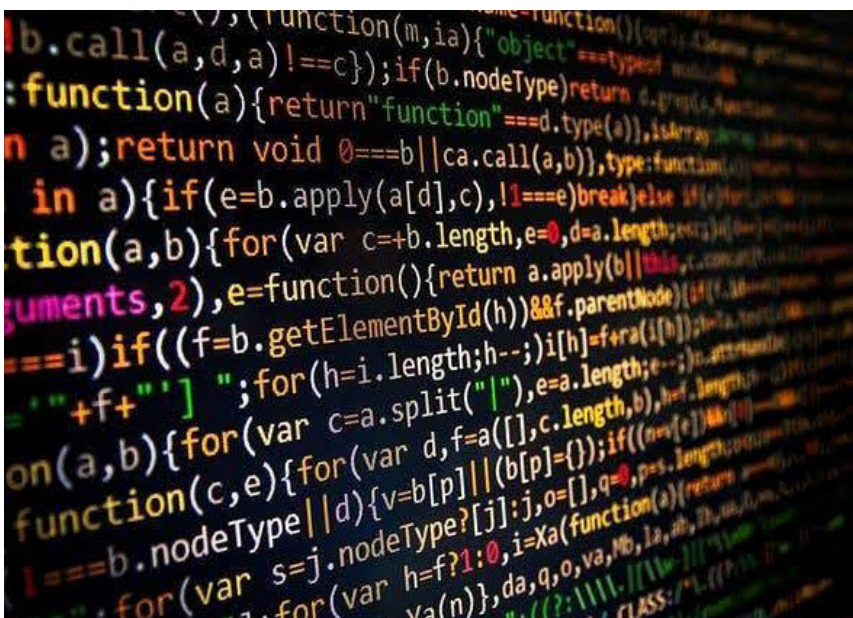
Talking about decision-making, we're flooded with information and decisions to make. Computer Science helps by giving access to lots of data and creating smart tools to help us choose wisely.

Think about when you're watching videos online. The platform suggests new videos based on what you've watched before. It's like having a friendly guide who knows your interests and helps you discover new things. This technology is like a helpful companion in our ever-changing digital world.

The impact of computer science on our lives has been a long and significant journey. It has touched every aspect of our existence, bringing both positive and negative changes.

Picture this: Cybercrime, privacy dilemmas, and security challenges were the obstacles trying to rain on our parade. In a world capable of growing such problems, how we use computer science will shape our future. Its influence will keep growing, and we must use it wisely.
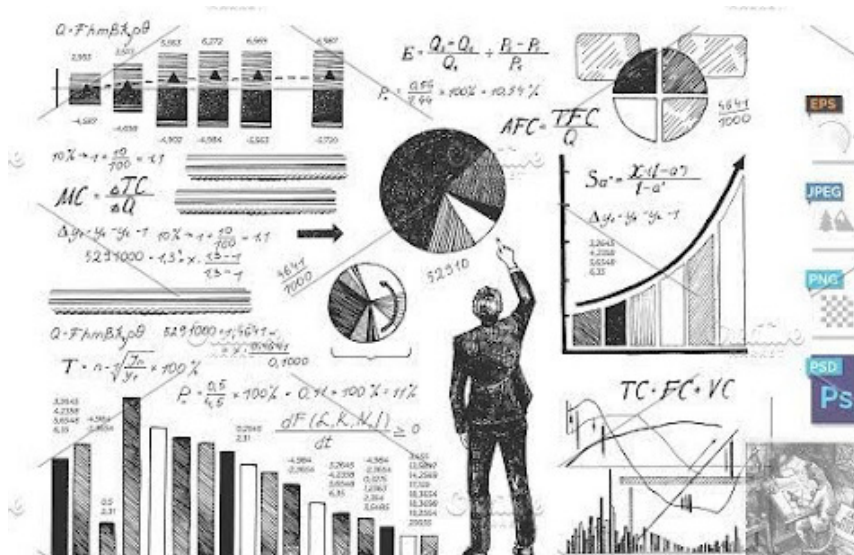
Igniting the Digital Age with Data Literacy

Dilasha Upadhyay
Computer Science 2020

Data takes various forms, spanning from valuable numerical measurements and descriptive text to intricate visual representations like images. Each element contributes its distinct significance to the realm of Data. The importance of data goes beyond its role as a reservoir of information; it extends into the domains of analysis, manipulation, and thorough examination, enabling the extraction of meaningful patterns and valuable insights. It serves as the foundation for informed decision-making and

strategies across various domains, particularly within the business landscape. In our digital age, data is all around us, generated by individuals, organizations, and devices. By delving into the depths of Data, organizations gain the capacity to uncover hidden trends, identify emerging opportunities, and navigate complex challenges. Ultimately, this transformative power of data-driven insights is serving as a catalyst for many businesses for their innovation and progress. Now, let's talk about Data Literacy. It is the ability to encapsulate the capacity to comprehend, interpret, and extract insights from data, ultimately helping us in finding patterns, trends, and correlations that we couldn't have otherwise. Data Literacy enables us to harness the inherent potential of Data to make informed decisions about real-world problems. While Data Literacy undeniably resonates with data-driven specialists like analysts and scientists, its reach extends far beyond these realms. Data Literacy is all about empowerment. Armed with this skill, individuals can navigate the complexities of their domains more deeply. Therefore, the power of data literacy lies in its potential to transform passive recipients of information into active participants in the decision-making process. By connecting individuals with the vast expanse of digital information it acts as a vital gateway for information exchange.

individuals can navigate the complexities of their domains more deeply. Therefore, the power of data literacy lies in its potential to transform passive recipients of information into active participants in the decision-making process. By connecting individuals with the vast expanse of digital information it acts as a vital gateway for information exchange.

As the world becomes increasingly interconnected and digitised, the volume and variety of data generated have grown exponentially, laying the foundation for the digital age we inhabit today. Within this context, the concept of Data Literacy gains even more significance, acting as the key to unlocking the vast potential that Data holds. It helps to connect individuals with the vast digital sea of unmanaged information out there

and empowers them to make sense of hidden patterns and concealed correlations. Every interaction online, each search query, and every click contributes to the vast reservoir of digital data. All of this ultimately contributes to the digital ecosystem that humans have tried to build over the years.

Let's take the example of E-commerce. In the realm of E-commerce, Data Literacy empowers businesses to discern customer preferences, personalised recommendations, and enhance their overall online shopping experience. It enables individuals to extract meaningful insights, make sound judgments, make sound judgments, and harness the power of Data to generate positive outcomes for their well-being.

Ultimately, Data Literacy holds the key to unlocking the full potential of our ever-changing and confusing digital age. It equips us with the knowledge to traverse the expansive realm of digital information allowing us to make informed choices in our everyday life.

My journey in Data Literacy further illustrates this transformation. Through a Data Fellowship affiliated with Code for Nepal, and enriched by resources like DataCamp, I've transitioned from being a Data Fellow to a passionate Data Advocate. This immersive experience equipped me with the skills to decipher complex data landscapes, extract meaningful insights, and advocate for Data Literacy among my peers. From understanding the intricacies of data to advocating for its importance, I've harnessed the power of data to create positive change, amplifying its significance in today's digital era. This fellowship has enriched my understanding and motivated me to spread the importance of Data Literacy far and wide.

Therefore, Data Literacy is the beating heart of our ever-so-changing digital age, a relentless force driving informed choices, fueling innovation, and propelling our society forward into the future at full speed. Whether it's businesses leveraging insights, educators customising curricula, healthcare providers improving patient care, or citizens making well-informed decisions, Data Literacy weaves through every aspect of our lives. As we continue to navigate the digital age, embracing Data Literacy becomes an investment that equips individuals not just to endure but to excel amid the vast ocean of data, guiding us toward a more enlightened and empowered future.

Addressing Data Leakage: Essential Considerations for Trustworthy Machine Learning Models

Mala Deep Upadhaya
Computer Science 2016

With the rise of the ChatGPT use case and other AI markets, the accuracy and trustworthiness of AI models are of utmost importance. The numerous moving parts in this endeavor make it challenging, including data leakage, which is frequently underrated but has serious repercussions. Before delving into what data leakage entails, let us consider an example..

Do you recall a scenario where you received hints about the answers to a test before you had even begun studying? If so, although your exam preparation might have gone well, on exam day, you would likely be unprepared because you relied on these hints. Similarly, when a machine learning model is trained with such 'hints,' or leaked information from the test, it may appear effective, but in real-world applications, without these hints, the model may not perform well

If you get this scenario, then you understand almost 60% of the topic.

Data leakage, often referred to simply as leakage, occurs when the training dataset includes pertinent information about the target variable, but comparable data is not available during the model's utilization for prediction purposes. It happens when information that should not be available to the model during training is somehow incorporated into the training process.

Machine learning models will inevitably make mistakes, but since they can only understand 0s and 1s, the responsibility lies with you, the creator.

Your machine learning model, which boasts a faultless accuracy of 100% during training, appears to be unbeatable, yes?
But there's a catch: in the actual world, this seeming perfection may fall apart, leaving your model performing below par. It's like a success mirage that vanishes when confronted with the unflinching reality of new data. Dealing with data leakage is thus a necessity rather than an alternative.

Types of Data Leakage in Machine Learning

Consider the following scenario: You have data on patients' current health status, including hemoglobin levels and other medical test results, and you want to predict whether a patient has anemia (the target variable).

Gender	Hemoglobin	MCH	MCV	Current Meds	Result
Male	9.3	21.5	90	Yes	1
Female	14.1	29.7	92.3	No	0
Male	6.9	28.1	32.5	Yes	1

Based on the scenario, let's understand the types of data leakage.

1. Target Data Leakage

Target leakage occurs when the information used to create the target variable is somehow included in feature variables. This means that feature variables contain data that would not be available when making predictions in the real world.

In our scenario, when you use the "Current medication" feature during training, you introduce target leakage. Models might learn quickly that a patient taking anemia medication (yes) in this feature has a high probability of having anemia. It is unlikely that your model would have access to this anemia medication status in real-world scenarios when applied to new patients, as it would not have access to whether a patient is cur-

Feature leakage as we have introduced Current Meds in the training phase.

Gender	Hemoglobin	MCH	MCV	Current Meds	Result
Male	9.3	21.5	90	Yes	1
Female	14.1	29.7	92.3	No	0
Male	6.9	28.1	32.5	Yes	1

rently taking anemia medication when predicting anemia.

You should carefully choose features to make sure that none contain any information that directly or indirectly reveals the target variable in order to prevent feature leaks. Remember, features should only include information that would be available at the time of prediction and not provide hints about the target variable's status.

2. Train-Test Data Leakage

In terms of leakage, train-test leakage isn't much different from target leakage. In the process of dividing your dataset into a training set and a test set (70—30 or 80—20 rules), you mistakenly include some patient records in both training and test sets in order to evaluate the performance of your model on unseen data. Simply put, there is a lot of overlap between the two sets of patient data in our scenario of anemia detection.

Because of this overlap, the model sees some of the same patient information during training and testing, which could lead to unduly optimistic performance estimates. When evaluating patients in the real world, you will not have access to the same data that you do

How to overcome Data Leakage

1. Split data even before preprocessing data

To prevent data leakage, split the data set and execute preprocessing separately for train and test data. As a result, the data closely resembles real-world events in which your model has no prior knowledge of the test data. To make sense of this, let's include two scenes

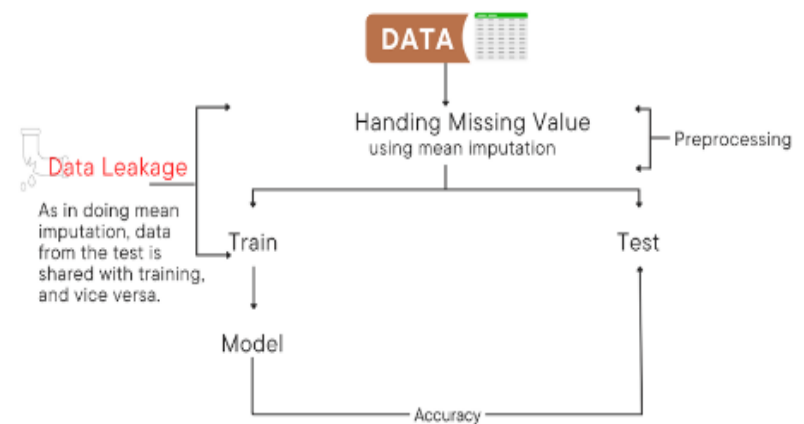### a. Data Preprocessing without Separation (Data Leakage)

Figure 3: Example showing feature leakage. Image by the author.

Here, data is split after dividing the mean by the average. In this scene, data leakage occurs because the model is exposed to test data during preprocessing, leading to misleadingly high performance on the test set.

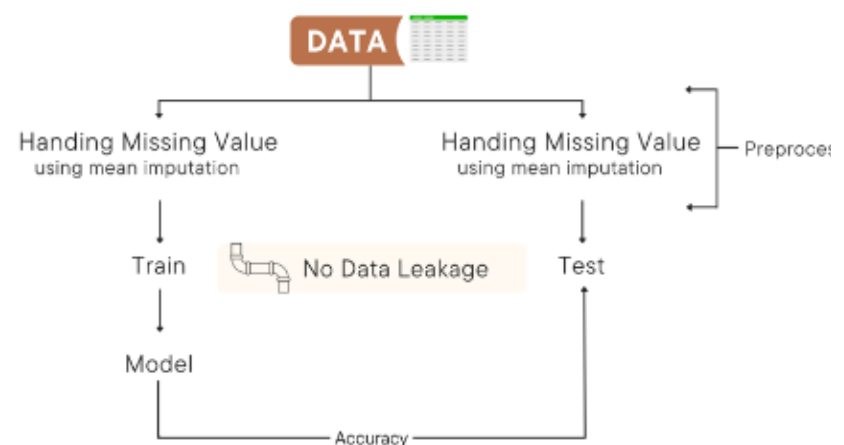### b. Data Preprocessing with Separation (No Data Leakage)

Figure 4: Example showing feature leakage. Image by the author.

In this scenario, proper separation of preprocessing ensures that the model's performance on the test set accurately reflects its ability to generalize to new, unseen patient data. The information between the test and the train is not shared.

2. Perform K-fold Cross-Validation

K-fold cross-validation involves dividing your dataset into K subsets (folds) and training and evaluating your model K times, with each fold serving as the validation set once. K-fold cross-validation ensures that each data point is used for both training and validation, but never at the same time. By repeating the training and
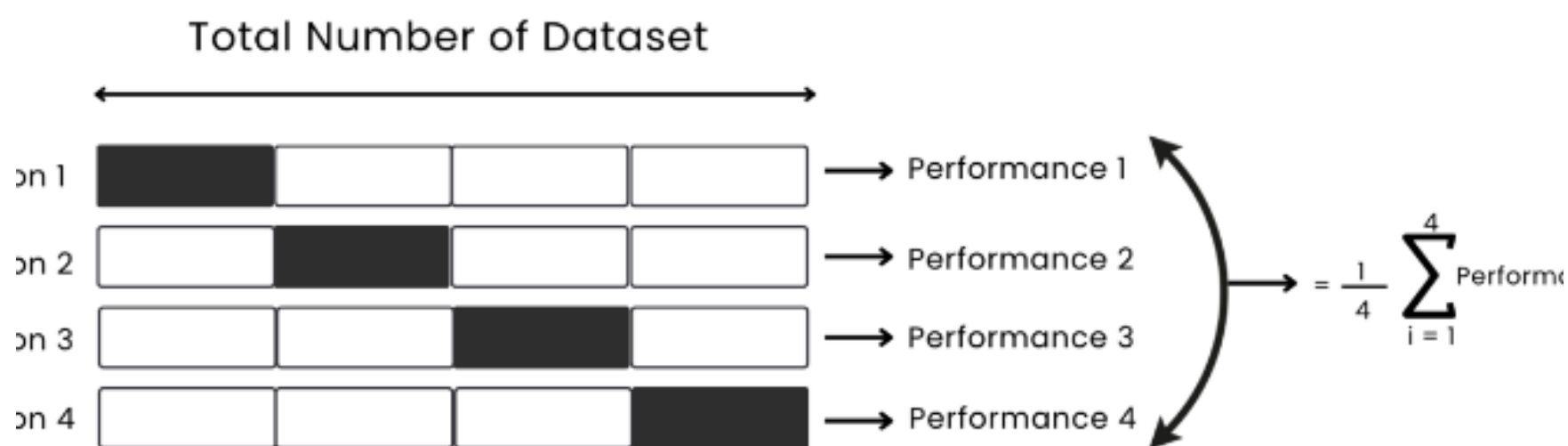
Total Number of Dataset

Figure 5: K-Fold Cross Validation when k =4. Image by the author

evaluation process K times with different validation sets, you obtain a more robust estimate of your model's performance. This helps ensure that the performance metric is not overly optimistic or pessimistic due to random variations in the data split and prevents data leakage by providing a clear separation between the data used for model training and validation.

Apart from these, you can also use the following methods for data leakage prevention:

1. The **Holdout Set** set stands as an impartial and untouched dataset, set aside exclusively for the final evaluation of your models. By preserving this holdout set, you shield your models from the pitfalls of data leakage, ensuring that their performance is rigorously assessed without any unintended influences from the training or test data. This set is not used during training or hyperparameter tuning but is reserved for final model validation.

2. **Stratified Sampling** contributes to data integrity by mitigating class imbalance, which can be a potential source of data leakage. It ensures that the model's training and evaluation are based on representative samples of the data, which is essential for accurate and unbiased model assessments. By using stratified sampling, you reduce the risk of data leakage stemming from class imbalance and promote a more reliable and equitable model development process.

In conclusion, data leakage emerges as a significant challenge within the domain of machine learning, posing a threat to the reliability and integrity of model outcomes. Given that the responsibility ultimately rests with the creator, vigilance throughout every stage of the model creation process is paramount. After all, it's best to refrain from indulging in false confidence, right?

Code in Amor: A Beginners's Guide to Secure Coding

Hritik Thapa
Computer Engineering 2018

Picture this: You've just created an awesome app that's gaining popularity by the second. There are millions of downloads in the Play Store and people are valuing your app up to thousands of dollars. Life's good, right? But then, all of a sudden your app is hacked, user data is stolen, and your reputation crashes faster than a falling meteor. All because of a tiny security loophole in the code. Had you possessed a good understanding of potential vulnerabilities in your code and prioritized secure coding practices, it could've raked in some serious financial benefit. Not just that, it would've been the super app, keeping the trust and privacy of millions of users in check. But nope, missed the boat on that one!

Why Secure Coding Matters

In an era where we're more digitally connected than ever, secure coding isn't just a fancy term thrown around in Silicon Valley - it's a necessity. Every app you build, every website you design, and every piece of software you write has the potential to become one of two things: a fortress guarding valuable data or a sieve leaking it out. And as software developers, we're not just coders; we're also the architects of these digital fortresses. Secure coding, then, becomes our suit of armor, our shield and sword that fortifies the fortress against waves of cyber threats.

Security != Boring

Now, before you roll your eyes and say, "But security is so boring!", let me stop you right there. Sure, security can be complicated, but guess what? So was learning to ride a bike, and look how that turned out! Think of encryption as a secret handshake, or a firewall as your own personal bouncer. Exciting, isn't it? Let's dive a bit deeper.

The Basics of Secure Coding

Input Validation: Imagine running a concert where anyone can enter without a ticket check. Chaos, right? That's your program without input validation. It acts as the bouncer of your code, verifying all incoming data for a valid 'ticket' or format.

Secure Design Principles: Ever heard of the saying, "Don't put all your eggs in one basket"? That's the essence of secure design principles like the principle of least privilege and defense in depth. It's about having multiple layers of defense and giving minimum necessary access.

Common Security Vulnerabilities: Did you know that something as innocuous as 'SQL Injection' or 'Cross-Site Scripting' could be a nightmare for your code? These are just some of the common vulnerabilities that can be exploited by attackers, and understanding them is the first step towards prevention. Now, you might be thinking, "Great, another expensive course or certification to add to my list." But hold on, what if I told you there's a way to boost your security knowledge without breaking the bank? Welcome to the world of OWASP, your personal security coach, offering comprehensive knowledge and free labs featuring modern, intentionally non-secure web applications for you to test your newfound hacking skills (they call it 'Juice Shop').

If you want to take it up a notch, OWASP ASVS (Application Security Verification Standard) is your go-to guide. Think of it as a checklist for secure development. While you don't need to tick every box on the list, the more checks you have, the stronger your code fortress becomes. So gear up and dive in, because in the realm of secure coding, knowledge is your greatest weapon!

Secure Coding in Practice

Secure coding isn't a one-time event; it's a continuous process that's integrated into your software development life cycle. You should always be open to learning more about security. As a developer and security enthusiast myself, I know how difficult it is to keep security in priority, especially when you are coding your semester projects. But here's the catch - when you step into the professional world, the game changes.

Yes, writing an efficient code that needs minimal refactoring should be your top priority, but you wouldn't want to let your software leak the customer's personal information all over the place either. So, how do you start practicing secure coding right from university? Here are some pointers:

Start Early: Incorporate secure coding practices in your university projects. It might seem like extra work, but it's the best way to learn.

Use Tools: Leverage static code analysis tools for detecting possible security vulnerabilities in your code. Tools like SonarQube can be a great help.

Educate Yourself: Stay updated about the latest security threats and countermeasures. Follow blogs, attend webinars, and participate in coding competitions focused on security.

Hands-on Practice: Use platforms like OWASP Juice Shop to test and improve your secure coding skills. There's no teacher-like experience.

Peer Review: Encourage code reviews among peers focusing on security aspects. This will not only help identify potential security issues but also promote a culture of secure coding. (Believe me, this is what peeps do half of the time in their workplace)

By integrating these practices into your routine, you'll be well on your way to becoming not just a developer, but a secure and responsible coder.

Secure coding might seem daunting, but remember, every expert was once a beginner. As you step into the thrilling world of coding, keep security at the forefront. Nothing beats the feeling of seeing your code run flawlessly... and knowing that it's as secure as Fort Knox. Happy secure coding!

Resources for Future Learning

- OWASP Top Ten Project

- Microsoft's Security Development Lifecycle

- Veracode Secure Coding Labs
  (14 days of free trial)

- OWASP Secure Coding Dojo

- SAFECode

- Secure Code Labs
  (Arriving soon on Play Store and App Store)

Can you find the vulnerability in the code?

```python
files = {
    '123': 'user1secret.txt',   #only user 1 is supposed t
    '456': 'user2secret.txt',   #only user 2 is supposed t
}


@app.route('/files')
@login_required
def get_file():
    file_id = request.args.get('id')
    if file_id in files:
        return f"File content: {files[file_id]}"
    else:
```

Message From Seniors

Aayam Adhikari
CE, 4th Year

Reflect on your favorite memory from your time at KU.

There are many favorite moments during my time at KU, but if I have to choose one it would be during our class tour to Mustang while I was in 3rd year. Those moments with my friends, ahhhh it was all worth it. Late night walks, and talks, simple yet most memorable!

What advice would you give to the juniors who will be following in your footsteps?

Your time in KU will be a hell of an experience, many ups and downs, but you'll surely find the true version of yourself at some point, and everything will work out in the end, just study when you need to and fully enjoy while you can!

Nischal Shakya
CE, 4th Year

Reflect on your favorite memory from your time at KU.

The project defense day are my favorites, the photo session after the defense and relaxing with friends, having a laugh on all the jugaad we did to make the project work , all the hard work we put into the project and satisfaction we felt after completing it .

What advice would you give to the juniors who will be following in your footsteps?

To cherish and enjoy every moment of KU. It still feels like yesterday when I joined, met and made friends. I never realized how fast these four years passed in their company .

Gaurav Khadka
CE, 4th Year

Reflect on your favorite memory from your time at KU.

We crashed a random wedding on the semester project defense day wearing the same formal dress. Travelled to Lalitpur from Dhulikhel at around 6 pm and decided to go to a wedding whose venue had fancy lights. Congratulated the bride and took a photo pretending to know her. Returned to Dhulikhel at around 12 and survived to tell the tale.

What advice would you give to the juniors who will be following in your footsteps?

Take your chances, be open to all experiences and opinions and keep a wide perspective of overall undergrad life. KU teaches you a lot, and the experiences you'll have here will shape your views and determine what you become in life. You'll meet all kinds of people of different spectrums here, so try to be an observer, judge less, and find something to learn from them all. Stack up on the experiences and qualities of all the individuals, adventures and form a strong philosophical foundation. Discover what you want in life as a person, what you want to achieve and find your principles accordingly. Stay strong upon them and live a revered life. Always vie for more than you are. If you view the life and happenings around you with an open mind, KU holds the power to make you the person you always wanted to become.

Aashutosh B Rajan

CE, 4th Year

Reflect on your favorite memory from your time at KU.

The very first day of KU HackFest

It was during the COVID era when the world was swiftly transitioning to online platforms for various activities. IT Meet, DoCSE's prominent annual event, had faced postponement for two consecutive years. However, amidst these circumstances, came the onset of KU HackFest.

Given the virtual nature of the event, we started setting up our base camp and the control room in the graduate room in Block 9. For the first day, we had a lineup of fun events planned for the stream, which were mostly scheduled for the night. As evening approached, we prepared our camp for the chilly winter night. We were armed with just mattresses and sleeping bags, and the big windows in our department posed an additional obstacle. But hey, we were somehow able to manage a heater. 😉

A quick trip for supplies later, we faced another set back. We got back to our camps only to realize that our food was not in good condition. Undeterred, we faced another challenge when our block's water supply was unexpectedly cut off. *#survival_101*

Despite these obstacles, the experience was unforgettable. We slept in shifts to make sure we would make it through the three days of the hackathon. Planning the judging process was a major hurdle, requiring fairness and adherence to time constraints.

As I reflect on this inaugural chapter of KUHackfest, I eagerly anticipate the legacy of KU HackFest and its evolution in the future. ✨

What advice would you give to the juniors who will be following in your footsteps?

⚠ Disclaimer: These are just my perspectives
- Don't be scared to make mistakes, else you will miss out on a lot of opportunities
- Stay humble; networking and effective communication can open doors to unimaginable opportunities.
- CSE is such an interesting field; you don't have to restrict yourself to your class or college; collaborate globally
- In many cases, the mind acts as the bottleneck. You'll be amazed at how much you can push your body when you set your mind to it.
- Burnout is real, so many folks involved in communities don't even want to get involved again. I think focusing on the organizers' well being should be one of the priorities.

Message From Seniors

Nayan Thapa Magar
CS, 4th Year

Reflect on your favorite memory from your time at KU.
During my tenure at Kathmandu University, I greatly appreciated the support, love, and care extended to me by my peers and acquaintances. I have come to understand that the most profound lessons are those learned from the depths of one's heart. Among the myriad memories I hold dear from my time at KU, the acoustic night stands out prominently. It was during this event that I received heartfelt encouragement and camaraderie from my friends as I shared my musical talents.

What advice would you give to the juniors who will be following in your footsteps?
I would advise my juniors at Kathmandu University to prioritize building strong relationships, both academically and socially, during their time here. From my own experience, I've found that genuine connections offer invaluable support and encouragement throughout the academic journey. It's important to approach learning with sincerity and passion, recognizing that some of the most profound lessons come from the heart. Cherishing memorable moments, such as participating in community events and extracurricular activities, can greatly enrich the university experience. Lastly, I would encourage them to pay forward the support and care they receive, creating a positive and nurturing environment for everyone within the university community.

Ayush Paudel
CE, 4th Year

Reflect on your favorite memory from your time at KU.
All the laughter shared with friends.

What advice would you give to the juniors who will be following in your footsteps?
You're absolutely on the right path. Don't stop.

Anything else you want to share?
Man ma janmeka katha haru lai, jeewan jeeuna nadi namara.

Message From Seniors

Sabin Badal
CS, 4th Year

Reflect on your favorite memory from your time at KU.

Good friends and faculty members asking me how I was doing. Juniors asking me for guidance and suggestions with their studies and career prospects. KU Cafe dai and didi handing me the tea in a ceramic cup instead of the regular paper cup. These little things. Those smiles and greetings. They will always be my favorite memories.

And you know what I'll never forget ? The time I got locked inside the faculty's restroom. The janitor was cleaning the student's restroom. And the faculty's one was open. So, I decided to go in there. After completing my work in there, I tried to pull open the door but it wouldn't move an inch no matter how I tried. After a few attempts I realized that it was automated and needed a pass-code to open. So, I had to call the CR (Aayush) and make him ask the teachers. He went to Dhiraj sir who told him that a passcode was not needed to open the door from the inside. So, Baccha haru if you ever find yourself in such a situation remember that there is a white-colored switch on the left side of the door. Press that and the door will unlock. I had seen the switch before calling Aayush. But, in that moment of panic and hearing my friends outside laughing at my misery I thought the switch was for the lights inside the restroom.

And you know what happened for a second time? I got locked inside the Health Informatics Lab with recruiters from LIS Nepal, after finishing the internship screening interview I had just bombed. This door too was automated and needed the pass-code to unlock. And, kids there is no switch to unlock this door from the inside. So, you'll need a pass-code to unlock it. Neither I nor the recruiters knew the pass-code. So, I had to sit there in awkward silence for another 15-20 minutes, until the pass-code arrived, all while my friends laughed at my misery and took pictures from the outside. The only thing that was on my head during that whole time was that scene from the Hindi movie Dhamaal movie :

"Pata nahi aise situations mai, may automatically aage kaise aa jata hu".

What advice would you give to the juniors who will be following in your footsteps?
- Don't strive for perfection in everything you do. Don't wait for perfect moments. You'll probably be late.
- You'll meet the coolest people in college. Befriend them and learn from them. That's all.
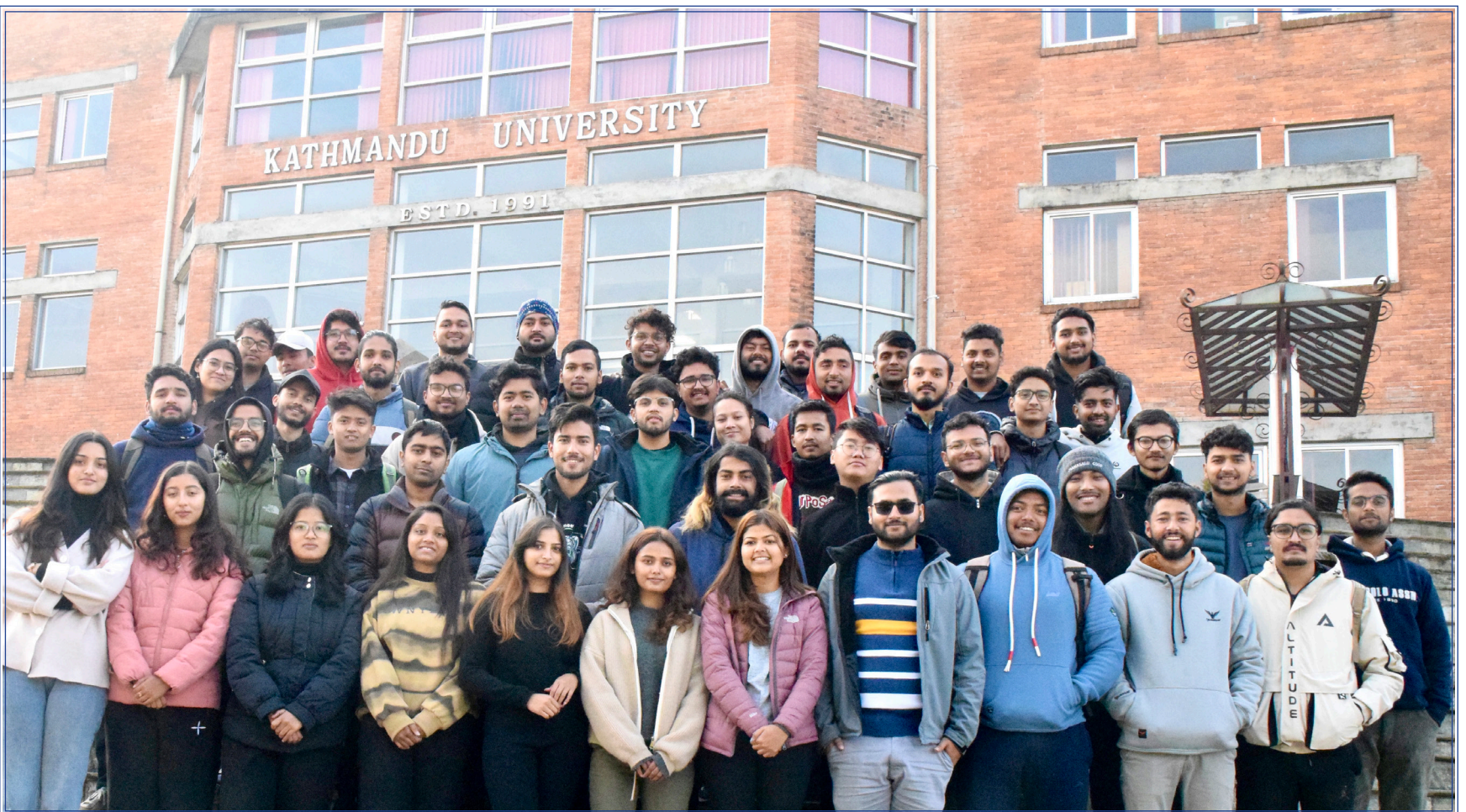
Photo Gallery
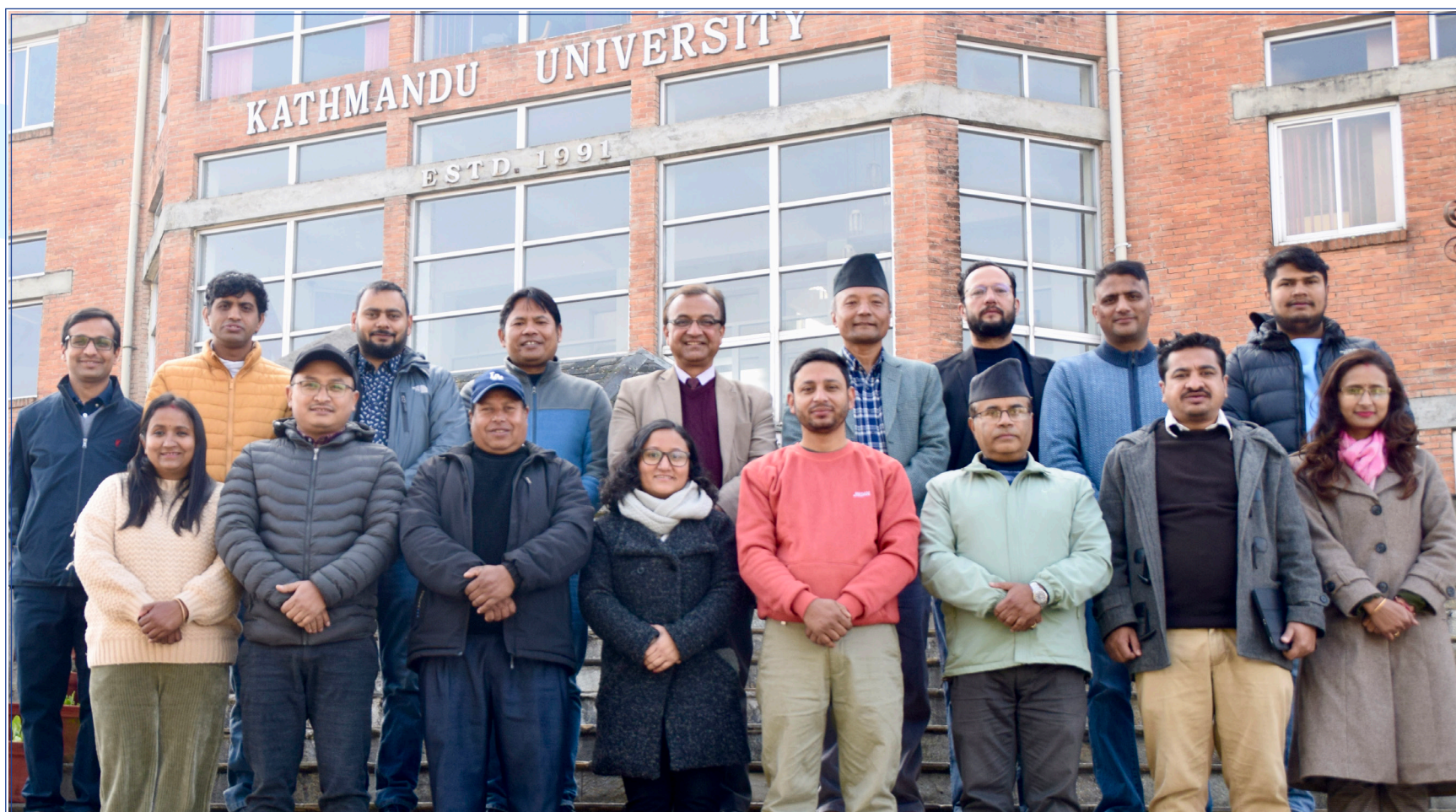
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2023-2024

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IT MEET TEAM

2023

IT EXPRESS TEAM
2023

ABOUT THE MAGAZINE

IT Express is the departmental magazine of Department of Computer Science and Engineering . Every year, the magazine is released with a variety of contents, which holds different insights. IT Express is not a trend, but a legacy, which we have been carrying since a long time back.