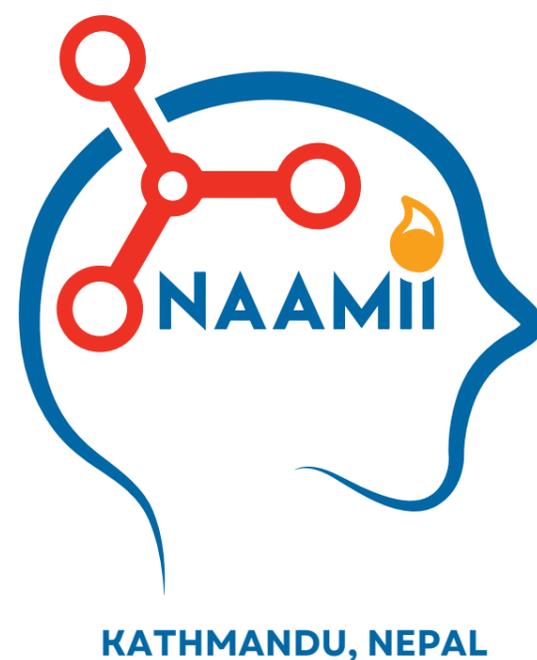


NAAMII NEWSLETTER

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IN THIS ISSUE

- Highlights of the Year
- Research Division of NAAMII
- Research Groups at NAAMII
- Publications of the Year
- Featured Research Projects
 - AI Assisted Smartphone Microscopy
 - Cervical Cancer VIA Screening
 - Intimate Partner Violence (IPV)
 - Multi-Drug Resistant Tuberculosis
- Onboardings & Departures
- Up-Close with Kanchan
- Funding & Grant Awards of 2022
- Featured Incubator
- #Throwback: AI School Speakers
- Upcoming Events



DIRECTOR'S MESSAGE

Welcome to the first issue of Annual NAAMII Newsletter. NAAMII started from a shared vision of young Nepali scientists and professionals working in various countries who wanted to build a center of excellence for scientific research and innovation in Nepal. We wanted to focus on the domains where most of us had our expertise and strengths: computing sciences & engineering, including Artificial Intelligence, applied mathematics, and informatics. Building a research organization from scratch in Nepal was not easy for us. From a vague idea of a world-class research center, higher education, and innovation in Nepal with global impact, we have come a long way to this point.

Since this is the first annual newsletter, I will briefly take you through our journey, give an overview of NAAMII, and let you know how you could get involved. The rest of the newsletter contains our activities in 2022.

The preparations and brainstorming to convert a vague idea into an organization with a clear vision, mission, goals, and organizational structure started around 2014. We formally established NAAMII in March 2018. We organized our first big international event, Annual Nepal AI School (ANAIS), in December 2018, when all our co-founders except one were residing outside Nepal. At the beginning of 2019, I resigned from my research position in London, moved back to Nepal, and started working full-time at NAAMII. Regular involvement and strong support of our co-founders living abroad, our adjunct research scientists via our virtual lab, and the hard work of young Nepali engineers motivated to learn and do research have helped NAAMII establish itself as a leading research institute in Nepal in the field of AI research.

Our three main divisions Research, Education-Outreach, and Industry-Innovation all work towards building a vibrant research & innovation ecosystem in Nepal, and contribute globally to knowledge generation and push the frontiers of technology from our unique experiences.

Research Division has multiple autonomous research groups working on different fields of theory and applications of informatics, applied mathematics, and AI.

Education and Outreach Division focuses on providing learning opportunities for youths, building a solid educational foundation and supporting universities in Nepal, providing expertise to the Government and related agencies for building policies, and educating the general public about the potential and challenges of emerging technologies such as AI.

The Industry and Innovation Division collaborates with Industries in and outside Nepal, providing our scientific expertise to the industries. Finally, we incubate start-ups in Nepal providing them with high-end scientific expertise which could spin off into successful independent companies in the future.

We will be releasing newsletters every three months from 2023. We always look forward to i) hearing your feedback on improving the newsletter or any aspects of NAAMII and ii) people who want to join or contribute to NAAMII in various forms. Contact us at info@naamii.org.np, and we'll be delighted to connect! Happy reading and Happy New Year 2023!!

– Bishesh Khanal, PhD
Director/Co-Founder



SCIENTIFIC RESEARCH

- **5 autonomous Research Groups** (1 led by a full-time research scientist; 4 as part of **the virtual lab** led by adjunct faculty remotely)
- AI, Machine Learning, Computer Vision, Natural Language Processing, Medical Imaging Informatics, Global Health, Genomics, Epidemiology, Robotics etc.
- Published **30 articles** in top-tier international peer-reviewed journals, conferences & workshop proceedings. [[Google Scholar](#)].
- Awarded Research funding from organizations like Wellcome Trust, KOICA, UNESCO, UNDP, RSTMH, etc.
- Trained 36 research staff, supervised 4 M.Sc. theses, 2 undergraduate final year projects, and ongoing co-supervision of 3 PhD students based in Nepal, Korea, and the USA.
- The MultiModal Learning Lab of NAAMII **won** a FETREG 2021 at MICCAI, a **global scientific challenge** on specific tasks for fetal surgery, competing **against top research labs** and universities from around the world.

EDUCATION - OUTREACH

- Organized three winter editions of the **Annual Nepal AI school (ANAIS)** in 2018, 2019 & 2021; this is a 10-day intensive course on AI foundations & applications.
- ANAIS has attracted **more than 50 researchers** worldwide as speakers, & nearly **400 participants** from more than **20 countries**.
- Organized training programs such as foundations **Summer training workshop 2020**: 3 days/week for 3 months training of 40 participants from Nepal and India that included 60 hrs of lectures and paper reading sessions.
- Engagement with Nepal's Ministry of Education, Science & Technology in formulating policies and educating Government bureaucrats, policymakers,, and industry professionals on applications, potential, and challenges of AI.
- **NAAMII Public Lecture Series**, an interactive talk targeted and open to the general public, where a scientist gives a talk on a selected topic. Restarting soon after pause due to COVID-19.
- Organized Deep Learning in Medical Imaging (DLMI) workshop (September 26 - October 2, 2021). Online; 15 participants.
- **More than 30 talks** on various national and international platforms.
- Focused Group Discussion and Research output Dissemination of the project on **AI ethics in Nepal**. Stakeholders and speakers from Universities, Government, and Government think tank institutes participated in the event.

INDUSRTY & INNOVATION

- Engaged in **capacity building** of more than 50 engineers for a leading AI service company in Nepal, and **helped create an AI team** for an outsourcing company interested to get into AI.
- **R&D** work of three companies abroad (UK and Canada) for whom we are doing frontier AI research and development for AI-based products.
- **Incubation** of one start-up company-AI working in the next generation of conversational AI in Nepali and South Asian languages.
- Preparations at the final stages for establishing an **incubator-accelerator** for tech and AI-based start-ups in partnership with Nepal's leading business and entrepreneurship school, a software development company with two decades of experience, and an investor group.

KEY HIGHLIGHTS OF THE YEAR

PARTNERSHIPS



We have signed a joint partnership between NAAMII, Vedic Smile Academy & Punyaarjan Foundation that are led by Dr. Sushil Koirala to work in the field of Dental AI.



We have partnered with Kathmandu Institute of Child Health (KIOCH) & Dr. Bhagwan Koirala to work in the field of Children Health.

GRANTS AWARDED



Our project "AI-Assisted Smartphone Microscopy for Automatic Detection of Diarrhea-Causing Parasites" got awarded by Lacuna Fund & Wellcome Trust.

AI-Assisted Smartphone Microscopy for Automatic Detection of Diarrhea-Causing Parasites



The AI-assisted VIA Screening of Cervical Cancer project has also received a grant of xx from the Korea International Cooperation Agency (KOICA).

AI-assisted VIA Screening of Cervical Cancer

GUEST VISITS

We were pleased to have Prof. Dr. Hong-Gee Kim from Seoul National University & the Director at Bike Lab in our office. He had an amazing conversation with our enthusiastic researchers. It was a great opportunity for learning exchange as well as to discuss collaboration opportunities to diversify and scale our researches.



Our Team with Prof. Dr. Hong-Gee Kim

Dr. Kumud Dhital who is globally renowned for being the surgical pioneer of the world's first Donation After Circulatory Death (DCD) or Dead Heart Transplantation visited our office and talked about the developments in the health sector and also talked to our research assistants regarding their projects.



Dr. Kumud Dhital at NAAMII's Office

We had an insightful discussion with the National Coordinator of Nepal Intensive Care Research Foundation, Dr. Diptesh Aryal during his visit in NAAMII's office. He talked about his project on creating a Nepal ICU Registry and how we can use the technology to manage our medical databases.



Discussion with Dr. Diptesh Aryal

KEY HIGHLIGHTS OF THE YEAR

TEAM GET-TOGETHERS



In June 2022, our Research Scientist, Dr. Binod Bhattarai, visited Nepal from Scotland and convened a team-gathering with the members of the B Bhattarai MultiModal Learning Lab to exchange insights among the Research Assistants & Interns on their work experiences and to foster a sense of camaraderie among the team.

PROJECT VISITS



Bringing advanced technology to rural communities, we are dedicated to improving healthcare outcomes through our AI-Assisted Smartphone Microscopy project. Funded by Lacuna Fund and Wellcome Trust, our team was actively engaged in site visits, data collection, and training programs for medical professionals in Janakpur and Bayalpata Hospital, Achham to ensure the successful implementation of this innovative solution for the automatic detection of diarrhea-causing parasites.

AI-Assisted Smartphone Microscopy for Automatic Detection of Diarrhea-Causing Parasites

DAY-TO-DAY ACTIVITIES



Paper Reading Sessions



Employee Birthdays



Dashain Luncheon

NAAMII places equal importance on both recognizing and commemorating significant events, milestones and festivities along with promoting continuous learning & development through knowledge sharing sessions. We believe that this balance enhances our company culture & creates a positive, fun & supportive work environment.



Tihar Celebrations

THE RESEARCH DIVISION OF NAAMII

Research Division is one of our core pillar where multiple **autonomous research groups** work on different fields within informatics, applied maths and AI. We publish in top international conferences and journals, while also looking for potential industrial translation of the research.

RESEARCH GROUPS AT NAAMII

TRANSFORMING GLOBAL HEALTH WITH AI (TOGAI)



Led by [Dr. Bishesh Khanal](#),
Research Scientist at NAAMII

B BHATTARAI MULTIMODAL LEARNING LAB (MMLL)



Led by [Dr. Binod Bhattarai](#),
Adj. Research Scientist at NAAMII
& Assitant Professor at University of Aberdeen

COMPUTATIONAL GENOMICS LAB



Led by [Dr. Raunak Shrestha](#),
Adj. Research Scientist at NAAMII
& Research Scholar at UCSF

RESEARCH USING ARTIFICIAL INTELLIGENCE IN NEUROSCIENCE (RAIN)



Led by [Dr. Nabin Koirala](#),
Adj. Research Scientist at NAAMII
& Associate Research Scientist at Yale University

COMPUTATION ENDOSCOPY, SURGERY AND PATHOLOGY GROUP



Led by [Dr. Sharib Ali](#),
Adj. Research Scientist at NAAMII
& Lecturer at University of Leeds

OTHER ADJUNCT FACULTIES



[Dr. Ajad Chhatkuli](#),
Adj. Research Scientist at NAAMII
& Postdoc Researcher at ETH Zürich



[Dr. Danda Pani Paudel](#),
Adj. Research Scientist at NAAMII
& Researcher at Computer Vision Lab, ETH Zürich



[Dr. Taman Upadhaya](#),
Adj. Research Scientist at NAAMII
& Associate Researcher at UCSF



[Shreyasha Paudel](#),
Research Fellow/Alumni at NAAMII
& PhD Scholar at University of Toronto



[Dr. Suman Raj Bista](#),
Adj. Research Scientist at NAAMII

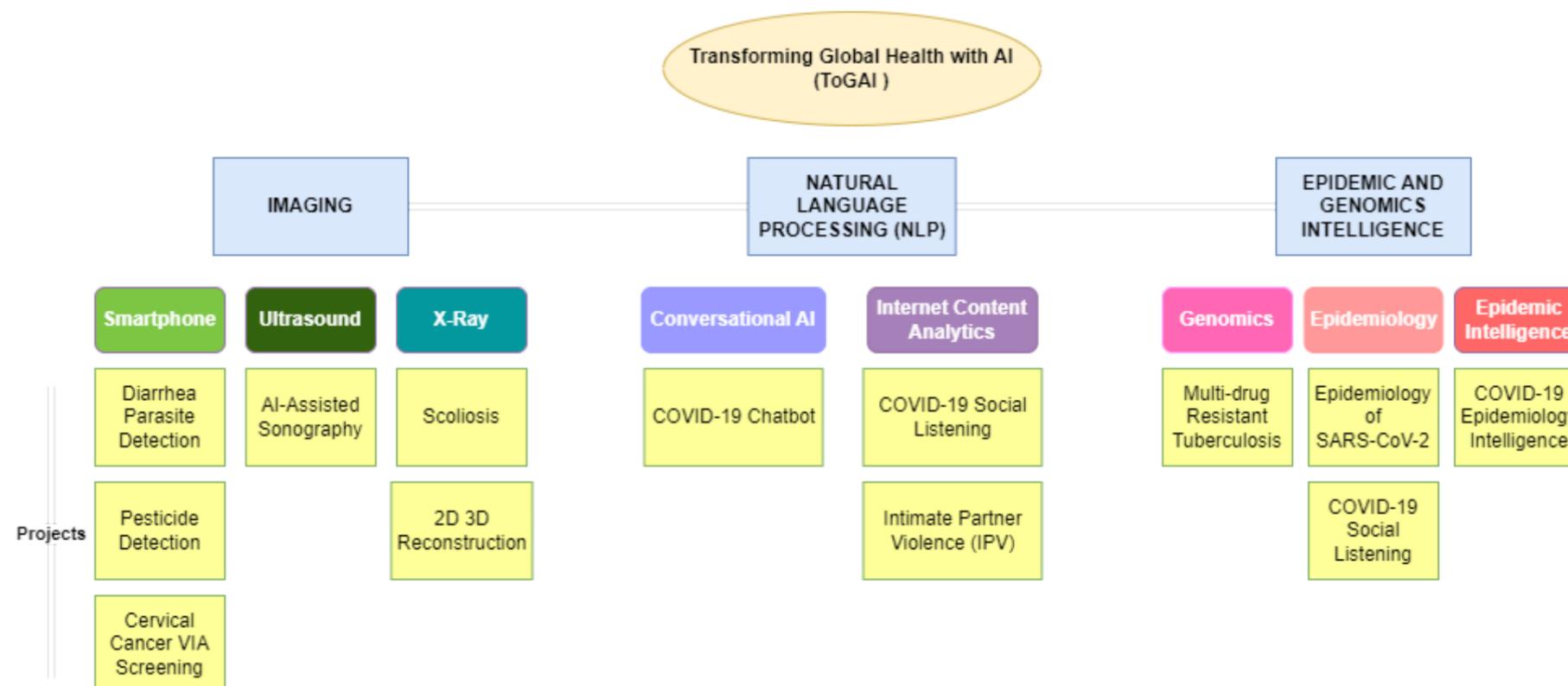


[Prof. Sabita Maharjan](#),
Adj. Research Scientist at NAAMII
& Associate Professor at University of Oslo

RESEARCH GROUP 1: ToGAI

Transforming Global health with AI (TOGAI) is a Research Group within NAAMII that focuses on pushing the frontiers of AI to transform global health. We identify problems to work on by routinely engaging with health care providers and patients in both the rural and urban health centers of different levels in Nepal. Our experience and evidence from other researchers across the globe show that there are several unmet clinical needs of resource-constrained regions across the globe, specifically in LMICs, that cannot be solved by existing AI technologies. Hence, our group strives to advance the current state of AI towards solving the identified big problems of LMICs where we could have transformative impact.

Majority of imaging-based research focuses on improving the utility of Ultrasound, X-rays, and smartphone; signals focus on low-cost EEG and ECG. We also work on NLP and conversational AI in local languages, exploring their applications in healthcare system driven by community and primary health centers.



RESEARCH TEAM



Dr. Bishesh Khanal



Kanchan Poudel



Mahesh Shakya



Manish Dhakal



Prasiddha Bhandari



Rabin Adhikari



Safal Thapaliya

UNDERGRADUATE RESEARCH INTERNS



Prashant Shrestha



Achyut Burlakoti



Janak Sharma



Sanskar Amgain



Ashish Lamsal



Supriya Khadka

ToGAI PARTNERS



ToGAI GROUP ALUMNI



Sushant Gautam

2022

[MSc. Thesis, Degree from Tribhuvan University;
in collaboration with Nabin Koirala & Ajad Chhatkuli]



Dayisha Daga as Undergraduate Summer Intern

2021

[visiting from Mount Holyoke College, USA]



Sneha Pradhan as Undergraduate Summer Intern

2021

[visiting from Mount Holyoke College, USA]



Samip Ghimire

2021

[MSc. Thesis, Degree from Pokhara University]



Pramesh Gautam

2021

[MSc. Thesis, Degree from Pokhara University]



Ashim Mahara

2021

[MSc. Thesis, Degree from London Metropolitan University]



Pratima Upretee as Research Associate

2019 - 2021

[current: PhD student at Ghent University, Belgium]



Bidur Khanal as Research Assistant

2019 - 2020

[current: PhD Student at RIT, USA & visiting student at NAAMII]



Lavslen Dahal as Research Associate

2019 - 2020

[current: Research Associate at Duke University, USA]



Prahlad Shrestha

2020

[MSc. Thesis, Degree from Pokhara University]

FUNDING AGENCIES



Wellcome Trust



Lacuna Fund



Sexual Violence Research Institute



National Academy of Science and Technology
(NAST)

FEATURED PUBLICATION

COVID-19-related Nepali Tweets Classification in a Low Resource Setting

by **Rabin Adhikari, Safal Thapaliya, Nirajan Basnet, Samip Poudel, Aman Shakya & Bishesh Khanal**. "COVID-19-related Nepali Tweets Classification in a Low Resource Setting." *Computational Linguistics Journal - ACL Anthology* (2022).
<https://aclanthology.org/2022.smm4h-1.52/>

People across the globe used social media platforms in their local languages to voice their opinions about the COVID-19 pandemic. Several organizations, including the World Health Organization - developed automated social media analysis tools that classify COVID-19-related tweets to various topics. However, these tools that help combat the pandemic are limited to very few languages. While multi-lingual or low-resource language-specific tools are being developed, there is still a need to expand their coverage, such as for the Nepali language. In this paper, we identified the eight most common COVID-19 discussion topics among the Twitter community using the Nepali language, set up an online platform to automatically gather Nepali tweets containing the COVID-19-related keywords, classify the tweets into the eight topics, and visualize the results across the period in a web-based dashboard.

The dashboard can be accessed via <https://covid-talks.naamii.org.np/>

Our interns worked under the supervision of Dr. Bishesh Khanal to publish this paper in the ACL Anthology Journal. The paper was also presented at the 7th Social Media Mining for Health (#SMM4H) Workshop, co-located at the 29th International Conference on Computational Linguistics - COLING 2022.

RESEARCH GROUP 2: B Bhattarai MultiModal Learning Lab (MMLL)

B Bhattarai MultiModal Learning Lab (MMLL) is a research group within NAAMII that focuses on theoretical and applied research in Machine learning (ML) where the researches process information from heterogeneous sources such as vision, text, and speech to make computers understand, interpret and reason. Our applications include but are not limited to computer vision, medical image analysis and low-resource language processing.

FEATURED PUBLICATION

NepBERTa: Nepali Language Model Trained in a Large Corpus
by **Milan Gautam, Sulav Timilsina & Binod Bhattarai.**

"NepBERTa: Nepali Language Model Trained in a Large Corpus."
Proceedings of the 2nd Conference of the Asia-Pacific Chapter of the Association for Computational Linguistics and the 12th International Joint Conference on Natural Language Processing. 2022. <https://aclanthology.org/2022.aacl-short.34.pdf>

This research explores the use of the Natural Language Understanding (NLU) model in order to train the most extensive monolingual Nepali corpus ever. The models and datasets are publicly available and can be accessed via <https://nepberta.github.io/>

The poster presentation for this paper has also already released via NAAMII's social media platforms.

RESEARCH TEAM



Binod Bhattarai



Rebati Raman Gaire



Suman Sapkota



Ronast Subedi



Shrawan Kumar Thapa



Sudarshan Regmi



Sandesh Pokhrel



Sanjay Bhandari

FUNDING AGENCIES



Palua.AI

Palua.AI Ltd UK



Redev Enterprises UK



Zeg.AI Ltd. UK

RESEARCH GROUP 3: Computational Endoscopy, Surgery & Pathology (CESP) Group

Computational Endoscopy, Surgery & Pathology Group (CESP) is another autonomous research group within NAAMII led by Dr. Sharib Ali that focuses on endoscopic computer vision, surgical data science, computational pathology, conducting high-throughput imaging and other medical image analyses. The CESP group has three interns from Low Middle Income Countries (LMICs).

FEATURED PUBLICATION

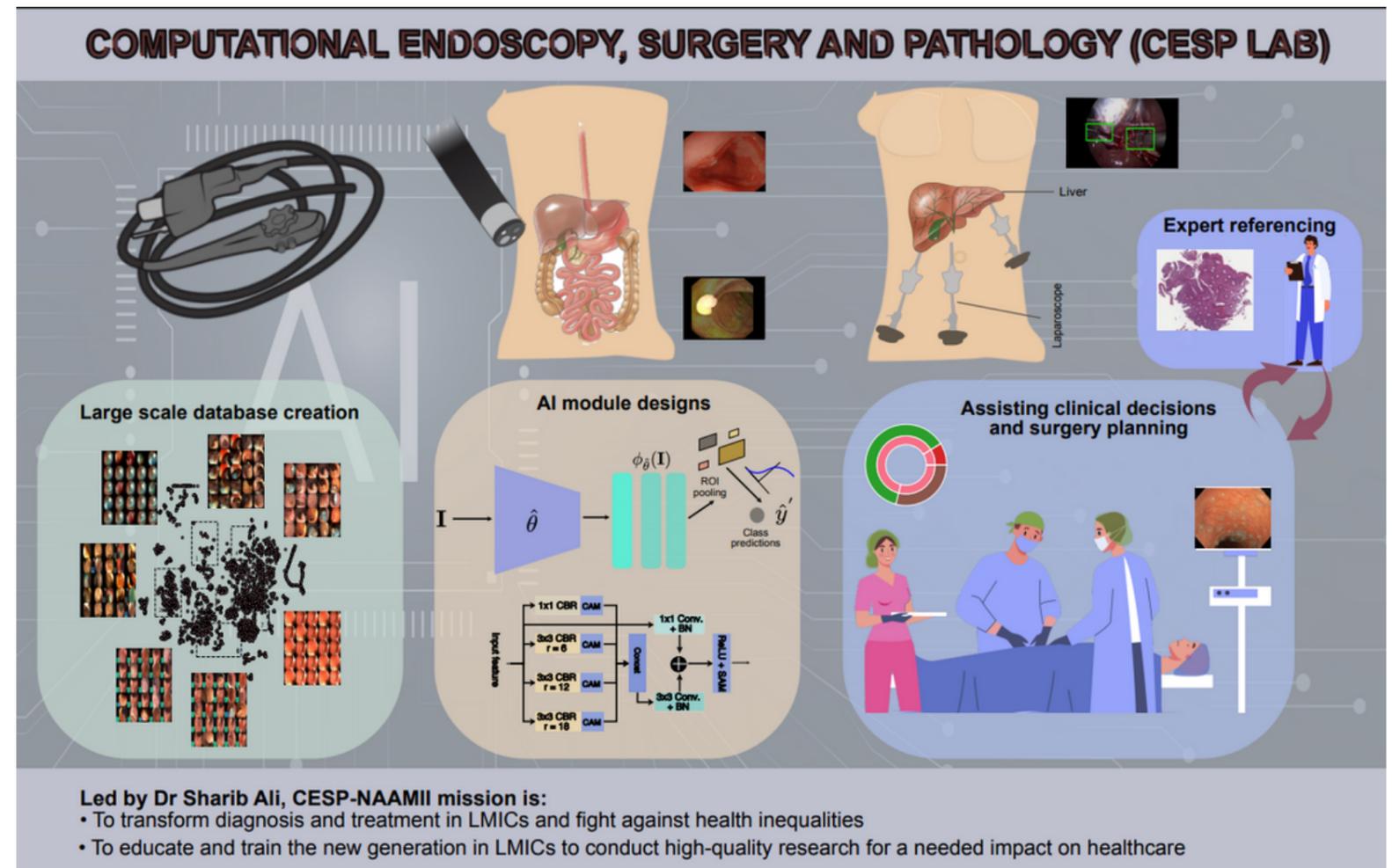
TCANet: Text-Guided Attention for Improved Polyp Segmentation

by **Nikhil K Tomar, Debesh Jha, Ulas Bagci & Sharib Ali**.

"TCANet: Text-Guided Attention for Improved Polyp Segmentation." *Medical Image Computing and Computer Assisted Intervention – MICCAI 2022. MICCAI 2022. Lecture Notes in Computer Science, vol 13433. Springer, Cham.*

https://doi.org/10.1007/978-3-031-16437-8_15

The key direction of this project is to develop deep learning models for detection and segmentation of polyps found in colonoscopy surveillance. The idea is to also assess generalizability and develop methods to tackle this issue using novel techniques.



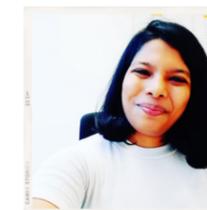
RESEARCH TEAM



Dr. Sharib Ali



Ajay Pyatha



Sweta Banerjee



Mohammad Al-Amin

CESP ALUMNI



Shruti Shrestha



Nikhil Kumar Tomar

RESEARCH GROUP 4: Computational Genomics Lab (CGL)

The **Computational Genomics Lab (CGL)** aims to solve complex problems in biological sciences using computational techniques. This research group combines genomics and bioinformatics to develop efficient computational algorithms including machine learning methods.

These methods are then applied to various types of biological data sets to address key challenges to transform global health focusing on infectious disease and cancer genomics.

The research domain of CGL lies under Bioinformatics, Genomics, Infectious Disease, Cancer & Transforming Global health with AI (TOGAI). CGL focuses on genomic epidemiology and the development of biomarkers for disease progression and treatment resistance.

PAPERS & PUBLICATIONS

In Progress

The research group, has been working on some interesting projects such as **Systems Genomics Modeling of Multi-drug Resistant Tuberculosis** and **Genomic Epidemiology of SARS-CoV-2**.



RESEARCH TEAM



Dr. Raunak Shrestha



Parikshit Prasai

FUNDING AGENCIES

NIHR | National Institute for Health and Care Research

National Institute for Health Research (NIHR), UK



Royal Society of Tropical Medicine and Hygiene (RSTMH), UK

RESEARCH GROUP 5: RAIN

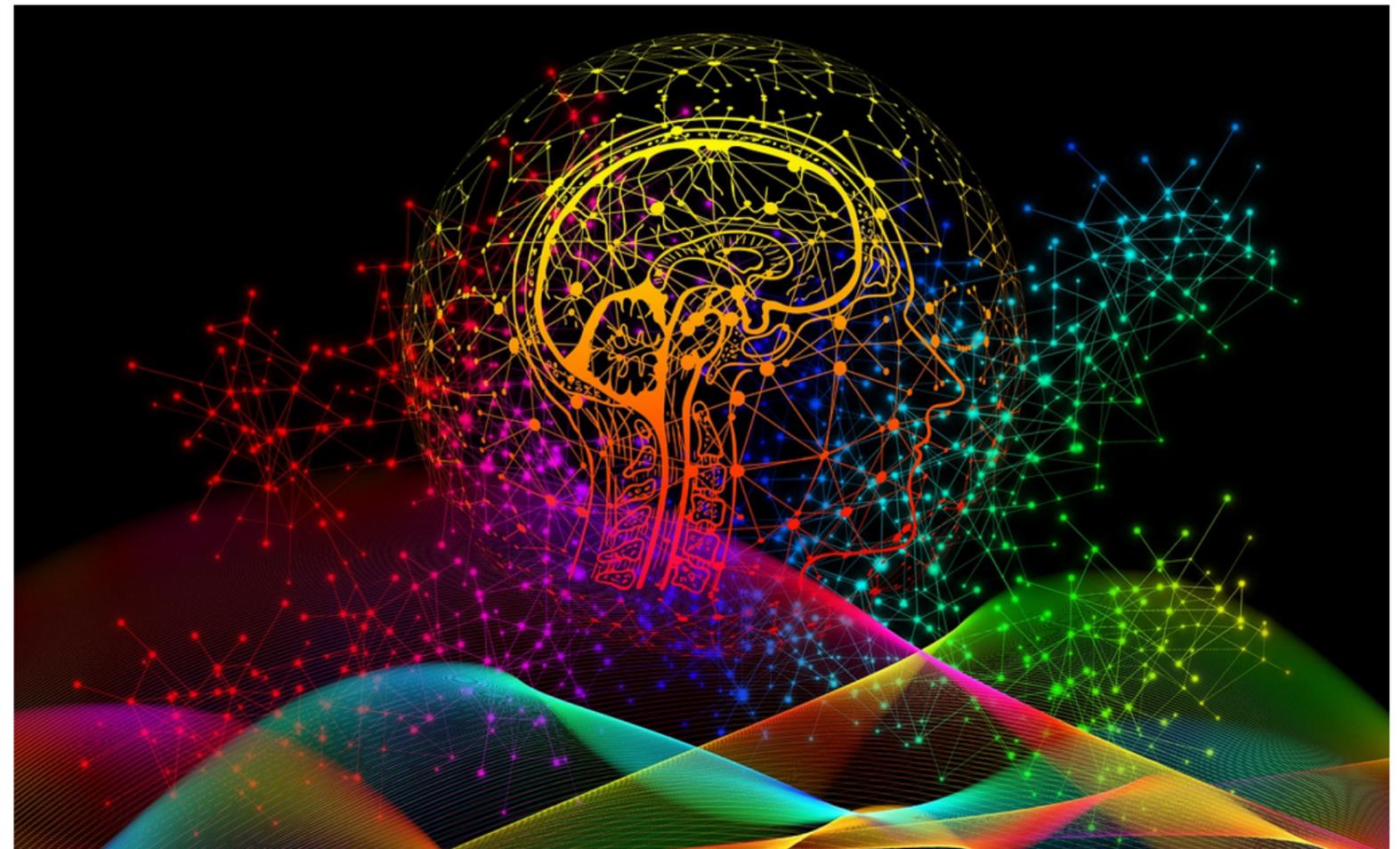
Research using Artificial Intelligence in Neuroscience (RAIN) is another autonomous research group within NAAMII that focuses on AI & Neuroscience. The research group focuses on different neurological conditions that causes disorders in the human body.

Movement disorders are a group of neurological conditions that cause either increased movements or reduced or slow movements. Some examples of such disorders are Parkinson's disease and dystonia. These disorders are diagnosable in its most classic expressions where patients exhibit abnormal movements and postures, however less severe forms are often misdiagnosed, or diagnosis is delayed for many years. Moreover, there is a lack of movement disorder specialists in the clinics of low- and middle-income countries and the literature has suggested the meaningful differences exist in terms of care, management and diagnosis between having a specialist or a general neurologist.

Hence, the primary goal of this group is to explore the possibility of using artificial intelligence-based techniques to obtain objective measures and low costs solutions for clinical diagnosis of these disorders.

PAPERS & PUBLICATIONS

In Progress



RESEARCH TEAM



Dr. Nabin Koirala



Prasiddha Bhandari

RAIN PARTNERS



Haskins Laboratories



Yale University



The Dystonia Coalition (DC)

OTHER ADJUNCT FACULTIES



Dr. Ajad Chhatkuli



Dr. Taman Upadhyaya



Dr. Danda Pani Paudel



Shreyasha Paudel



Rashik Shrestha



Abhigyan Bhusal



Raunak Mishra



Aatiz Ghimire



Pragya Neupane

Dr. Ajad Chhatkuli, a postdoctoral researcher at Computer Vision Lab in ETH Zürich is supervising Rashik Shrestha and Abhigyan Bhusal. They are doing a research project with the aim to create a cost-effective and energy-efficient robotics system. Currently, their focus is on developing a lightweight visual localization system that can be utilized with low-power devices.

Dr. Taman Upadhyaya, postdoctoral researcher at University of California San Francisco (UCSF) Medical Center is supervising Raunak Mishra. They are working towards next generation of AI-based tools for assisting orthopedic surgeons in hip and lower limbs surgery with precise quantitative tools to estimate important clinical parameters in CT scans.

Dr. Danda Pani Paudel, lecturer at ETH Zürich specializes in Computer Vision, Visual-SLAM, Unsupervised Learning, and Optimization Methods. He mentored a team at the National Innovation Center (NIC) of Mahabir Pun, in the development of autonomous robot.



Ms. Paudel, previously a Research Fellow at NAAMII, led a UNESCO funded project on scoping review of AI Ethics in Nepal. She supervised Research Interns Aatiz Ghimire & Pragya Neupane. The AI Ethics project aimed to assess the understanding and attitudes toward AI ethics among Nepal's technology students, professionals, and policymakers. The goal was to identify challenges and promote responsible and ethical AI development through a shared language and understanding of AI ethics. Information was gathered through surveys and publicized to facilitate a national conversation on AI ethics in Nepal. Learn more:

<https://www.naamii.org.np/projects/ai-ethics-survey-in-nepal/>

PUBLICATIONS OF THE YEAR

1. **Sulav Timilsina, Milan Gautam, and Binod Bhattarai. NepBERTa: Nepali Language Model Trained in a Large Corpus.** *Proceedings of the 2nd Conference of the Asia-Pacific Chapter of the Association for Computational Linguistics and the 12th International Joint Conference on Natural Language Processing*, 2: 273–284, November 2022. <https://aclanthology.org/2022.aacl-short.34>

Peer-Reviewed Conference Articles B Bhattarai MultiModal Learning Lab (MMLL)

2. **Rabin Adhikari, Safal Thapaliya, Nirajan Basnet, Samip Poudel, Aman Shakya, and Bishesh Khanal. COVID-19-related Nepali Tweets Classification in a Low Resource Setting.** *Proceedings of The Seventh Workshop on Social Media Mining for Health Applications, Workshop & Shared Task*, 209–215. Gyeongju, Republic of Korea. Association for Computational Linguistics., October 2022. <https://aclanthology.org/2022.smm4h-1.52>

Peer-Reviewed Workshop Articles ToGAI

3. **Suman Sapkota, Bidur Khanal, Binod Bhattarai, Bishesh Khanal, and Tae-Kyun Kim. Label Geometry Aware Discriminator for Conditional Generative Adversarial Networks.** *26th International Conference on Pattern Recognition (ICPR)*, 2914–2920, August 2022. <https://doi.org/10.1109/ICPR56361.2022.9956292>

Peer-Reviewed Conference Articles B Bhattarai MultiModal Learning Lab (MMLL) ToGAI

4. **Pratima Upretee and Bishesh Khanal. FixMatchSeg: Fixing FixMatch for Semi-Supervised Semantic Segmentation.** *arXiv preprint arXiv:2208.00400*, August 2022. <https://doi.org/10.48550/arXiv.2208.00400>

Pre-Prints ToGAI

5. **Suman Sapkota and Binod Bhattarai. Noisy Heuristics NAS: A Network Morphism based Neural Architecture Search using Heuristics.** *DyNN Workshop at the 39th International Conference on Machine Learning*. Baltimore, Maryland, USA. July 2022. https://dynn-icml2022.github.io/papers/paper_6.pdf

Peer-Reviewed Workshop Articles B Bhattarai MultiModal Learning Lab (MMLL)

6. **Nikhil Kumar Tomar, Debesh Jha, Ulas Bagci, and Sharib Ali. TGANet: Text-guided attention for improved polyp segmentation.** *International Conference on Medical Image Computing and Computer Assisted Intervention*. May 2022. https://doi.org/10.1007/978-3-031-16437-8_15

Peer-Reviewed Conference Articles Computational Endoscopy, Surgery & Pathology (CESP)

CONTINUED: PUBLICATIONS OF THE YEAR

7. **Shrawan Kumar Thapa**, Pranav Poudel, **Binod Bhattarai**, and Danail Stoyanov. **Task-Aware Active Learning for Endoscopic Image Analysis**. *arXiv preprint arXiv:2204.03440*, April 2022. <https://doi.org/10.48550/arXiv.2204.03440>

Pre-Prints **B Bhattarai MultiModal Learning Lab (MMLL)**

8. **Binod Bhattarai**, Ronast Subedi, **Rebati Raman Gaire**, Eduard Vazquez, and Danail Stoyanov. **Histogram of Oriented Gradients Meet Deep Learning: A Novel Multi-task Deep Network for Medical Image Semantic Segmentation**. *arXiv preprint arXiv:2204.01712*, April 2022.

<https://doi.org/10.48550/arXiv.2204.01712>

Pre-Prints **B Bhattarai MultiModal Learning Lab (MMLL)**

9. **Sharib Ali**, ..., **Nikhil Kumar Tomar**, ..., and James E East. **Assessing Generalizability of Deep Learning-Based Polyp Detection and Segmentation Methods through a Computer Vision Challenge**. *arXiv preprint arXiv:2202.12031*, February 2022. <https://arxiv.org/pdf/2202.12031.pdf>

Pre-Prints **Computational Endoscopy, Surgery & Pathology (CESP)**

10. Md. Kamrul Hasan, **Lavsén Dahal**, ..., and **Bishesh Khanal**. **Challenges of Deep Learning Methods for COVID-19 Detection Using Public Datasets**. *Informatics in Medicine Unlocked*, 30, 100945. February 2022. <https://doi.org/10.1016/j.imu.2022.100945>

Peer-Reviewed Journal Articles **ToGAI**

11. Sophia Bano, ..., **Binod Bhattarai**, **Rebati Raman Gaire**, **Ronast Subedi**, ..., and Danail Stoyanov. **FetReg2021: A Challenge on Placental Vessel Segmentation and Registration in Fetoscopy**. *arXiv preprint arXiv:2206.12512*, February 2022. <https://doi.org/10.48550/arXiv.2206.12512>

Pre-Prints **B Bhattarai MultiModal Learning Lab (MMLL)**

12. **Parikshit Prasai**, and **Bishesh Khanal**. **COVID-19 Policy Level Decision Support System for Nepal with Advanced Computational Epidemiology Intelligence**. *for Nepal Academy of Science and Technology (NAST)*

Technical Reports **ToGAI**

13. **Shreyasha Paudel**, and **Aatiz Ghimire**. **AI Ethics Survey in Nepal**. *for Public Release & UNESCO: United Nations Educational, Scientific and Cultural Organization*. <https://www.naamii.org.np/projects/ai-ethics-survey-in-nepal/>

Technical Reports **Other Adjunct Faculties**

FEATURED RESEARCH PROJECTS



1. Using Smartphone Microscopes for Detection of Parasites

Around the globe, 760,000 deaths are recorded annually among children under five years of age due to diarrhea. In Nepal as well, Diarrhea is one of the major causes of death and morbidity among children of the same age group ([Budhathoki et al., 2016](#)). Diarrheal diseases are mostly caused by the consumption of food and water that are contaminated with parasites namely giardia and cryptosporidium. There are various methods that are in use to detect these parasites such as by use of a fluorescence microscope, ELISA test and PCR kits. Brightfield microscope has been one of the most common methods that is used to detect parasites and is commonly available in diagnostic laboratories. But, in a geographically diverse region like Nepal, the aforementioned methods cannot be suitable in all kinds of settings, particularly in resource-constrained ones. In order to make these methods functional, we need expensive lab setups, experts to analyze the samples and there are also other costly reagents.

Cost of traditional microscopes range from US\$ 1,500 to US\$ 75,000. Our partners from Kathmandu Institute of Applied Sciences (KIAS) have developed a smartphone microscope for detecting diarrhea parasites that will cost just US\$15 ([Shrestha et al., 2020](#)). Its utility has been validated in vegetables and water samples for the two most common parasites that are usually detected by using microscopy: Giardia and Cryptosporidium. This low-cost and portable microscope can be easily made available in low-resource rural areas, for countries like Nepal another challenge remains: lack of experts to detect parasites

from images captured by the microscopes. In this project, we intend to address this challenge by building AI-assisted parasite detection tool so that non-experts working in health care and community care settings can use the smartphone microscope to test for parasites.

The first step of building an AI-based tool is creating a large annotated database of images that contain parasites. There aren't any publicly available datasets for the two parasite cysts using microscopic images in different types of samples such as water, raw

PROJECT IN SUMMARY

FUNDED BY:

Lacuna Fund and Wellcome Trust

PROJECT Co-LEADS:

Dr. Bishesh Khanal

Dr. Basant Giri (KIAS)

PROJECT TEAM:

Udit Chandra Aryal, Safal Thapaliya, Prasuma Rawal, members from KIAS

CLINICAL PARTNERS:

Nyaya Health Nepal, Achham

Provincial Public Health Laboratory, Janakpur
Kathmandu Institute of Child Health,
Kathmandu

Damak Children's Hospital, Jhapa

PAPER PUBLICATION DETAILS:

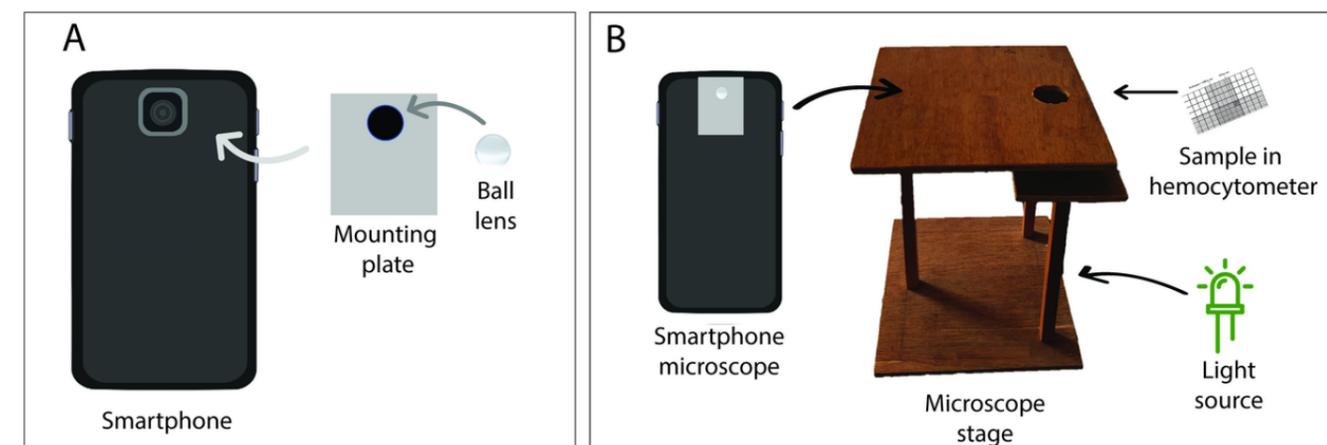
<https://doi.org/10.1371/journal.pntd.0008560>



vegetables and stools. With support from Lacuna Fund, we are building a large annotated database of microscopic images, both traditional brightfield and our low-cost smartphone microscope, where Giardia and Cryptosporidium cysts are identified in water, vegetables and stool samples. Moreover, the annotations will be done by both experts and non-experts so that it can be used later to assess the performance of AI models in both the contexts of experts' availability or unavailability. The proposed dataset will enable a much more comprehensive evaluation, for instance, comparison on challenges of domain shift (change in slide matrix from water, food and stool). We have already developed a web-based platform where multiple centers can upload microscopic images, and annotators can login and annotate images. We are in the data collection phase.

This multidisciplinary project has included people from different dimensions including researchers and professionals including AI researchers, microscopy and optics experts, chemistry and low-cost device experts, clinicians, pathologists and public health experts.

Our clinical partners will help us collect datasets, provide stool samples and also make these datasets and images available to us for further research and exploration.



CERVICAL CANCER VIA SCREENING

2. AI-assisted VIA Screening of Cervical Cancer

PROBLEM:

- Cervical cancer is the fourth-most common cancer among women globally that leads to 90% deaths LMICs
- Can be easily cured if diagnosed at an early stage and treated properly but Nepal lacks the accessibility in early-stage screenings
- VIA (Visual Inspection Using Acetic Acid), is a simpler, inexpensive & accessible test that can be adapted suitably for low-resource settings
- But VIA is subjective, that is dependent on human expertise which is often unavailable in low-resource settings such as primary and community health care settings

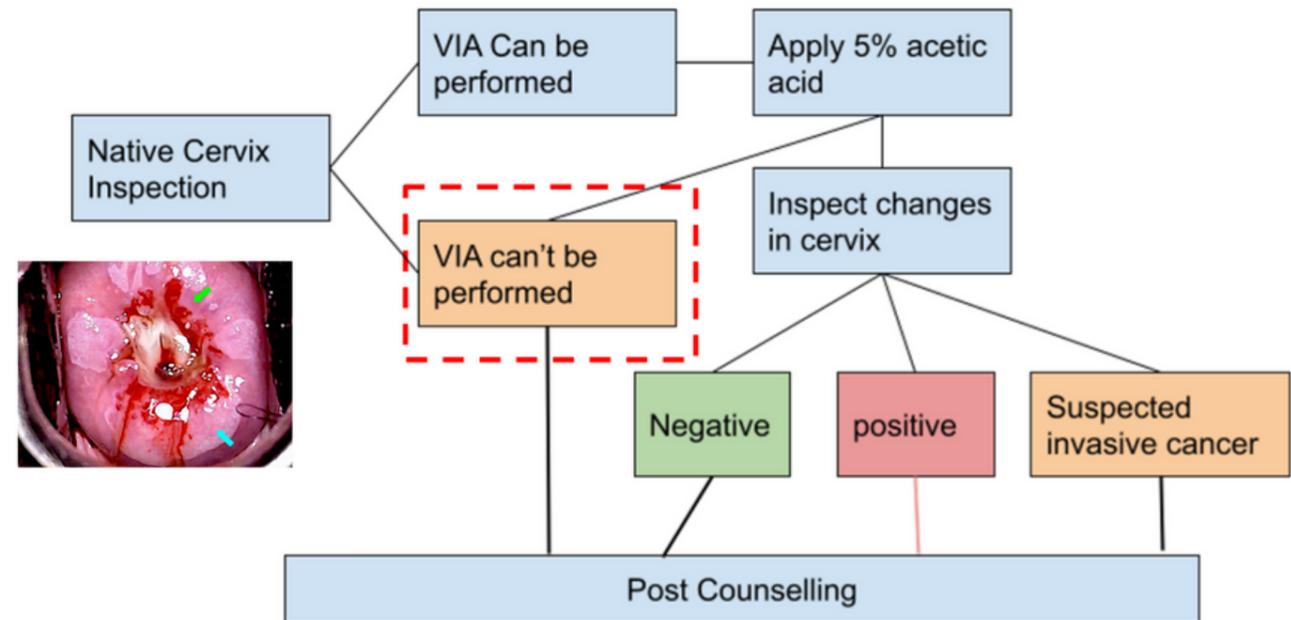


OUR PROPOSAL:

- To research and develop AI-assisted VIA screening using mobile captured photos
- To build more consistent and accurate smartphone based cervical cancer screening tool that can be used by nurses and community health workers

PAPER PUBLICATION DETAILS:

In Progress



PROJECT STATUS:

- Initial stage of data collection - capturing multiple images over the span of one minute and ongoing validation studies
- Three different health camps have been set up to follow the data collection protocol
- 57 patients from these camps have been a part of the validation study
- VIA test conducted on 758 patients so far (Target: 1500 patients)
- To reduce the limitations, we plan to establish an open-source database portal for other people to contribute as well and make the screening as applicable and accurate as possible with the help of the AI-model
- Further aim to design a mobile application that can be used for testing in hospitals and low-resource settings

FUNDED BY:

Korea International Cooperation Agency (KOICA)

PROJECT Co-LEADS:

Dr. Bishesh Khanal, NAAMII

Dr. Archana Shrestha, IISH

CLINICAL PARTNERS:

- Institute for Implementation Science & Health (IISH)
- Budhanilakantha Municipality

PROJECT TEAM:

- Kanchan Poudel, Research Assistant
- IISH members



Budhanilkantha Municipality Office
Clean, Peaceful, Prosperous, Tourism Town Budhanilkantha



3. Automatic Detection of Online Nepali Abusive Text for Intimate Partner Violence Research

PROBLEM:

- Mostly we only look into physical abuse as a form of violence and As most of the young society is moving towards social engagements virtually via various social media and messaging platforms, there has been a rise in incidences of online abuse and violence. Violence against an intimate partner via internet is online Intimate Partner Violence (IPV), which seems to be increasing but its nature and prevalence is not yet well known.
- This work focuses on aiding IPV research to understand the nature and prevalence of online IPV, and to build foundations for detecting potential IPV Nepali texts at scale.
- One of the first steps to detect potential IPV Nepali texts is to be able to automatically detect abusive texts and contexts in Nepali language. However, there currently exists a gap in good Nepali Natural Language Processing (NLP) AI models

OUR PROPOSAL:

- Build a suitable annotated dataset and train AI models for abusive text detection. The texts are gathered from Twitter posts and YouTube comments, which are annotated to describe various forms of abuse. Train the AI model to generate a rough estimate of how prevalent is Intimate Partner Violence in the context of Nepal. comments, which are annotated to describe various forms of abuse.



PAPER PUBLICATION DETAILS:
In Progress

- Train the AI model to generate a rough estimate of how prevalent is Intimate Partner Violence in the context of Nepal.
- An online web-based platform that collects publicly available data and provides outputs of model for humans to verify and correct, when necessary, from which various studies can be carried out to understand the nature and prevalence of abusive texts.

PROJECT STATUS:

- A chat application has been developed where users can voluntarily simulate conversations, which is being used to simulate IPV related and normal conversations.
- Annotated Nepali Twitter posts at sentence and phrase level for various forms of abusive texts vs normal texts
- Evaluation of AI models is ongoing.
- A web-based platform has been built which gathers keywords based Nepali texts from Twitter and youtube comments, classifies them using AI model into abusive vs non-abusive, detects phrases and classifies into various types of abuse, human in the loop system to verify and correct AI predictions, and analytics on various forms of abusive text.

FUNDED BY:

Sexual Violence Research Initiative (SVRI)



PROJECT TEAM:

Rabin Adhikari & Dr. Bishesh Khanal,
members from ChildSafeNet



CLINICAL PARTNERS:

- ChildSafeNet Nepal

ChildSafeNet

Safer internet for children and young people

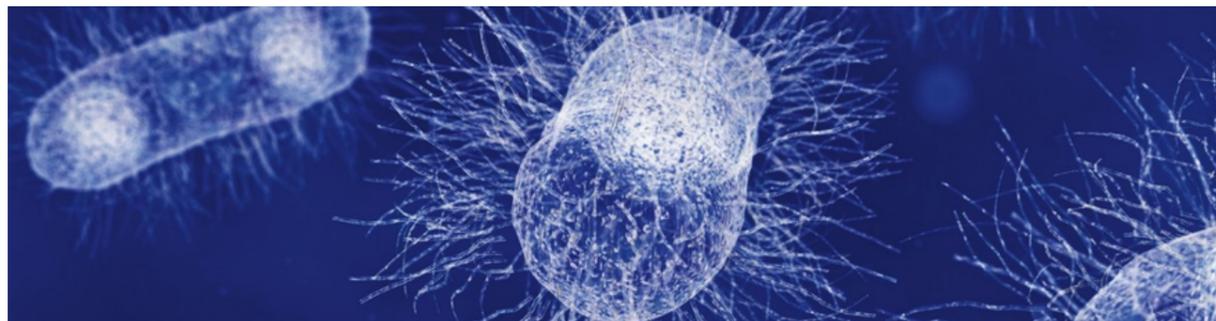
4. Systems Genomics Modeling of Multi-drug Resistant Tuberculosis

PROBLEM:

- Tuberculosis (TB) is a major communicable disease and the world's top infectious killer
- Nepal is among the leading countries in Asia with a high TB burden
- TB caused by an airborne bacterium: Mycobacterium tuberculosis (Mtb) has a high resistance to antibiotic drugs
- An estimated mortality rate could exceed 10 million people a year due to drug resistance by 2050
- Despite the implementation of successful TB control programs, Nepal is struggling with the early identification and management of new cases of drug resistance TB
- The emergence of drug resistance is linked to specific mutations in Mtb genome and identifying drugs that a TB patient is resistant to could potentially help clinicians make efficient treatment decisions

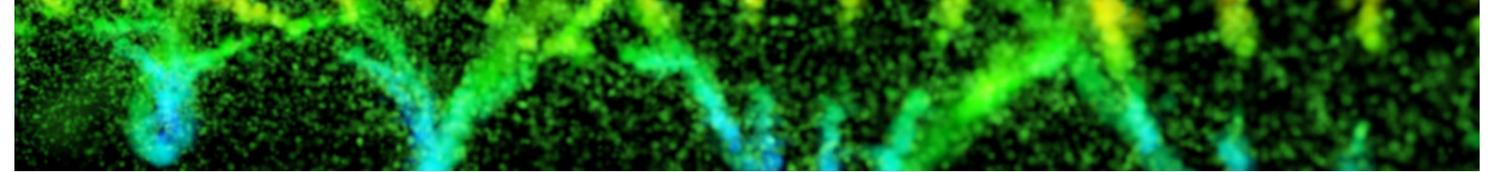
OUR PROPOSAL:

- Use of efficient machine learning approaches to mine voluminous Mtb genome data and identify mutations associated with drug-resistant tuberculosis
- Develop integrative machine learning methods that integrate gene mutations in Mtb whole genomes and Mtb-interactome to identify genomic predictors of drug-resistant TB



PAPER PUBLICATION DETAILS:

In Progress



PROJECT STATUS:

- Designed and deployed a Whole Genome Sequence processing pipeline to perform end-to-end data processing on a massive scale and is easily deployable to most High-Performance Computing clusters.
- Investigated various methods which have been employed in the past, to study antimicrobial resistance in Tuberculosis and reproduced results of all recent, state-of-art machine learning models that predict the resistance.
- Experimented with mutation data represented as “mutation heatmap” images. Although there are peculiarities among heatmaps of susceptible vs heatmaps of resistant organisms, the experiment was discontinued because the image dimension would change with each new organism included in the dataset.
- Performed network analysis on graphs obtained using Protein-Protein Interaction data for Mycobacterium Tuberculosis that encapsulate information regarding interaction between genes, and mutations each gene might have.
- Currently experimenting on different pooling algorithms for graph information aggregation, and aggregation of mutation features embedded in each node of the graphs.

FUNDED BY:

National Institute for Health Research (NIHR), UK
Royal Society of Tropical Medicine and Hygiene (RSTMH), UK



PROJECT TEAM:

Dr. Raunak Shrestha, Dr. Bishesh Khanal, and Parikshit Prasai



NIHR | National Institute for Health and Care Research

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Alina Devkota
Research Assistant



Ronast Subedi
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Pragya Neupane
Research Intern



Aatiz Ghimire
Research Assistant



Shruti Shrestha
Research Assistant



Nikhil Tomar
Research Assistant

2022 was the year NAAMII set a record for onboarding the most number of employees in a single year. But we also had a handful of departures. We wish them the best for their future endeavors and will continue to celebrate their achievements!

"I would like to express my sincere gratitude to Shreyasha Paudel and Dr. Bishesh Khanal, Ph.D. for allowing me to be a part of this exciting and important research project on AI ethics. Their guidance and support have been invaluable in helping me grow and develop as a thinker and researcher, and I am deeply grateful for the trust and confidence they have placed in me. Thank you again for this incredible opportunity."

– **Aatiz Ghimire**

I joined the MultiModal Learning Lab at NAAMII after completing my undergraduate degree. My research focused on the application of Computer Vision for Medical Image Analysis. Under the supervision of Prof. Binod Bhattarai, I worked on two research projects, one of which is published in the Medical Image Analysis Journal. Similarly, another significant achievement was winning FetReg Endovis Sub-challenge on Semantic Segmentation, organized in conjunction with MICCAI 2021. The overall experience was awesome. The lab provided me with tremendous opportunities for learning and research. I would like to thank everyone at NAAMII for making my stay productive.

– **Ronast Subedi**

Kanchan Poudel has been working with NAAMII for the past seven months as a Research Assistant. She's a part of the ToGAI research group and is currently involved in the AI-assisted VIA Screening of Cervical Cancer research project. A recently graduated Computer Engineer from Institute of Engineering (IOE), Pulchowk Campus - in this tête-à-tête, Kanchan shares with us how she's been exploring the fields of Health, AI & Research.

Initial Inclination Towards Research

Kanchan was always interested to pursue research over pre-defined industry work because of the sense of liberation and opportunity for discovery that it offers. She didn't want to be within a pre-defined boundary. Even in research there always lies a guiding factor but it also allows an individual to flourish by providing a creative outlet for exploration and discovery, allowing for the testing of new ideas and the generation of new knowledge. This sense of freedom and the potential for meaningful contributions to a field is initially what inspired Kanchan as it offers a unique blend of challenge and reward, making it a fulfilling and rewarding career choice.

NAAMII & AI School

Despite that Kanchan was always keen and aware of the applicability of mathematics since high-school, her undergraduate degree & joining NAAMII's Annual Nepal AI School strengthened her foundation on how to immediately apply the theoretical knowledge in a manner that we can actually see the impact of mathematics and AI in day-to-day lives.

A Human-Centric Perspective on a Project

As a Research Assistant, Kanchan is not only involved in her project in the research dimension but is also fully involved in its development, machine learning & quality control stages. She tells that all the ongoing projects at NAAMII are currently application-based but her project is particularly inspiring to her because she is closely being able to interact with the direct beneficiaries of the project be it the targeted risk population or the healthcare officials.

For Kanchan to know that - this Cervical Cancer project is not only changing women's perspective towards general health but it's also spreading an awareness on sanitary and health habits and why you need to conduct occasional medical tests - is something that motivates her. Also, it helps her to see that her work has an impact somewhere in the society.

Personal Growth & Changes

Apart from the technical skills, Kanchan believes that joining NAAMII has also enhanced her interpersonal skills because she wasn't open to seeking help and was reluctant to articulate her problems however, the environment at NAAMII has helped her to enhance her communication skills and discuss ideas with her colleagues.

Every day she is pitching her project to not just her colleagues but different guests and now is capable of making other people understand her projects confidently.

She is also highly inspired by Dr Bishesh Khanal, the Research Scientist of ToGAI who left his comfortable jobs abroad to make an impact in Nepal and to help build the capacity of the researches of Nepal.



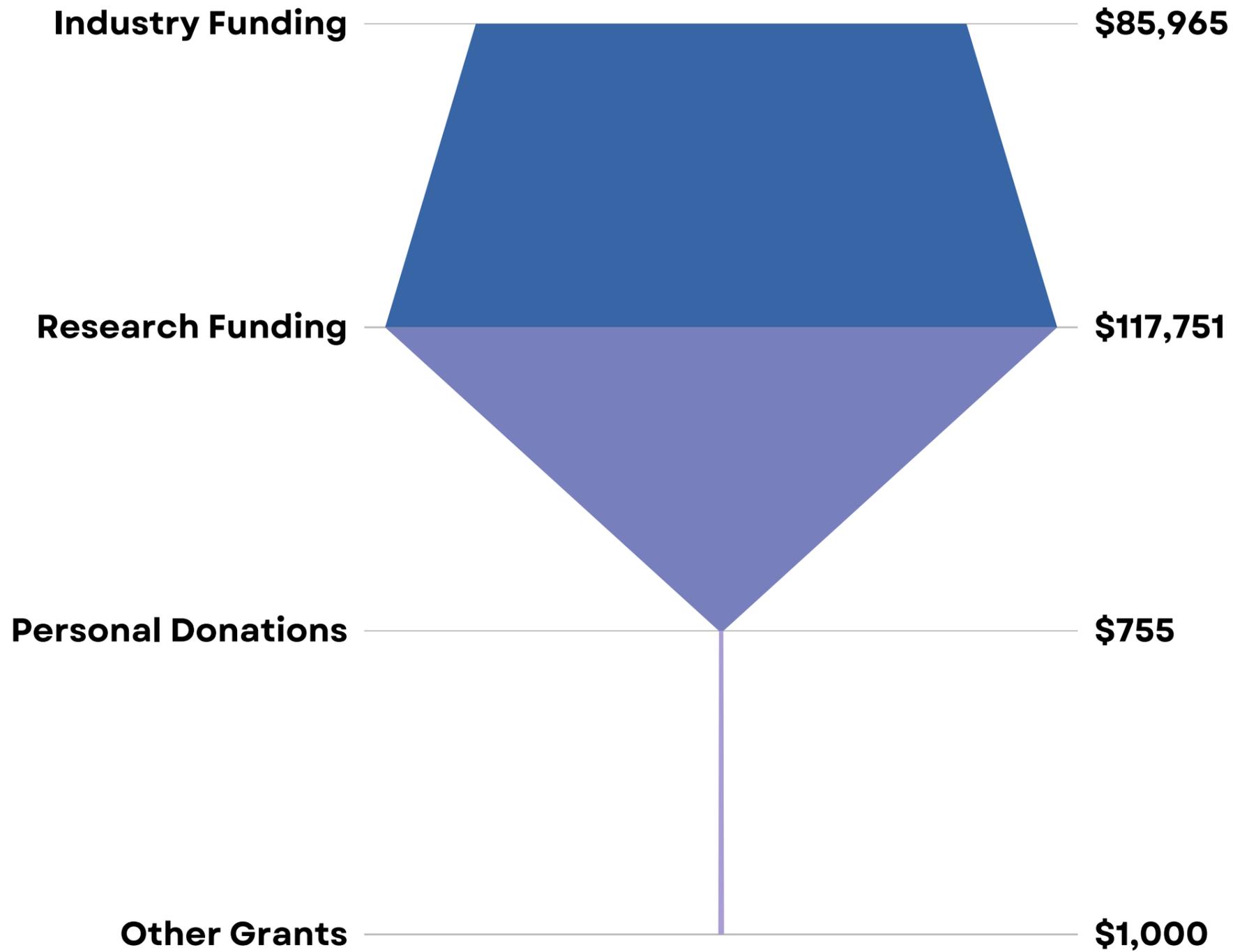
UP-CLOSE
with **KANCHAN**

Advice for Aspiring Researcherrs

For an upcoming researcher, It is important to approach your work with a growth mindset. Research is a challenging and complex process that requires patience, perseverance, and a willingness to learn. There may be times when your efforts do not yield immediate results, but this should not discourage you. Instead, embrace this as a natural part of the learning process and use these experiences to refine your skills and knowledge.

Embrace failure and treat it as a learning opportunity. Research is a process of trial and error, and you may feel frustrated seeing that your efforts are not garnering the desired results but you shouldn't feel worthless because of that. It feels fascinating to see the research outputs of other researchers and you may have the mindset of achieving it in a similar level but sometimes things may not work out and there are both sides to the coin. So stay motivated, persistent, and focused on your goals while being flexible and adaptable.

FUNDINGS OF THE YEAR: 2022



TOTAL FUNDS & GRANT AWARDS OF 2022: \$205,471



FEATURED INCUBATOR



Diyo.ai is a Nepal-based AI company incubated at the NAAMII. It focuses on localizing complex AI solutions for businesses. In the past year, the company has had notable achievements, including being the second runner-up at the NYEF Startup Awards, participating in the EO Global Student Entrepreneur Awards, leadership changes, and launching a new product, Diyochat. Diyo.AI has also made significant progress in its core mission of developing conversation AI-based chatbots and customer experience management platforms. This includes launching the new product, Diyochat, and acquiring clients in the chatbot industry. The company is developing chatbots for government agencies, including the Lalitpur Metropolitan City and Butwal Sub-Metropolitan City. In addition to these achievements, Diyo.AI has also been committed to creating employment opportunities in Nepal and is currently expanding its team. There is also interest from investors in the company, which is working to mature and strengthen its team and overall operations. One area of focus for Diyo.AI has been the development of chatbots that understand both Devanagari and Romanized scripts for local languages in South Asia. This has been a significant undertaking and the company is dedicated to continuing this work in the future.

KEY ACHIEVEMENTS

- **Second Runner Up: NYEF Startup Awards**

Diyo.ai achieved recognition as the second runner up in the NYEF Startup Awards 2022! The awards ceremony, organized by the NYEF Kathmandu Chapter, is a premier competition and bootcamp for young entrepreneurs. It provides a platform to nurture startups that have been in the market for less than 4 years and help them grow into scalable businesses. Diyo.ai was awarded a prize of Rs. 100,000 for its outstanding performance and its impact in today's business world. We are grateful for this recognition and will continue to work hard to bring our innovative ideas to life. Congratulations to all the other participants and winners of the NYEF Startup Awards!

- **UNDP Accelerator Lab InnoFest**

The UNDP Accelerator Lab hosted InnoFest Carnival with over 300 attendees. 15 innovative local solutions were showcased that was explored and tested by the Accelerator Lab Nepal to promote youth engagement in addressing emerging urban challenges such as pollution and unemployment. Diyo.ai was also one of the businesses that was recognized among these 15 innovations for its influence in achieving the Sustainable Development Goals (SDGs).



Bijayan Bhattarai
CEO



Santosh Dahal
CTO



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UPCOMING EVENTS

- **Annual Nepal AI School 2023**

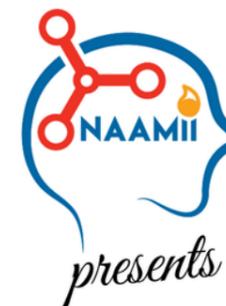
The Annual Nepal AI School (ANAIS) is back for its fourth Edition in Spring, May 22 - June 1, 2023. More details will be shared soon through the ANAIS website and our official social media channels.

- **Newsletter Every Three Months**

Our newsletter will now be released quarterly from this year! Our next edition is scheduled to be published at the end of March 2023. Stay up to date with all the latest news and developments in our field and organization by subscribing to our newsletter. Simply click on the link at the footer of this page to join our mailing list. Don't miss out on this opportunity to stay informed and connected with NAAMII. If you already received this edition via mail, it is not required to subscribe again.

- **Public Lecture Series Announcement**

Our Public Lecture Series is set to resume soon. We are now inviting experts, both based in Nepal and abroad, to participate as keynote speakers. If you are traveling to Nepal in the near future and are interested in sharing your knowledge and insights with our community, we would love to have you join us. Please get in touch with us via publiclectures@naamii.org.np to express your interest and discuss further details. Stay tuned for more information on the dates and themes of our upcoming events



**PUBLIC
LECTURE
SERIES**

Stay
tuned

The image features the text "Stay tuned" in a playful, cursive font. The word "Stay" is written in red, and "tuned" is written in yellow. The text is slanted upwards from left to right. At the end of the word "tuned", there is a decorative flourish consisting of three yellow, leaf-like shapes pointing upwards and to the right.