

# Manish Dhakal

Computer Engineer . Machine Learning Researcher

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## Summary

An accomplished computer engineer with experience as a Research Assistant (RA), interested in multimodal learning, medical imaging, and continual learning, skilled in maths and programming, and adept at communicating research results to the community.

## Work Experience

### Nepal Applied Mathematics and Informatics Institute for research (NAAMII)

Research Assistant

Lalitpur, Nepal

April 2022 – Present

Supervisor: [Bishesh Khanal, Ph.D.](#)

- Developed skills for *object detection and segmentation* tasks on 2D medical images and explored their multi-modal approach ( esp. *vision-language models* ); also worked for segmentation with *3D mesh* data.
- Demonstrated *strong skills in writing scientific manuscripts*, with multiple papers submitted for review, showcasing the ability to *communicate methodologies, results, and implications* effectively.
- Ensured *reproducibility and modularity in ML projects* by implementing robust methodologies and practices, allowing for the transparent and replicable programming of the projects.

### Sireto Technology

Blockchain Intern

Kathmandu, Nepal

August 2021 – December 2021

- Wrote *smart contracts in Haskell* language using the Plutus framework for the Cardano ecosystem.
- Improved *software development skills* by learning new tools and techniques that assist in completing the project.

### Techniti Nepal

Co-founder

Lalitpur, Nepal

September 2020 – Present

- Co-founded Nepal-based company providing *software solutions* such as websites, electronic health record management systems, data visualization interfaces, and IoT-based solutions as well.
- Coordinated with clients* to understand their requirements and provided them with feasible and impactful solutions.
- Worked as a frontend developer with *ReactJS* and backend developer with *Django and FastAPI* for web applications.

## Education

### Bachelor in Computer Engineering

Pulchowk Campus, Institute of Engineering, Tribhuvan University

Bachelors

November 2017 – April 2022

Thesis Supervisor: [Prof. Subarna Shakya](#)

- Ranked 11th* in the engineering entrance exam, competing with *15,000+ candidates*, received *full scholarship* for undergraduate study.
- Gained knowledge about *significant CS courses* like AI, Image Processing, Data Structure & Algorithm, DBMS, Software Engineering, and so on.
- Thesis*: Automatic speech recognition for *low-resourced Nepali language* which was later presented at an IEEE conference.

## Publications

## Vision-Language Model, NLP, Medical Imaging

Lead author / Presenter / Co-first author

2022-Present

- Adhikari, R.\*, [Dhakal, M.\\*](#), Thapaliya, S.\*, Poudel, K., Bhandari, P., & Khanal, B. (2023, October). [Synthetic Boost: Leveraging Synthetic Data for Enhanced Vision-Language Segmentation in Echocardiography](#). In *International Workshop on Advances in Simplifying Medical Ultrasound* (pp. 89-99). Cham: Springer Nature Switzerland.<sup>1</sup>
- Poudel, K.\*, [Dhakal, M.\\*](#), Bhandari, P.\*, Adhikari, R.\*, Thapaliya, S.\*, & Khanal, B. (2023). [Exploring Transfer Learning in Medical Image Segmentation using Vision-Language Models](#). *arXiv preprint arXiv:2308.07706*.<sup>2</sup>
- [Dhakal, M.](#), Chhetri, A., Gupta, A. K., Lamichhane, P., Pandey, S., & Shakya, S. (2022, July). [Automatic speech recognition for the Nepali language using CNN, bidirectional LSTM and ResNet](#). In *2022 International Conference on Inventive Computation Technologies (ICICT)* (pp. 515-521). IEEE.<sup>3</sup>

## Teaching

### Community Eye, ENT & Rehabilitation Center (CEERS)

Trainer

Bhaktapur, Nepal

June 2023 – Present

- Training a group of interns* to develop medical imaging applications with the use of ML.
- Instructing and guiding them about ML through activities like *paper reading sessions, lecture-lab sessions, and topic presentations*.

### 4th Annual Nepal AI School (ANAIS)

Lab Instructor

Kathmandu, Nepal

May 2023 – June 2023

- Guided participants* through a series of labs related to *neural networks, transformers, federated learning, graph neural networks, active learning*, and so on.
- Mentored three groups* during the 10-day *machine learning hackathon* (namely, Hack-a-Dev).

### Software Fellowship, Locus 2021

Programming Instructor

Online

Summer 2021

- Provided tutoring on *software development life cycle* and assisted participants with *software documentation* and *library/framework installation*.
- Taught participants about *API development for web applications*, emphasizing its concepts, best practices, and usage.

## Projects

### Lower Limb Segmentation

Medical Imaging

July 2023 – September 2023

Supervisor: [Taman Upadhaya, Ph.D.](#)

- Conducted *training experiments* of different deep learning models on the remote server to segment three bones – knee, pelvis, and ankle – from CT scans of the lower limbs of patients.
- Deployed a robust Python rest API* on the remote server for the segmentation request from a client, with a pipeline including pre-processing, inference, and post-processing steps.
- Ensured *interoperability, reproducibility, and understandability* of the deployed application using Docker, and well-structured documentation and comments.

### Vision Language Segmentation Models (VLSMs) for Medical Images

Medical Imaging

February 2023 – June 2023

- Reported zero-shot and finetuned segmentation performance of *4 VLSMs* on *11 medical datasets* using *9 types of prompts* derived from *14 attributes*, prompts are given as text conditioning information.

<sup>1</sup><https://github.com/naamiinepal/synthetic-boost>

<sup>2</sup><https://github.com/naamiinepal/medvlsm>

<sup>3</sup><https://github.com/manishdhakal/ASR-Nepali-using-CNN-BiLSTM-ResNet>

- Worked with *encoder-decoder architecture* to generate binary segmentation masks for VLSMs.
- Tested the compatibility of the VLSMs (such as *CLIPSeg and CRIS*) pre-trained for open-domain images with medical images.

## Object Detection in 2D Orthopantomogram (OPG) Images

September 2022 – Present

### Dental Imaging

- Critically analyzed the *literature and state-of-the-art* models for different segmentation and detection tasks on radiology images of dentistry and their inadequacy.
- Designed and developed the *data annotation tool* for object detection over 2D OPG images.
- Working on identification and localization of dental *anatomical structures and abnormalities* while benchmarking with existing methods like *YOLO, RetinaNet, RCNN, and FastRCNN*.

## Segmentation in 3D Teeth Scan

Summer 2022

### MICCAI Challenge 2022

- Learned about the representation and preprocessing of *3D mesh and point cloud* data.
- Benchmarked with different 3D point cloud segmentation models such as *Pointnet++ and DeltaConv*.

## Nepali AutoComplete and LM

August 2020 – October 2020

### Open Source Project

- Designed and trained *language model of Nepali (ie. Devnagari transcript)* for the text auto-complete system.
- Programmed the *pre-processing pipeline* to remove the non-Nepali characters from the dataset.

## Super-Resolution with GAN (SRGAN)

May 2020 – August 2020

### Open Source Project

- Implemented *open source model* of *SRGAN* with Keras/TensorFlow.
- Developed the *understanding of generator and discriminator* in GAN-based generative models.

## Technical skills

<b>Machine Learning</b>	<i>Unimodal and multimodal (esp. vision-language model)</i> ML project structuring for detection and segmentation task while maintaining <i>reproducibility and modularity</i> ; integrating <i>open source models</i> for benchmarking. Proficiency in using libraries and frameworks like <i>NumPy, Pandas, PyTorch, and TensorFlow</i> .
<b>Writing</b>	<i>Knowledge synthesis</i> from the existing literature, <i>writing scientific documents and manuscripts</i> with <i>LaTeX</i> , and <i>communicating the results</i> to the community with transparency.
<b>Web Development</b>	Competence in creating well-documented backend applications with relational databases using frameworks like <i>Django, FastAPI, and NodeJS</i> . Adept at client-side programming with <i>ReactJS</i> .
<b>Remote Server</b>	Able to work with <i>remote Linux machines</i> for coding and project deployment using <i>SSH, shell script, tmux, Nginx, and Docker</i> .

## Extracurricular Activities

### DataRush (AI and Data Science Competition, Locus)

Spring 2022

#### Co-ordinator

- *Call for sponsors*, maintained communication and coordination between sponsors, participants, mentors, and other organizers.

- Made the *budget planning* , prepared the *event's rule book* , planned the *event structure* , and ensure the smooth operations of the event.
- *Tested and validated* the machine learning models and their *solutions* submitted by the participants.

## Achievements and Awards

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<b>Full Scholarship</b>	B.E. funded by Government of Nepal.
<b>Winner</b>	LogPoint CTF, Cybersecurity Competition.
<b>Finalist</b>	Spirathon 2020, TechXperience Nepal.

## Certifications

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<b>Stanford University</b>	<a href="#">Machine Learning</a>
<b>DeepLearning.AI</b>	<a href="#">Deep Learning Specialization</a>
<b>DeepLearning.AI</b>	<a href="#">AI for Medicine</a>
<b>DeepLearning.AI</b>	<a href="#">Natural Language Processing</a>
<b>DeepLearning.AI</b>	<a href="#">TensorFlow in Practice</a>
<b>University of Alberta</b>	<a href="#">Reinforcement Learning</a>

## References

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### **Bishesh Khanal, Ph.D.**

Research Director, *Nepal Applied Mathematics and Informatics Institute for research (NAAMII)*

[bishesh.khanal@naamii.org.np](mailto:bishesh.khanal@naamii.org.np)

### **Prof. Subarna Shakya**

Professor of Computer Engineering, *Department of Electronics and Computer Engineering, Pulchowk Campus, Institute of Engineering, Tribhuvan University*

[drss@ioe.edu.np](mailto:drss@ioe.edu.np)

### **Taman Upadhaya, Ph.D.**

Associate Researcher, *University of California San Francisco* || Adjunct Research Scientist, *Nepal Applied Mathematics and Informatics Institute for research (NAAMII)*

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