

DEEP SHANKAR PANDEY

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RESEARCH INTERESTS

Uncertainty Awareness, Meta-learning, and Robustness in Machine Learning
Application of Machine Learning and Deep Learning models to Real-World Problems

EDUCATION

ROCHESTER INSTITUTE OF TECHNOLOGY

Rochester, NY

Ph.D. in Computing and Information Sciences (CGPA: 3.93/4.00)

Expected August 2024

Research focuses on developing trustworthy uncertainty-aware deep-learning models that can learn from limited data

Relevant Coursework: Mathematics of Deep Learning; Data-Driven Knowledge Discovery; Statistical Machine Learning

TRIBHUVAN UNIVERSITY

Lalitpur, Nepal

Bachelors in Electronics and Communication Engineering at Institute of Engineering, Pulchowk Campus Nov 2013 - Dec 2017

Relevant Coursework: Data Mining; Artificial Intelligence; Big Data Technologies

PUBLICATIONS

- **Deep Shankar Pandey**, and Qi Yu. Learn to Accumulate Evidence from All Training Samples: Theory and Practice. *International Conference on Machine Learning*. PMLR, 2023. (**ICML 2023**)
- Wang, Dingrong, **Deep Shankar Pandey**, Krishna Prasad Neupane, Zhiwei Yu, Ervine Zheng, Zhi Zheng, and Qi Yu. "Deep Temporal Sets with Evidential Reinforced Attentions for Unique Behavioral Pattern Discovery." *International Conference on Machine Learning*. PMLR, 2023. (**ICML 2023**)
- **Deep Shankar Pandey**, and Qi Yu. "Evidential conditional neural processes." *Proceedings of the AAAI Conference on Artificial Intelligence*. Vol. 37. No. 8. 2023 (**Oral Paper Presentation AAAI 2023**)
- **Deep Shankar Pandey**, and Qi Yu. "Multidimensional Belief Quantification for Label-Efficient Meta-Learning." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2022 (**CVPR 2022**)
- Zhu, Yuansheng, Weishi Shi, **Deep Shankar Pandey**, Yang Liu, Xiaofan Que, Daniel E. Krutz, and Qi Yu. "Uncertainty-Aware Multiple Instance Learning from Large-Scale Long Time Series Data." In *2021 IEEE International Conference on Big Data (Big Data 2021)*

RESEARCH EXPERIENCE

MINING LAB, RIT. (A research lab at Rochester Institute of Technology)

Rochester, NY

Graduate Research Assistant

Aug 2019 – Present

- Carried out a thorough theoretical analysis of evidential deep learning models for classification to identify the key cause for their suboptimal performance. Based on the analysis, developed a theoretically justified regularization for evidential models, enabling the model to learn from all training data.
- Developed a novel, outlier robust, and uncertainty-aware conditional neural process model for few-shot regression and image completion problems.
- Developed a novel computationally efficient uncertainty-aware meta-learning model for few-shot classification tasks. Parts of the work appeared in CVPR 2022. Successfully applied the model for maritime surveillance application.
- (Ongoing Work) Investigating adversarial vulnerabilities and miscalibration issues of evidential deep learning models to develop a robust, well-calibrated uncertainty-aware model that can learn from limited, potentially noisy data.

RESEARCH POTENTIAL ASSESSMENT WORK, RIT.

Rochester, NY

Work done for successful completion of Research Potential Assessment Exam

Aug 2019 – May 2020

- Worked on efficient optimization-based meta-learning via active-task selection
- Carried out in-depth analysis of the state-of-the-art meta-learning algorithms along with their implementations
- Developed active task selection methods to improve the performance of the meta-learning models across various classification and regression problems

PROJECTS

DEVELOPING MACHINE LEARNING MODELS CONSISTENT WITH THE REAL-WORLD PHYSICS

Ongoing collaboration project with University of Rochester Research Group, 2022-2023

- Working on extending the Deep Learning models to be consistent with the real-world observations and the underlying physics in the real world. Introducing the consistency from architecture modification and physics-based regularizations.
- Developed a novel deep-learning model for the equation-of-state regression problem of Deuterium material. The model has less than 2% Mean Relative Error on the test set while remaining thermodynamically consistent. The work is under review.

ATTENTION-BASED DEEP SETS TO IDENTIFY CHARACTERISTIC PATTERNS OF CHILDREN WITH AUTISM SPECTRUM DISORDER

A collaboration project as a part of the summer work, 2022

- Worked on the development of an attention-driven deep learning model that differentiates children with Autism Spectrum Disorder (ASD) from typically developing children using time-series data collected from an interactive Virtual Reality-based game environment. Also developed a framework to identify the characteristic patterns of children with ASD. The work appeared in ICML 2023.

UNCERTAINTY-AWARE DECISION-MAKING FOR IMPROVED MARITIME SURVEILLANCE

Minor Project as a part of the summer work, 2021

- Worked on the development of Bayesian Neural Networks for uncertainty-aware image classification models for maritime vessel images collected from satellites (SAR data).

HANDWRITTEN DIGIT CLASSIFICATION

Minor Project as a part of Mathematics of Deep Learning course, 2020

- Implemented Neural Network models from scratch in Numpy to solve image classification problems
- Worked on analysis of the backpropagation, optimization, vectorization, and sanity checks for the neural networks

MULTIMODAL DATA FUSION TO IMPROVE MEDICAL IMAGE UNDERSTANDING

Minor Project as a part of the Data-Driven Knowledge Discovery course, 2019

- Worked on using deep learning models to combine multimodal information (image of the skin lesion and the verbal description of the lesion) for improved medical diagnosis of different skin diseases

FACE IDENTIFICATION

Minor Project as a part of Artificial Intelligence course, 2016

- Worked on dimensionality reduction and feature extraction using Principal Component Analysis
- Carried out face classification using multiple classifiers: KNN Classifier, Support Vector Machines, and Logistic Regression

PROFESSIONAL EXPERIENCES

INTERN, DEEP LEARNING FOR IMAGE AND VIDEO PROCESSING

May, 2023 - Aug., 2023

InterDigital Communications Inc. R&I Department, Los Altos, California

Worked on addressing blind face restoration problem with VQ-GAN and transformer networks. Modified the transformer architecture to an uncertainty-aware transformer. Introduced novel uncertainty-guided model-training/inference mechanisms leading to an improvement of up to 0.8dB PSNR without hurting other metrics. The internship work is planned to be submitted to a conference.

SKILLS

Programming Languages: Advanced in Python, Basic in C, C++ and C#

Machine Learning and Deep Learning: Advanced in Pytorch, Scikit-learn, Numpy, Basic in Tensorflow and Keras

Languages: Fluent in English and Nepali; Conversational Proficiency in Hindi

Certifications, Coursera: Bayesian Methods for Deep Learning, Deep Learning Specialization, Python3 Specialization, and Mathematics for Deep Learning Specialization

Personal Growth: Member of Toastmasters at RIT to improve my public speaking, communication, and leadership skills. Currently working as Club Officer (Vice President, Membership) for TigerTales Toastmasters.

Leadership: President (April 2019 - April 2020) of the Nepalese Student Association at RIT.