AYUSH KUMAR SHAH

Ph.D. student in Computer Science

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EDUCATION

PhD in Computing and Information Sciences, CGPA: 3.93/4 *Aug 2020 – Present*
Rochester Institute of Technology (RIT) *Rochester, NY, USA*
Research Group: Document and Pattern Recognition Lab (DPRL)
Area of focus: extraction and visual parsing of graphical structures and notations, focusing on mathematical formulas and chemical diagrams in documents.
Research Interests: Pattern recognition, computer vision, detection and recognition of graphical structures, speaker understanding, multi-modal deep learning, natural language processing, visual scene parsing.
Relevant Courses: Pattern Recognition, Computer Vision, Mathematics for Deep Learning, Natural Language Processing, Software Engineering.

Bachelors in Computer Engineering, CGPA: 3.96/4 *Aug 2015 – Oct 2019*
Kathmandu University *Kavre, Nepal*
Relevant Courses: Artificial Intelligence, Data Structures and Algorithms, Algorithm and Complexity, Software Engineering, Probability and Statistics, Machine Learning, Speech and Language Processing, C, C++.

HONORS AND AWARDS

RIT Ph.D. Merit Scholarship/Assistantship. Financial Support for Ph.D. at RIT. *2020 – Present*

Kathmandu University Merit-based scholarship (4x). $440 worth scholarship awarded for securing the highest GPA in the Computer Engineering cohort (4/7 semesters). *2015 – 2019*

Fusemachines Artificial Intelligence Scholarship Program. Selected among thousands of candidates nationwide for fuse.ai Artificial Intelligence Scholarship Online Course. Nov 2018

American Society of Nepalese Engineers Merit Award. A merit worth $200, rewarded to the entrance topper of each university in Nepal, seeking admission for undergraduate degrees. May 2016

46th International Physics Olympiad (IPhO) Contestant. One of the largest olympiads for high school Physics enthusiasts with 5 contestants, each from 100 participating countries. June 2015

WORK EXPERIENCE

Amazon - Alexa AI Sunnyvale, California
Applied Scientist Intern *May 2022 – Aug 2022*

- Reduced annotation costs and training time, with competitive speaker identification results in voice assistants (e.g., Alexa) using semi-supervised techniques (Alexa Speaker Understanding team).

Fusemachines Kathmandu, Nepal
Machine Learning Engineer *June 2019 – Aug 2020*

- Optimized a client's business decisions for chemical products that go unsold using boosting classifiers.
- Automated bank data extraction by building a 95% accurate handwritten text (English & Nepali) recognizer.
- Increased a subscription-based e-commerce client revenue by 6% building a recommendation system.
- Prepared Fusemachines AI Education Programs course materials for AI Democratization.

RESEARCH EXPERIENCE

Document and Pattern Recognition Lab (DPRL), RIT Rochester, New York
Graduate Research Assistant *Aug 2020 – Present*

- Improved expression recognition rate of math formulas by 7% using improved visual features (shape and context features, spatial pyramidal pooling to avoid spatial information loss), and modified graph attention network (GAT) for additional context.

- Accelerated math formula recognition by 6 times by implementing a custom dataloader with dynamic batch size for full GPU utilization in a distributed parallelization framework.
- Helped the document recognition community to visualize and evaluate graphical recognition results and errors, including specific type of errors in place, by building a new open-source visualization tool.
- Improved accessibility of mathematical information by creating innovative search engines, interfaces, and algorithms for extracting and recognizing math, including a new open-source math formula extraction and retrieval system for PDF documents.

PUBLICATION

- **A. K. Shah**, and R. Zanibbi, "Line-of-sight with Graph Attention Parser (LGAP) for Math Formulas – ICDAR 2023, Cham, 2023, accepted.
- **A. K. Shah**, A. Dey, and R. Zanibbi, "A Math Formula Extraction and Evaluation Framework for PDF Documents," in Document Analysis and Recognition – ICDAR 2021, Cham, 2021, pp. 19–34. doi: 10.1007/978-3-030-86331-9_2
- B. M. Amador, M. Langsenkamp, A. Dey, **A. K. Shah**, and R. Zanibbi. 2023. "Searching the ACL Anthology with Math Formulas and Text". In Proceedings of the 46th International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR '23). Association for Computing Machinery, ACM, New York, NY, USA, 5 page, accepted

TEACHING EXPERIENCE

Rochester Institute of Technology — Rochester, New York
Graduate Teaching Assistant — *Aug 2022 – Dec 2022*

- Course: Introduction to Machine Learning

Samriddhi College — Kathmandu, Nepal
Computer Science Instructor — *Jan 2020 – June 2020*

- Educated undergraduate Computer Science students about "Foundations in AI: Computer Science and Mathematics" including topics like Introduction to AI, CS Fundamentals, Python, Data Structure, DBMS.

TECHNICAL SKILLS

Programming Languages	Python, R, Matlab, C, C++, JAVA
Python Packages	Pytorch, Tensorflow, Scikit-Learn, OpenCV, Nltk, Pandas, Numpy, Matplotlib, Fastapi, BeautifulSoup, Regex, NetworkX, Jupyter
Database	MySQL, MongoDB
Miscellaneous	Git, Github, Bash, LaTeX, Jira, Linux, Arduino, Raspberry-pi

TALKS

Research Idea Ring (RIR) talk on "Line-of-sight with Graph Attention Parser (LGAP) for Math Formulas" at RIT. — *April 17, 2023*

Poster presentation on "Reconstructing the Structure of Molecular Diagrams in PDF Documents using a CNN-Attention-Based Parsing Model" at the Molecule Maker Lab Institute (MMLI) All-Institute Retreat at **University of Illinois Urbana-Champaign (UIUC)**. — *Sept 28, 2022*

Guest lecture on "Bayesian Decision Theory" for RIT's undergraduate course - Intro to Machine Learning (40 students). — *Sept 5, 2022*

Research Idea Ring (RIR) talk on "A Fast and Interpretable Context-aware Parser for Isolated Formulas and Chemical Diagrams" at RIT. — *April 7, 2022*

Poster presentation on the MathSeer extraction pipeline at the 16^{th} International Conference on Document Analysis and Recognition ICDAR 2021, Lausanne, Switzerland virtually. — *Sept 9, 2021*