

AYUSH KUMAR SHAH

4th year Ph.D. student in Computer Science

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📧 @ayushkumarshah 💻 @ayush7 🖥 shahayush.com 🏠 Ayush Kumar Shah

EDUCATION

PhD in Computing and Information Sciences, CGPA: 3.93/4 Aug 2020 – Present
Rochester Institute of Technology (RIT) Rochester, NY, USA
Area of focus: extraction and visual parsing of graphical structures and notations from documents
Relevant Courses: Pattern Recognition, Computer Vision, Deep Learning Mathematics, NLP, 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++.

PROFESSIONAL EXPERIENCE

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

- Improved speaker identification results in voice assistants like Alexa by reducing training time and annotation costs through semi-supervised learning.

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

- Optimized 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.
- Prepared Fusemachines AI Education Programs course materials for AI Democratization.

PUBLICATION

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- A. K. Shah***, A. Dey*, B. M. Amador*, M. Creekmore*, B. Ocampo, S. Denmark, and R. Zanibbi, "ChemScraper: Graphics Extraction, Molecular Diagram Parsing, and Annotated Data Generation for PDF Images," in Document Analysis and Recognition (Journal) - **IJDAR**, vol. 27, May. 2024, *submitted (*Equal contribution)*
 - A. K. Shah**, and R. Zanibbi, "Line-of-Sight with Graph Attention Parser (LGAP) for Math Formulas," in Document Analysis and Recognition - **ICDAR** 2023, Cham: 2023, pp. 401–419. doi: 10.1007/978-3-031-41734-4_25.
 - B. M. Amador, M. Langsenkamp, A. Dey, **A. K. Shah**, and R. Zanibbi. "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, in SIGIR '23. ACM 2023, Jul. 2023, pp. 3110–3114. doi: 10.1145/3539618.3591803
 - 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

RESEARCH EXPERIENCE

17th International Conference on Document Analysis and Recognition San José, California
Program Committee (PC) Member 2023

- Reviewed and evaluated five research paper submissions, and provided feedback and recommendations to authors.

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

- Enhanced accessibility of mathematical information through a documents search system within the ACL Anthology, integrating both text and mathematical formulas search for users with context-aware word and formula matching.
- Developed a fast and accurate molecular diagrams parser, with annotated data generation techniques in the chemical domain. Contributed to the evaluation of chemical parsers through novel graph-based metrics and analysis tools.

- Improved expression recognition rate of math formulas by 15% using improved attention and context features using modified graph attention network (GAT) and spatial pyramidal pooling.
- 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.
- Aided the document recognition community by introducing a valuable open-source visualization tool, facilitating the evaluation of graphical recognition results and the identification of specific errors within documents in context.

Research Interests: Pattern recognition, computer vision, detection and recognition of graphical structures, speaker understanding, multi-modal deep learning, natural language processing, visual scene parsing.

HONORS AND AWARDS

RIT Ph.D. Merit Scholarship/Assistantship. Financial Support for Ph.D. at RIT, which includes support via NSF Grants.	<i>2020 – Present</i>
Kathmandu University Merit-based scholarship (4x). \$440 worth scholarship awarded for securing the highest GPA in the Computer Engineering cohort (4/7 semesters).	<i>2015 – 2019</i>
Fusemachines Artificial Intelligence Scholarship Program. Selected among thousands of candidates nationwide for fuse.ai Artificial Intelligence Scholarship Online Course.	<i>Nov 2018</i>
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.	<i>May 2016</i>
46th International Physics Olympiad (IPhO) Contestant. One of the largest olympiads for high school Physics enthusiasts with 5 contestants, each from 100 participating countries.	<i>June 2015</i>

TEACHING EXPERIENCE

Rochester Institute of Technology <i>Graduate Teaching Assistant</i>	<i>Rochester, New York</i> <i>Aug 2022 – Dec 2022</i>
<ul style="list-style-type: none"> • Course: CSCI 335: Machine Learning 	
Samriddhi College <i>Computer Science Instructor</i>	<i>Kathmandu, Nepal</i> <i>Jan 2020 – June 2020</i>
<ul style="list-style-type: none"> • Course: “Foundations in AI: Computer Science and Mathematics” 	

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, L ^A T _E X, Jira, Linux, Arduino, Raspberry-pi

TALKS

Poster presentation on “ChemScraper: Extracting Molecule Diagrams from PDF Vector and Raster Images with CDXML and SMILES Output” at the Molecule Maker Lab Institute (MMLI) All-Institute Retreat at University of Illinois Urbana-Champaign (UIUC) .	<i>Sept 12, 2023</i>
Research Idea Ring (RIR) talk on “Line-of-sight with Graph Attention Parser (LGAP) for Math Formulas” at RIT.	<i>April 17, 2023</i>
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) .	<i>Sept 28, 2022</i>
Guest lecture on “Bayesian Decision Theory” for RIT’s undergraduate course - Intro to Machine Learning (40 students).	<i>Sept 5, 2022</i>
Research Idea Ring (RIR) talk on “A Fast and Interpretable Context-aware Parser for Isolated Formulas and Chemical Diagrams” at RIT.	<i>April 7, 2022</i>
Poster presentation on the MathSeer extraction pipeline at the 16 th International Conference on Document Analysis and Recognition ICDAR 2021, Lausanne, Switzerland virtually.	<i>Sept 9, 2021</i>