

Archit Rathore

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EDUCATION

University of Utah

Ph.D. in Computer Science (Expected graduation: May 2022)

August 2017- Present

Indian Institute of Technology (IIT) Kanpur

B.Tech in Computer Science and Engineering

July 2012- April 2016

RESEARCH INTEREST

I am working towards understanding ML models through the lens of Computational Topology and Visualization. I believe that the strong mathematical foundations of topological analysis and interactive capabilities through visualization techniques can pave a path to traverse the inherently complex structures of ML models, especially in the context of deep learning. I am creating frameworks for Topological Data Analysis (TDA) and visualization to analyze and reason about deep learning models, as a step towards explainable and interpretable ML.

WORK EXPERIENCE

OpenSesame, Portland, OR

ML Engineer Intern

May 2021 - Aug 2021

Data Science Team

- Implemented a NLP based conversational AI assistant to provide low-friction discovery of advanced features.
- Created end-to-end architecture and APIs to deploy trained models in a scalable and secure manner using Docker.
- Used AWS cloud infrastructure and Terraform for MLOps and Python for model creation.

VISA Research, Palo Alto, CA

Research Intern

May 2019 - Aug 2019

Risk Modelling Team

- Proposed a method to create an auto-encoding framework using Recurrent Neural Networks for time-series data.
- Developed models to create embeddings for entities that capture multiple facets using unsupervised learning.
- Implemented an end-to-end pipeline in PyTorch to interface with upstream tasks.
- Implemented efficient and scalable models capable of handling more than a million data points.

Samsung R&D Institute, Bangalore, India

Data Engineer

Jun 2016 - July 2017

Data Analytics Team

- Built and optimized ETL pipelines for processing device logs for Samsung smartphones using Apache Spark.
- Proposed and implemented methods to find recurrent temporal patterns in smartphone usage and app activities.
- Developed server side aggregation for upto 500 million daily users with nearly 5 billion data points.
- Integrated the output from above into the intelligence module for Bixby in low-resource high-throughput setting.

PROGRAMMING EXPERIENCE

Programming Languages - Python, Javascript, C, Terraform

Data Science - Tensorflow, Pytorch, Scikit-Learn, Numpy, Pandas, Apache Spark (PySpark), SQL

Frameworks - Vue, Angular, CSS, HTML, D3.js (frontend), Docker (container technology), Hadoop, Spark, AWS (cloud and distributed computing)

PUBLICATIONS

VERB: Visualizing and Interpreting Bias Mitigation Techniques for Word Representations. A. Rathore, S. Dev, J.M. Philips, S. Srikumar, *et al.* Tutorial at [AAAI 2021](#) and [KDD 2021](#). Under review at TVCG. [[code](#)]

TopoAct: Exploring the Shape of Activations in Deep Learning. A. Rathore, N. Chalapathi, S. Palande, B. Wang. Computer Graphics Forum, 2020. [[pdf](#) | [demo](#) | [code](#) | [video](#)]

Autism Classification Using Topological Features and Deep Learning: A Cautionary Tale. A. Rathore, S. Palande, J. S. Anderson, *et al.* 22nd International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2019. [[pdf](#) | [code](#)]

Mapper Interactive: A Scalable, Extendable, and Interactive Toolbox for the Visual Exploration of High-Dimensional Data. Y. Zhou, N. Chalapathi, A. Rathore, Y. Zhao and B. Wang, 2021 IEEE 14th Pacific Visualization Symposium (PacificVis), 2021. [[code](#)]

KEY PROJECTS

VERB: Visualizing and Interpreting Bias Mitigation Techniques for Word Representations

- Decomposed multiple debiasing algorithms into atomic operations for interpretability and interactivity.
- Built an interactive system to allow exploration of various biases present in word vector embeddings and tweak parameters for debiasing algorithms in real-time.
- Chosen as part of the systems presented at the ‘Discover Engineering’ outreach program for students interested in data science across 1000 high-schools in Utah.

TopoAct: Exploring the Shape of Activations in Deep Learning

- Proposed a method to extract topological structures in the activation space of object detection and language modeling neural networks.
- Implemented deep learning models and data processing in Python and PyTorch.
- Built visualization tools using JavaScript, HTML and D3js which allows layer-wise analysis of activation vectors.
- Presented exploration scenarios that provide valuable insights about the learned representations of the deep neural network.

Autism Classification Using Topological Features and Deep Learning

- Developed a novel multi-branch neural network that combines vanilla features with topological information obtained from functional MRI scans to predict autistic vs control patients.
- Used TDA (persistent homology) in conjunction with deep learning to improve classification scores.
- Performed rigorous statistical testing to establish the significance of the accuracy scores.

Scalable Mapper Algorithm for Big Data

- Optimized the Mapper algorithm, a central tool in TDA, to efficiently parallelize the clustering step.
- Achieved speedup of upto 10x on dataset sizes of more than 1 million points.

RELEVANT COURSEWORK

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|--------------------------|-------------------------------|--------------------------|
| • Machine Learning | • Natural Language Processing | • Advanced Algorithms |
| • Computational Geometry | • Probabilistic Modeling | • Database Systems |
| • Vis for Data Science | • Data Mining | • Computational Geometry |

TEACHING AND TALKS

- Teaching Mentor for Discrete Mathematics at University of Utah, Spring 2020.
- Teaching Mentor for Theory of Computation at University of Utah, Fall 2020.
- Tutorial on debiasing word vector embeddings at AAAI 2021 and KDD 2021.
- Invited talk on analyzing embeddings from transformer models at Michigan State University in Oct 2021