Rachna Ramesh

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Education

Master's, Data Science & Artificial Intelligence **2023 – 2025**
Eindhoven University of Technology (TU/e) *Eindhoven, The Netherlands*
***Thesis**: Neural Simulation of Spatiotemporal Dynamics in Bubbly Flows*

Bachelor's, Computer Science & Engineering **2014 – 2018**
University of Kerala *Trivandrum, India*
***Thesis**: Handwritten Mathematical Expression Recognition and Evaluation*

Research

Neural Simulation of Spatiotemporal Dynamics in Bubbly Flows
Nov 2024 – Aug 2025
Mentor: Dr. Vlado Menkovski, ML for Physical Sciences, TU/e

- Exploring generative models with Conditional Flow Matching (CFM) to model spatiotemporal dynamics in rising bubble systems, focusing on continuous-time system evolution. Leveraging a GNN encoder + temporal U-Net architecture to learn latent velocity fields for high-dimensional, interacting systems.
- Implemented an autoregressive Equivariant Graph Neural Network (EGNN) model to simulate stepwise transitions in bubble states, encoding pairwise interactions under symmetry constraints, where nodes represent bubble states and edges capture the relative interactions between the bubbles.

Analysis of Deep Learning Approaches for Graph Drawing
Apr 2024 – Aug 2024
Mentor: Dr. Alessio Arleo, Visual Analytics Cluster, TU/e

- Performed an extensive literature review of state-of-the-art deep learning methodologies for graph drawing, focusing on advancements in representation learning and layout optimization.
- Proposed a taxonomy of graph drawing approaches, categorizing them into direct and indirect methods, as well as supervised, unsupervised, and criteria-based optimization frameworks, based on learning paradigms and objectives.
- Analyzed the reproducibility and scalability of these techniques by evaluating publicly available implementations, datasets, and training pipelines for practical applicability and fine-tuning.

Experience

Machine Learning Engineer **Aug 2019 – July 2023**
Emerging Technologies, R.R Donnelley (RRD) *Chennai, India*

- Designed and deployed deep learning pipelines (in PyTorch) for document layout analysis, combining token classification, sequence modeling, and object detection. Increased automation from 50% to over 80%, streamlining accessibility remediation and ensuring compliance with WCAG standards across the organization
- Built and operationalized a conversational chatbot for automated financial document retrieval. Integrated transformer-based language models, entity recognition, and retrieval-augmented generation (RAG) methods to enhance retrieval accuracy, and user experience.

- Led the deployment of scalable ML and Deep learning pipelines leveraging Docker containerization and AWS cloud infrastructure. Implemented continuous integration and delivery (CI/CD) strategies to streamline the end-to-end model deployment lifecycle.

Machine Learning and Data Analytics Intern **Dec 2018 – May 2019**
QuEST Global *Trivandrum, India*

- Performed time-series forecasting and anomaly detection for energy consumption analysis, applying exploratory data analysis (EDA) and feature engineering to extract valuable insights and enhance predictive modeling.
- Researched and implemented regression algorithms, recurrent neural networks (RNNs), and long short-term memory (LSTMs) to predict electricity bills and optimize system efficiencies.

Skills

Languages: Python, C++

Deep Learning Frameworks: PyTorch, TensorFlow, Keras

Machine Learning Techniques: Graph Neural Networks, Equivariant Neural Networks, Generative Models

Tools: Docker, Jupyter, Git

Additional Relevant Experience

Graduate Teaching Assistant **Q2 2024 – Present**
Eindhoven University of Technology (TU/e), The Netherlands

- Assisting in the graduate-level Machine Learning Engineering course (2AMM15), providing guidance on assignments, coding exercises, and theoretical concepts.
- Supporting students in understanding ML model development, deployment, and best engineering practices.

Relevant Coursework

Deep Learning, Machine Learning Engineering, Reinforcement Learning, Research Topics in Data Mining, Neural Networks, Big Data Management

Achievements

- Recognized by RRD Leadership for High Performance in AI-driven Product Development, contributing to a new revenue stream (July 2022).
- Selected as **Employee of the Quarter** for **Delivery Excellence** (Q2 2021) from over 1500 employees by RRD.
- Received a **National Level Merit Scholarship** from the All India Council for Technical Education (AICTE) in 2015.