JASRAJ SINGH

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RESEARCH STATEMENT

My objective is to advance our understanding of under investigated techniques and phenomena in deep learning using dynamical systems theory, probabilistic modeling and approximate methods.

Keywords – Learning dynamics of neural nets, probabilistic ML, approximate inference for deep learning

EDUCATION

University College London, England **Sep 2023 – Dec 2024**
M.Sc. in Machine Learning

- **Grade** – 84.59% (Highest Distinction, Dean's List Award)
- **Thesis Title** – On the Effects of DropEdge on Over-squashing in Deep GNNs
  Supervisors – Prof. Laura Toni and Prof. Brooks Paige

Nanyang Technological University, Singapore **Aug 2019 – May 2023**
B.Sc. in Mathematical and Computer Sciences

- **Grade** – 4.58/5.00 (Highest Distinction)
- **Thesis Title** – Training-Free Neural Active Learning with Initialization-Robustness Guarantees
  Supervisors – Prof. Bryan Kian Hsiang Low and Prof. Ping Tong

Venkateshwar International School, India **Mar 2015 – May 2019**
All India Senior School Certificate

- **Grade** – 96.4%

MANUSCRIPTS

Effects of Dropout on Performance in Long-range Graph Learning Tasks. *J. Singh*, K. Jiang, B. Paige, L. Toni. In preparation for *NeurIPS*, 2025. URL.

- Theoretically characterized the detrimental effects of 6 dropout-like algorithms for graph neural networks
- Empirically showed their limitations in modeling long-range dependencies, challenging conventional wisdom

LingML: Linguistic-Informed Machine Learning for Enhanced Fake News Detection. *J. Singh*, L. Fang, X. Hong, B.C. Ng, W. Zhang. URL.

- Developed LingML, a novel linguistics-informed ML approach for enhanced fake news detection
- Achieved an 18% average improvement in COVID-19 fake news detection across 11 large language models

Training-Free Neural Active Learning with Initialization-Robustness Guarantees. A. Hemachandra, Z. Dai, *J. Singh*, S.K. Ng, B.K.H. Low. In *ICML*, 2023. PMLR 202:12931-12971. URL.

- Developed EV-GP, a data-efficient algorithm for training neural networks in low-data settings like healthcare
- Outperformed competing approaches across UCI ML datasets while eliminating surplus model training needs

EMPLOYMENT EXPERIENCE

Indeed Inc., Singapore **May 2022 – Aug 2022**
Product Science Intern

- Analyzed ∼5M job applications in large-scale A/B tests using Python and SQL with PySpark and the Imhotep analytics platform, driving strategic model deployment across APAC
- Developed interpretable minimum viable criteria for resumes using Decision Trees, XGBoost and SHAP, enabling job seekers optimize applications across industries and markets, boosting callback rates by 10%
- Spearheaded refinement of SQL-based data pipelines, improving resume processing efficiency by 15% and ensuring reliable end-to-end data flow for advanced analytics

Shopee Pte. Ltd., Singapore **Jan 2022 – May 2022**
Machine Learning Engineering (Recommendation) Intern

- Optimized the AI-driven product recommendation model using Tensorflow in C++ and Python
- Engineered ML features for recommendation model using MapReduce with Apache Hadoop and PySpark for ETL processes, increasing total orders by 11.79% and orders-per-user by 12.48% in Brazil
- Designed a multi-task learning approach to address data imbalance, boosting click-rate in Malaysia by 2%

Navtech Pte. Ltd., Singapore **Jul 2020 – Aug 2020**
Full Stack Data Science Intern
- Designed and built a B2B product recommendation service for jewelry retailers, using Keras in Python
- Led the model deployment on AWS SageMaker, using Docker and Dask for scalable real-time inference

TEACHING EXPERIENCE

Division of Mathematics, NTU, Singapore **Jan 2023 – Apr 2023**
Teaching Assistant – MH3500, Statistics

Division of Mathematics, NTU, Singapore **Aug 2022 – Nov 2022**
Teaching Assistant – MH2500, Probability and Introduction to Statistics

Center for Computational Brain Research, IIT Madras, India **Sep 2021 – Dec 2021**
Head Tutor – Machine Intelligence and Brain Research Winter School

VOLUNTEERING EXPERIENCE

- **Reviewer** – International Conference on Learning Representations (ICLR) **2024**

HONORS & AWARDS

- **Dean's List Award** – UCL, England **2024**
- **1st Prize in Integration Bee** – NTU, Singapore **2023**
- **3rd Prize in IET-Cup Hackathon** – NTU, Singapore **2022**
- **1st Prize in Integration Bee** – NTU, Singapore **2022**
- **1st Prize in Electronic Trading Challenge** – Jane Street Capital **2021**
- **3rd Prize in International Mathematics Competition** – UCL, England **2021**
- **President Research Scholar** – NTU, Singapore **2021**
- **JEE Advance Scholarship (National Rank 200, 99.98 percentile)** – FIITJEE, India **2019-23**
- **KVPY Scholarship (National Rank 868)** – DST, Government of India **2019**
- **KVPY Scholarship (National Rank 126)** – DST, Government of India **2018**
- **NTS Scholarship (State Rank 28)** – NCERT, Government of India **2017**

EXTRA CURRICULAR

- **Education Officer of the Sikh Society at NTU** – Led Sikh cultural awareness initiatives **2021-22**
- **Machine Learning and Data Analysis Club at NTU** – Led 3 week-long crash-courses **2020-21**
- **Inter-Hall Games at NTU** – Represented Hall of Residence 13 **2020**
- **Inter-School Games at NTU** – 3rd Prize representing School of Mathematical Sciences **2019**
- **Youth National Basketball Championship in India** – Represented NCT of Delhi **2017**
- **Youth National Basketball Championship in India** – Represented NCT of Delhi **2016**
- **Sub-Junior National Basketball Championship in India** – Represented NCT of Delhi **2014**

CERTIFICATIONS

- **Applied Social Network Analysis in Python** – University of Michigan **2021**
- **Deep Learning Specialization** – DeepLearning.AI **2021**
- **AI Engineering Specialization** – IBM **2020**
- **Algorithms: Design and Analysis** – Stanford University **2020**

TECHNICAL SKILLS

- **Programming Languages** – Python, C++, SQL, R, MATLAB
- **DevOps and Cloud** – CI/CD, Agile, Git, Docker, Kubernetes, AWS (SageMaker, Lambda, EC2, S3)
- **ETL Tools for Big Data** – Hadoop (HDFS, YARN), Hive, Spark, Airflow
- **ML Engineering** – PyTorch, Tensorflow, JAX, Scikit-learn, NLTK, OpenCV, Kaldi, Dask,, Numpy, Pandas
- **ML Theory** – Non-convex, Numerical and Bayesian Optimization, Probabilistic Modeling, Kernel Methods
- **Data Science** – Simulation, A/B Testing, Causal Inference, Predictive Modeling, Optimization