

Chaitanya K. Joshi

PhD Student, University of Cambridge

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Education

- 2022– **University of Cambridge**, UK.
PhD in Computer Science; Supervisor: Prof. Pietro Liò.
Research Areas: Graph Neural Networks, Geometric Deep Learning.
- 2015–2019 **Nanyang Technological University**, Singapore.
B.Eng. in Computer Science; Specialization in Artificial Intelligence.
GPA: 4.73/5.00; Valedictorian, Best FYP Gold Medal, Best Internship, Dean's List x2.
Thesis: *Graph ConvNets for the Travelling Salesman Problem*; Supervisor: Prof. Xavier Bresson.
- 2017 **École Polytechnique Fédérale de Lausanne**, Switzerland.
Exchange Program, Computer Science; GPA: 5.40/6.00 (graduate-level coursework).

Awards

- 2021 **National Science Scholarship (PhD)**, A*STAR, Singapore.
Fully funded scholarship to pursue PhD studies at University of Cambridge, UK.
- 2019 **Valedictorian**, SCSE, NTU, Singapore.
Awarded by the School of Computer Science and Engineering for excellent academic performance, leadership qualities and public-speaking skills among the graduating cohort.
- 2019 **Best Final Year Thesis Gold Medal**, SCSE, NTU, Singapore.
- 2018 **Best Professional Internship Award**, SCSE, NTU, Singapore.

Experience

- 2020–2021 **Institute for Infocomm Research, A*STAR**, Singapore, *Research Engineer*.
 - Worked on efficiency and scalability of Graph Neural Networks in scientific discovery applications with Dr. Chuan-Sheng Foo and Dr. Lin Jie.
- 2019–2020 **Graph Deep Learning Lab, NTU**, Singapore, *Research Assistant*.
 - Worked on benchmarking Graph Neural Network architectures and their application to combinatorial optimization problems with Prof. Xavier Bresson.
 - Presented an invited talk at the INFORMS Annual Meeting 2019 session on 'Boosting Combinatorial Optimization using Machine Learning' and a poster at NeurIPS 2019 workshop.
 - Co-authored 4 papers, open-sourced code with 2,000+ stars on GitHub.
- 2018 **SAP Leonardo**, Singapore, *Machine Learning Engineer Intern*.
 - Built and deployed deep learning systems for matching financial data to automate corporate accounting processes. Part of *Cash Application*, SAP's flagship ML product handling over €200 Million in annual sales pipeline for global companies.
 - Designed deep embedding models for structured data combined with graph combinatorial optimization to improve system accuracy by 8% and reduce computation time by 99%.
 - Co-authored 3 US patents, awarded Best Professional Internship Award by NTU.

Academic Service

- Organizer Learning on Graphs Conference 2022; URL: logconference.github.io.
- Outreach Administrator of GraphML Telegram Channel (3,400+ subscribers).
- Reviewer NeurIPS 2022, ICML 2022, ICLR 2022 (**Highlighted Reviewer Award**), NeurIPS 2021 (**Outstanding Reviewer Award, top 8%**), Distill Research Journal.

Publications

- [1] Chaitanya K. Joshi and Rishabh Anand. **Recent Advances in Deep Learning for Routing Problems**. In *Blog Track, ICLR 2022 – International Conference on Learning Representations*, 2022. URL: chaitjo.com/post/deep-learning-for-routing-problems.
- [2] Chaitanya K. Joshi, Fayao Liu, Xu Xun, Jie Lin, and Chuan-Sheng Foo. **On Representation Knowledge Distillation for Graph Neural Networks**. *ArXiv preprint, under review*, 2021. PDF: arxiv.org/abs/2111.04964.
- [3] Fayao Liu, Guosheng Lin, Chuan-Sheng Foo, Chaitanya K. Joshi, and Jie Lin. **Point Discriminative Learning for Unsupervised Representation Learning on 3D Point Clouds**. *ArXiv preprint, under review*, 2021. PDF: <https://arxiv.org/abs/2108.0210>.
- [4] Chaitanya K. Joshi, Quentin Cappart, Louis-Martin Rousseau, and Thomas Laurent. **Learning TSP Requires Rethinking Generalization**. In *CP 2021 – International Conference on Principles and Practice of Constraint Programming*, 2021. PDF: arxiv.org/abs/2006.07054.
- [5] Peng Xu, Chaitanya K. Joshi, and Xavier Bresson. **Multi-Graph Transformer for Free-Hand Sketch Recognition**. *IEEE Transactions of Neural Networks and Learning Systems (TNNLS)*, 2021. PDF: arxiv.org/abs/1912.11258.
- [6] Chaitanya K Joshi. **Transformers are Graph Neural Networks**, 2020. In *The Gradient* magazine. URL: thegradient.pub/transformers-are-graph-neural-networks/. **Read over 72,000 times**.
- [7] Vijay Prakash Dwivedi*, Chaitanya K. Joshi*, Thomas Laurent, Yoshua Bengio, and Xavier Bresson. **Benchmarking Graph Neural Networks**. *ArXiv preprint, under review*, 2020. *Equal contribution. PDF: arxiv.org/abs/2003.00982. **Starred over 1,800 times on GitHub**.
- [8] Chaitanya K. Joshi, Thomas Laurent, and Xavier Bresson. **On Learning Paradigms for the Travelling Salesman Problem**. In *NeurIPS Workshop on Graph Representation Learning*, 2019. PDF: arxiv.org/abs/1910.07210.
- [9] Chaitanya K. Joshi, Thomas Laurent, and Xavier Bresson. **An Efficient Graph ConvNet Technique for the Travelling Salesman Problem**. *INFORMS Annual Meeting, Session on Boosting Combinatorial Optimization using Machine Learning*, 2019. PDF: arxiv.org/abs/1906.01227.
- [10] Chaitanya K. Joshi, Fei Mi, and Boi Faltings. **Personalization in Goal-oriented Dialog**. In *NeurIPS Workshop on Conversational AI*, 2017. PDF: arxiv.org/abs/1706.07503.

Patents

- [1] Sean Saito, Truc Viet Le, Chaitanya K. Joshi, and Raja Shanmugamani. **Representing Sets of Entities for Matching Problems**. US Patent App. 16/208,681.
- [2] Sean Saito, Chaitanya K. Joshi, Raja Shanmugamani, Truc Viet Le, and Rajesh Arumugam. **Utilizing Embeddings for Efficient Matching of Entities**. US Patent App. 16/217,148.
- [3] Truc Viet Le, Sean Saito, Chaitanya K. Joshi, and Raja Shanmugamani. **Graphical Approach to Multi-Matching**. US Patent App. 16/210,070.

Invited Talks

- June 2021 **Learning TSP Requires Rethinking Generalization**, Canadian Operations Research Society (CORS) Conference 2021, Toronto, Canada. Host: Maxime Gasse.
- Sept 2020 **Benchmarking Graph Neural Networks**, Defense Science Organization (DSO) National Laboratories, Singapore. Host: Chieu Hai Leong.
- Oct 2019 **Graph ConvNets for the Travelling Salesman Problem**, INFORMS Annual Meeting 2019 Session: *Boosting Combinatorial Optimization using Machine Learning*, Seattle, USA. Host: Quentin Cappart.