

Shib Sankar Dasgupta

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My research focuses on learning **geometric representations** for **logical reasoning** and **set-theoretic** generalization in real-world applications, including **recommendation**, **complex query understanding**, and NLP. During my PhD, I have collaborated with industry researchers on **LLM**-powered solutions for **search**, **agentic planning**, and **personalization**, bridging foundational research with scalable ML systems.

Education

University of Massachusetts, Amherst

Amherst, Massachusetts

PH.D. IN COMPUTER SCIENCE

Sept. 2019 - May 2025(Expected)

- Advisor - **Prof. Andrew McCallum** GPA - **4.0/4.0**
- **Thesis: Learning Set-theoretic Representation with Box Embeddings**
- **Thesis Committee: Julian McAuley, Hamed Zamani, Cameron Musco, and Andrew McCallum**
- *Research Areas:* Geometric Representation, NLP, Information Retrieval, Recommendation, Graph learning
- *Courses:* Advanced Natural Language Processing, Information Retrieval, Reinforcement Learning, Convex Optimization

Indian Institute of Science, Bangalore

Bengaluru, India

MASTER OF TECHNOLOGY IN SYSTEM SCIENCE AND AUTOMATION

Aug. 2016 - May. 2018

- Advisor - **Prof. Partha Pratim Talukdar** GPA - **9.1/10.0**
- Awarded **Gold medal** for being the Top of the class in M.Tech
- *Research Areas:* Representation Learning, Temporal Information Processing, Graph Neural Networks, Knowledge Bases, NLP
- Developed State-of-the-Art Solutions for Temporal Representation Learning (500+ citations)

Jadavpur University

Kolkata, India

BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING

May. 2011 - April. 2015

- GPA - **8.41/10.0**

Research Experience

Microsoft Research

Summer 2024

RESEARCH INTERN, MANAGER - TOBIAS SCHNABEL

- Integrated **LLMs in Recommendation Systems** in an efficient and editable way, using a RAG-based approach with GPT-4.
- Achieved 50% improvement in human preference alignment over state-of-the-art algorithms.

IBM Research

Summer 2023

RESEARCH INTERN, MANAGER - ACHILLE FOKOUE

- Developed a dataset to evaluate and fine-tune **LLM agents for business processes**, emphasizing tool usage and multistep planning for accurate process execution.

Google Research

Summer 2022, Fall 2022

RESEARCH INTERN, MANAGER - STEFFEN RENDLE

- Introduced a benchmark to address **compositional queries** (e.g., *Jazz but not Smooth Jazz*) in recommendation systems.
- Designed a set-based embedding method, outperforming traditional vector baselines by 25% on the proposed benchmark.

IBM Research

Spring 2022

RESEARCH EXTERNSHIP, MENTOR - KEN CLARKSON (IBM), CAMERON MUSCO (UMASS AMHERST)

- Engineered a hashing-based fast and **scalable** technique for learning word embeddings with only a single pass over the data.

Adobe Research

Summer 2021

DOCUMENT INTELLIGENCE RESEARCH INTERN, MANAGER - DR. TONG SUN

- Proposed a dual embedding method to impose a hierarchical structure on vector representation using geometric embedding.

Minds.ai

2018 - 2019

NEURAL NETWORK ENGINEER, MANAGER - DR. TIJMEN TIELEMAN

- Developed a Graph Convolutional Network (**GCN**)-based molecular property predictor to aid automated **drug discovery**.
- Built a deep reinforcement learning-based controller to increase battery life and **fuel efficiency** for **hybrid vehicles**.

Selected Publications (15+ Publications – [Google Scholar Link](#))

A Geometric Approach to Personalized Recommendation with Set-Theoretic Constraints Using Box Embeddings

SHIB DASGUPTA, MICHAEL BORATKO, ANDREW MCCALLUM

In-Submission, ICML 2025

Recommendation Systems

Learning Representations for Hierarchies with Minimal Support

B.ROZONoyer, M.BORATKO, D.PATEL, W.ZHAO, SHIB DASGUPTA, H.LE, A.MCCALLUM

NeurIPS 2024

Machine Learning

Answering Compositional Queries with Set-Theoretic Embeddings

SHIB DASGUPTA, ANDREW MCCALLUM, STEFFEN RENDLE, LI ZHANG

ArXiv 2023

Information Retrieval

Word2Box: Capturing Set-Theoretic Semantics of Words using Box Embeddings

SHIB DASGUPTA, MICHAEL BORATKO, S. ATMAKURI, XIANG LORRAINE LI, D. PATEL, ANDREW MCCALLUM

ACL 2022

NLP

Measure-Theoretic Set Representation Learning

MICHAEL BORATKO, D. PATEL, SHIB DASGUPTA, ANDREW MCCALLUM

ArXiv 2022

ML Theory

Box-To-Box Transformations for Modeling Joint Hierarchies

SHIB DASGUPTA, XIANG LORRAINE LI, MICHAEL BORATKO, DONGXU ZHANG, ANDREW MCCALLUM

ACL (Rep4NLP) 2021

Graph Learning

Probabilistic Box Embeddings for Uncertain Knowledge Graph Reasoning

XUELIN CHEN, MICHAEL BORATKO, MUHAO CHEN, SHIB DASGUPTA, XIANG LI, ANDREW MCCALLUM

NAACL 2021

Graph Learning

Box Embeddings: An Open-source Library for Representation Learning using Geometric Structures

T. CHHEDA, P. GOYAL, T. TRANG, D. PATEL, M. BORATKO, SHIB DASGUPTA, ANDREW MCCALLUM

EMNLP(Demo Track) 2021

Open Source Contribution

Improving Local Identifiability for Probabilistic Box Embeddings

SHIB DASGUPTA*, MICHAEL BORATKO*, DONGXU ZHANG, LUKE VILNIS, XIANG LI, ANDREW MCCALLUM

NeurIPS 2020

Machine Learning

HyTE: Hyperplane-based Temporally aware Knowledge Graph Embedding

SHIB DASGUPTA, SWAYAMBHU NATH RAY AND PARTHA TALUKDAR

EMNLP 2018

Graph Learning

Mentorship Experience

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|---------|--|---------------|
| 2021-25 | Industry Mentorship Program , Mentored master's students every year (15+ students over 5 years) on projects in collaboration with industries, including IBM, Adobe, Spotify, and Uber . | UMass Amherst |
| 2021-25 | Mater's Research Project , Mentored 10+ Master's students over 5 years, offering research projects and guidance towards their degree completion. | UMass Amherst |

Software & Tools

Programing Languages: Python, C++ **Libraries:** PyTorch, TensorFlow **Tools:** Git, Weights & Biases, Slurm, Docker
Published Softwares and Dataset: [Box-Embedding Library](#), [HyTE](#), [Word2box](#), [Genre2Movies](#)

Awards & Achievements

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|------|---|---------------------|
| 2020 | Scholarship , Awarded the W. Bruce Croft Graduate Scholarship in Computer Science. | UMass Amherst |
| 2019 | Gold Medal , Awarded the N R Khambhati Memorial Medal for Topper of the class in M.Tech. | IISc, Bangalore |
| 2018 | Scholarship , Awarded Non-Student Travel Scholarship by EMNLP, 2018. | EMNLP |
| 2016 | All India Rank 47 , In GATE–2016(Grad Engineering Entrance test) among ~ 130, 000 applicants. | IISc, Bangalore |
| 2011 | All state Rank 166 , In WBJEE–2011 (Engineering Entrance test) among ~ 130, 000 applicants. | Jadavpur University |
| 2011 | Scholarship , University Students scholarship by Govt. of India for Higher Secondary merit. | Jadavpur University |