Tathagat Verma

Incoming Computer Science MS at Stanford University

tathagatv.github.io | tathagatv | verma_tathagat | tathagatv | tathagatswagverma@gmail.com

Education

Stanford University, Stanford, USA — *Sep 2022 - May 2024 (expected)*
Master of Science in *Computer Science*, Specialization - *Artificial Intelligence*

Indian Institute of Technology Bombay, Mumbai, India — *Jul 2018 - May 2022*
Bachelor of Technology in *Computer Science and Engineering* with *Honors* — CPI - **9.64/10**

Scholastic achievements

- Secured **All India Rank 53** in **JEE Advanced** out of 200,000 candidates *2018*
- Secured **All India Rank 34** in **JEE Main** out of 1.2 million candidates *2018*
- Recipient of the **Quadeye Excellence Scholarship**, awarded on the basis of academic achievements *2021*
- Amongst top **30** in India selected for the **International Astronomy Olympiad** Selection Camp *2018*
- Amongst top **35** in India selected for the **International Mathematical Olympiad** Training Camp *2017*
- Awarded **Advanced Performer (AP)** grade in **3** courses for exceptional performance *2018-21*
- Amongst top 300 students selected for the **Indian National Physics** and **Chemistry Olympiads** *2018*
- Recipient of the **Kishore Vaigyanik Protsahan Yojana** (KVPY) fellowship by **Govt. of India** *2017*

Publications

1. Title: **VarScene: A Deep Generative Model for Realistic Scene Graph Synthesis** [paper]
   Authors: ***Tathagat Verma***, *Abir De, Yateesh Agrawal, Vishwa Vinay, Soumen Chakrabarti*
   Conference: International Conference on Machine Learning (ICML) 2022

Research experience

VarScene: A Deep Generative Model for Realistic Scene Graph Synthesis — *Autumn 2021*
Guides: Prof. Soumen Chakrabarti, Prof. Abir De | R&D Project — *InfoLab, IIT Bombay*

- Developed a deep generative model for novel scene graph synthesis using **VAE** and **Graph Neural Networks**
- Designed a goal oriented decoder for minimizing the maximum mean discrepancy between graph distributions
- Developed code in **PyTorch** and used the Visual Genome and Visual Relationship Detection datasets
- Significantly outperformed baselines on the Fréchet Inception Distances (**FID**), Inception Scores (**IS**) and achieved better results on the Shortest Path, Weisfeller Lehman and Neighborhood Subgraph Pairwise Distance kernels

Deep Learning for Medical Image Quality Enhancement — *Spring 2021, Autumn 2021*
Guide: Prof. Suyash Awate | R&D Project, Bachelor's Thesis Project — *IIT Bombay*

- Enhanced the quality of MRI images with sub-sampling and Gaussian noise in the frequency domain and PET images with Poisson noise in the sinogram domain under the weakly-supervised regime
- Trained models using the **RED-CNN** and **UNet** architectures with Bayesian learning in **PyTorch**
- Utilized intermediate VGG-16 layers for **style based losses** and Fourier and Wavelet transform loss functions

Internships

Student Venture Partner — *Summer 2022*
Venture Highway LLP | Guides: Aviral Bhatnagar, Akul Jindal — *Bengaluru, India*

- Gained exposure to sourcing and evaluating **seed stage startups** and interacted with many founders

Image Functionality in the Whiteboard Android Application — *Summer 2021*
Microsoft India (R&D) Pvt. Ltd. | Software Engineer Intern — *Noida, India*

- Integrated **Microsoft Lens SDK** into Whiteboard Android, to support image and OCR tools provided by Lens
- Worked in **Java Android** backend, building the bridge to send images from native Android to the web application
- Developed code in **React** for the web application, making the UI component for triggering image workflow

Attribute Value Extraction from Product Descriptions — *Summer 2020*
Coupa Software India Pvt. Ltd. | Data Science Intern — *Pune, India*

- Developed unsupervised and semi-supervised methods for extracting attribute values from product descriptions
- Implemented an **RNN** model for sequence tagging using **CRF**, **BiLSTM** and attention mechanisms
- Optimized hyper parameters using **Bayesian Optimization**, reducing time required for tuning the model
- Automated taxonomy creation by clustering on co-occurrence graphs using the **Chinese Whispers Algorithm**

Business Monitoring and Alerting Systems *Summer 2019*
Delta Exchange | *Software Engineer Intern* *Mumbai, India*

- Made real time predictions for prices of multiple Crypto Derivative contracts by implementing ARIMA model
- Developed a dashboard using **Django** to monitor Business Performances, now being used on a daily basis
- Used **MySQL** database along with APIs and **WebSockets** of various exchanges for obtaining real time data

Technical projects

Blockchain Simulation and Applications *Autumn 2021*
Guide: Prof. Vinay Ribeiro | *Blockchains, Cryptocurrencies and Smart Contracts* *Course Project*

- Implemented a peer-to-peer cryptocurrency network simulation in **C++** following the **Bitcoin** protocols
- Simulated selfish and stubborn mining attacks, analyzing the effects of hash power and network connectivity
- Developed a decentralized payment application on top of **Ethereum** in Solidity, utilizing smart contracts

Adversarial Attacks and Robust Deep Learning Models *Spring 2021*
Guide: Prof. Sunita Sarawagi | *Advanced Machine Learning* *Course Project*

- Implemented the L_2 attack, L_∞ attack with first and second order norms and the L_0 Pointwise attack
- Trained 3 robust models using the methods; Analysis by Synthesis, Stability training and Adversarial training
- Developed code in **Keras**, doing a comparative study using the MNIST dataset on all models & across all attacks

Foreshadow Attack and its Variants *Spring 2021*
Guide: Prof. Bernard Menezes | *Advanced Network Security and Cryptography* *Course Project*

- Studied the **Foreshadow** attack and its impact on **Intel SGX** and **VM** systems due to speculative execution
- Simulated the proof-of-concept attack on **Linux** kernel with **x86** processor in the absence of Intel TSX

Topical Poetry Generation *Autumn 2020*
Guide: Prof. Pushpak Bhattacharyya | *Speech and Natural Language Processing* *Course Project*

- Developed a program to generate any number of poems on a user supplied topic and rhyme scheme
- Used the CMU Pronunciation Dictionary and **Fastext** word embeddings to obtain topical rhyming words
- Created **Finite State Acceptors** to accept word sequences following the iambic pentameter stress pattern
- Extracted fluent poems from the FSA with **RNN** language models trained on the Gutenberg Poetry Corpus

Route Optimization Algorithm *Winter 2019*
Inter IIT Technical Meet *IIT Roorkee*

- Proposed solution for the Vehicle Scheduling Problem in the setting of buses, winning **gold** medal among 20 teams
- Reduced the problem to multiple instances of the Travelling Salesman Problem(**TSP**) using k-means clustering
- Generated routes while taking real time traffic into account using **Google Maps APIs** in Python

Other projects

E-Commerce Recommender System *Spring 2021*
Guide: Prof. Umesh Bellur | *Database Management* *Course Project*

- Built an E-Commerce recommendation website using **Neo4j** graph database and **Node.js** runtime environment
- Included the features of user history, trending products and text similarity metrics to generate recommendations

Compiler for C-like Language *Spring 2021*
Guide: Prof. Uday Khedker | *Implementation of Programming Languages* *Course Project*

- Built compiler for a C-like language, constructing Three Address Code and Register Transfer Language incrementally
- Implemented the scanner in **lex**, parser in **yacc** and conversion of abstract syntax tree to TAC and RTL in C++

Medical Image Segmentation using Deep Learning models *Spring 2020*
Guide: Prof. Suyash Awate | *Medical Image Computing* *Course Project*

- Performed segmentation of neuronal structures from electron microscopy images on the ISBI 2012 dataset
- Implemented and trained the **Deep Multilevel Contextual Network** and **U-Net** models with variations

Portal for Selecting and Evaluating Teaching Assistants *Autumn 2019*
Undergraduate Academic Council *IIT Bombay*

- Revamped the selection portal for Teaching Assistants being used in the Institute by faculty and students
- Developed a **full-stack** application with backend in Django, MySQL DB and frontend with HTML and JavaScript

Splitwise Clone Web Application *Autumn 2019*
Guide: Prof. Amitabha Sanyal | *Software Systems Lab* *Course Project*

- Built a **Django** web app to automate addition and splitting of bills among stakeholders, similar to **Splitwise App**
- Designed a database in **MySQL** for efficiently implementing features like settling up expenses from all groups
- Provided statistical insights on the type of expenditures made by users, using **JavaScript** and **Highcharts**

Technical Skills

Programming	C++, Python, C, Java, Bash, Solidity, Racket, SQL, MATLAB
Packages	PyTorch, TensorFlow, Keras, NLTK, SciPy, Pandas, Statsmodels, NumPy
Software	Git, LaTeX, AutoCAD, SOLIDWORKS, Android Studio
Web Development	HTML, CSS, JavaScript, Django, Bootstrap

Relevant Courses

Artificial Intelligence: Foundations of Intelligent and Learning Agents; Machine Learning Theory and Methods; Medical Image Computing; Advanced Machine Learning; Speech and Natural Language Processing; Artificial Intelligence and Machine Learning; Data Analysis and Interpretation

Security: Introduction to Blockchains, Cryptocurrencies and Smart Contracts; Advanced Network Security and Cryptography; An Introduction to Number Theory and Cryptography

Computer Science: Automata Theory; Implementation of Programming Languages; Computer Architecture; Operating Systems; Database and Information Systems; Computer Networks; Data Structures and Algorithms; Digital Logic Design

Mathematics: Calculus; Linear Algebra; Differential Equations; Introduction to Numerical Analysis

Leadership Positions

Institute Student Mentor *Jun 2021 - Jun 2022*
Student Mentorship Program *IIT Bombay*

- Mentoring **12 freshmen**, helping them adjust to the institute environment, focusing on their holistic development
- Amongst 130 out of over 300 applicants selected through a rigorous procedure of interviews and peer reviews

Senior Department Academic Mentor *Jun 2020 - May 2022*
Computer Science and Engineering Department *IIT Bombay*

- Mentoring **6 sophomores** of CSE department to assist them in navigating department specific curriculum
- Working in a supportive, facilitative and developmental role for the student community in general as a mentor

Teaching Assistant *IIT Bombay*

- **Artificial Intelligence and Machine Learning** | *Prof. Ganesh Ramakrishnan* *Jul 2021 - Nov 2021*
- **Data Structures and Algorithms** | *Prof. Sharat Chandran* *Jan 2021 - May 2021*
- **Logic for Computer Science** | *Prof. Krishna S* *Jul 2020 - Nov 2020*

Responsible for conducting doubt sessions, preparing problem sets, programming labs and grading examinations

Organiser in Corporate Relations *Nov 2018 - Mar 2019*
Entrepreneurship Cell *IIT Bombay*

- Responsible for speaker handling and handling overall logistics in multiple events
- Part of the execution team for **The Panel Discussion** at Entrepreneurship Summit, 2019

Extracurricular

- Won **gold** medal in Route Optimization Competition at the **Inter IIT Technical Meet, IIT Roorkee** *2019*
- Represented IIT Bombay at the **34th Inter IIT Aquatics Meet, IIT Guwahati** *2018*
- Awarded **second** position in **CoDecode** (coding competition) organized by Techfest, IIT Bombay *2020*
- Covered a distance of **23.2 km** swimming continuously for **12 hours** at Swimathon, IIT Bombay *2019*
- Awarded Certificate of Merit for **winning** the Inter Department Football Tournament IIT Bombay *2019*
- Awarded Diploma Certificate for competing in the **Gothia Football Cup, Gothenburg, Sweden** *2011*
- Completed 2 levels of graded examination in communication skills from **Trinity College London** *2013*
- Phonathon: Pitched to 50 alumni the events conducted by Student Alumni Relations Cell, IIT Bombay *2019*