# Tathagat Verma

Master's in Computer Science at Stanford University

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## 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 - Dec 2021*
*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*
- Amongst top 300 students selected for the **Indian National Physics** and **Chemistry Olympiads**     *2018*

## 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

**Object Importance Classification and Natural Language Explanation Generation**     *Autumn 2022*
*Guides: Prof. Mykel Kochenderfer, Jiachen Li | Research Assistantship*                     *SISL, Stanford University*
- Developing a deep learning model for importance classification and explanation generation in autonomous driving
- Utilizing **CNN**, **Graph Neural Networks** and **attention** based **GRU** for image feature extraction, learning inter-object relationships and natural language generation respectively for the joint task in **PyTorch**

**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
- 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, $L_\infty$ 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

# TECHNICAL SKILLS

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|---|---|
| **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 |

# 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*
- Phonathon: Pitched to 50 alumni the events conducted by Student Alumni Relations Cell, IIT Bombay *2019*