Mohammad Taufeeque

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Education

Indian Institute of Technology Bombay 2018–2022
B.Tech (with Honors) in Computer Science and Engineering Mumbai, India

- GPA - **9.28**/10.0
- Bachelor's Thesis - Fianchetto: Speed, Belief, Guile, Caution to Win at Reconnaissance Blind Chess

Publications

[1] **Mohammad Taufeeque**, S. Koita, N. Spicher, and T. M. Deserno, "Multi-camera, multi-person, and real-time fall detection using long short term memory", in *SPIE Medical Imaging 2021: Imaging Informatics for Healthcare, Research, and Applications*, vol. 11601, SPIE, 2021, pp. 35–42.

[2] **Mohammad Taufeeque**, Nitish Tongia, Shivaram Kalyanakrishnan, "Fianchetto: Speed, Belief, Guile, Caution to Win at Reconnaissance Blind Chess", submitting to *The Journal of Artificial Intelligence Research**

**to be submitted*

Research Experience and Internships

AI Agent for Reconnaissance Blind Chess IIT Bombay
Bachelor's Thesis | *Guide: Prof. Shivaram Kalyanakrishnan* | Won NeurIPS competition (RBC) Aug '21-Present

- Developed an AI Agent for RBC, a variant of Chess where only a 3x3 region can be sensed before making a move
- Maintained a set of all possible board states with belief probability from a **Deep Neural Network** tuned with intuitions from tactics in RBC to select sense moves that maximizes information obtained about the state
- Won the **NeurIPS 2021** competition on RBC with a win rate of **91.3%** & a margin of about **100 Elo points** from the runner up agent
- Presented the algorithm in the NeurIPS 2021 **workshop** on Reconnaissance Blind Chess (RBC)

Integrating Feedback Rules with ML Model Microsoft Research Lab, India
Research Intern | *Guide: Dr. Sriram Rajamani* Nov '21-Present

- Developing novel methods to incorporate feedback rules on the fly in trained **language models** like BERT
- Created an artificial dataset with algorithmically generated high precision rules to study the problem
- Devised methods to transform sub-string presence based rules to the **embedding space** of the language model

Human Fall-Detection with Home Cameras Technische Universität Braunschweig, Germany
Research Intern | *Guide: Prof. Thomas Deserno* April '20 - July '20
GitHub: taufeeque9/HumanFallDetection

- Developed an application that **detects falls in real-time** using human pose keypoints from multiple cameras
- Designed a modified **Gale-Shapley algorithm** to track people across multiple cameras using HSV histogram
- Detected fall events by modeling **temporal dependencies** between frame features using **LSTM Networks**
- Published the work with a state of the art **F1-score of 92.56%** on the public UP-Fall Detection dataset

Pretrained Model for Structured Documents IIT Bombay & Adobe Research, India
Guide: Prof. Ganesh Ramakrishnan Jan '21 - Aug '21

- Proposed a **BERT**-based architecture to model structured documents using self-supervised learning
- Incorporated document structure based **attention masking** to regularize the model and increase efficiency
- Designed **novel self-supervision task** of matching the correct parent heading for all paragraphs in a document
- Achieved near **99%** accuracy on self-supervision tasks of masked language prediction and header alignment

Stock Factor Exposures Goldman Sachs, Bangalore

Summer Analyst | *Guide: Kesavan Mukunthan* | Received Job Offer Summer 2021

- Created a webapp module to compute and display performance exposures to different factors for each stock in a portfolio of mutual funds that helps portfolio managers to analyse the drivers of performance of every fund
- Brainstormed **business requirements** in a team of 20+ to tailor the module for all portfolio manager use cases
- Studied **finance theory** on alternative investments, portfolio risk evaluation & management using factor models
- Pushed code to production after an extensive **Code Review Process** with experienced employees in the firm

Randomized Planning Algorithms for POMDPs IIT Bombay

Guide: Prof. Shivaram Kalyanakrishnan Spring 2021

- Designed planning algorithms for **partially observable-MDPs** (POMDPs) by combining multiple policies
- Combined random subsets of nodes from Finite State Controllers of weak policies to obtain a strong policy
- Solver found policies with **20% higher rewards** than state of the art non-randomized planning algorithms

SAFE App Vulnerabilities IIT Bombay

Guide: Prof. Bhaskaran Raman Aug '20 - Apr '21

- Found **severe vulnerabilities** in the SAFE App IITB, used by many institutions to conduct remote exams
- Reported **data-leak**, **APK signature verification** and **timing-based** vulnerabilities in the Android app
- Suggested patches and fixes to the SAFE App development team at IITB to circumvent these vulnerabilities

Key Projects

Intrusion Detection System Season of Code '20, IIT Bombay

Project Mentor | GitHub: taufeeque9/IDS Summer 2020

- **Mentored** a team of **9 developers** in building a real-time system that monitors network for malicious activity
- Applied Chi-square test & Pearson Correlation on the CICIDS2017 dataset to select **best 15 out of 81** features
- Deployed an ExtraTrees model of **99.7% accuracy** with a raw network **packet sniffer** written in Python

Efficient Attention-based Object Detector GNR638

Machine Learning in Remote Sensing | GitHub: taufeeque9/detr Autumn 2020

- Implemented Facebook's Detection Transformer (DETR) model by using **ShuffleNet** to produce image features & **Performer** model for contextual object detection thereby reducing training and inference time by factor of **3**
- Trained the model on the COCO 2017 dataset and demonstrated accuracy within **2%** of the original model

Image Restoration with Deep Image Prior CS736

Medical Image Computing | Github: anuj27596/image-restoration Spring 2020

- Performed image restoration on standard inverse problems like **denoising, inpainting and super-resolution**
- Demonstrated the ability of deep CNNs like **U-Net** to capture low-level image statistics prior to any learning

Proof Reader Rewriter CS251

Software Systems Laboratory | GitHub: Utkarsh0203/Proof-Reader-Rewriter Autumn 2019

- Developed a proofreading rewriter webapp using **Django** backend that uses **Natural Language Processing** to correct spellings & grammatical errors & suggest synonyms for words by utilizing **NLTK** package in Python
- Checked grammar by **POS tagging** and by equating the sentence structure with predefined grammar rules

Ultimate Tic Tac Toe CS154

Abstractions & Paradigms in Programming | GitHub: taufeeque9/Ultimate_Tic_Tac_Toe Spring 2019

- Developed the game of Ultimate Tic Tac Toe composed of nine tic-tac-toe boards arranged in a 3-by-3 grid in **Racket**, a multi-paradigm programming language
- Designed an AI agent by implementing **Monte Carlo Tree Search (MCTS)** algorithm for single player mode

Scholastic Achievements

Attended Google Research Week	Selected among 50 undergraduates nationwide	2022
Best AI Agent out of 18 Bots	RBC chess competition in NeurIPS 2021	2021
AP (Advanced Performer) Grade	Best performance in Machine Learning course (GNR 638)	2020
All India Rank 303	JEE Advanced (230,000 aspirants)	2018
All India Rank 330	JEE Mains (1.2 Million aspirants)	2018
National top 1%	Indian National Physics Olympiad (INPhO)	2017
National top 1%	Indian National Chemistry Olympiad (INChO)	2017
KVPY Science Fellowship	Government of India	2016

Technical Skills

Programming	C++, C, Python, Java, Bash, Racket, Prolog, MIPS, PostgreSQL
ML Libraries	PyTorch, Tensorflow, Transformers (by Huggingface), Keras, Scikit-learn, Pandas
Web Development	HTML5, CSS, Bootstrap, JavaScript, React, jQuery, Django, PHP, AJAX
Softwares	Android Studio, MATLAB, Git, CMake, LaTeX, MakeFiles, RStudio, Wireshark

Relevant Coursework

Machine Learning	Foundations of Intelligent Learning Agents, Topics in Learning Algorithms, AI & ML, Formal Methods in ML, Medical Image Computing, ML in Remote Sensing II, Database & Information Systems, Data Analysis & Interpretation
Computer Science	Data Structures and Algorithms, Operating Systems, Computer Architecture, Implementation of Programming Languages, Automata Theory, Design & Analysis of Algorithms, Discrete Structures, Computer Networks, Software Systems Lab, Design and Analysis of Algorithm, Logic for CS
Mathematics	Numerical Analysis, Calculus, Linear Algebra, Differential Equations

Positions of Responsibility

Teaching Assistantships

- Artificial Intelligence & Machine Learning (Autumn 2021)
- Calculus II (Autumn 2021)
- Medical Image Computing (Spring 2022)

English Language Tutor at ELIT Autumn 2020

- Discussed, ideated and created an English language curriculum for 50+ students registered for the program
- Held online classes to teach students topics in written English and how to structure their written piece

Member in Developer's Community (DevCom) IIT Bombay Jan '19 - Aug '20

- Maintained, developed & updated features of **InstiApp**, the institute app with over **10,000+** downloads
- Designed **frontend** of a timetable feature along with API endpoint to generate a universal iCalendar file

SoS Mentor - Mentoring a group of 5 students exploring Artificial Intelligence through Summer of Science

Extracurricular Activities

- Built Arduino based **Remote-Controlled-Vehicle** in XLR8 conducted by Robotics Club, IITB 2018
- Taught Science & Maths to **underprivileged** school students under National Service Scheme (NSS) 2018
- Attended a three day **National Science Camp** organised by KVPY held at **IISc Bangalore** 2017
- Attended a two day workshop on **Ethical Hacking** conducted by E-Cell, IITB 2018