

Mihir Kulkarni

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EDUCATION

IIT BOMBAY

B.TECH (HONOURS) & M. TECH IN COMPUTER SCIENCE WITH MINOR IN MATH

Expected August 2017

GPA: 9.43

INTERESTS

AI, ML, Reinforcement Learning, Optimization, Mathematical Computer Science, Neural networks

RESEARCH AND EXPERIENCE

DEEP REINFORCEMENT LEARNING FOR SCRABBLE | MASTER'S THESIS | PROF. SHIVARAM K

April 2013 – ongoing | IIT Bombay

- Bootstrapping **genetic algorithms** for a state-of-the-art **deep-Q-learning** neural network-based agent. Using the CMA-ES algorithm to learn favourable weights for hand-crafted features.
- Testing against Quackle championship player, one of the top open-source Scrabble agents.
- Building a client-server based **open source environment** for Scrabble agents to encourage collaboration between researchers

CURRICULUM LEARNING | R & D PROJECT | PROF. SHIVARAM K

January 2015 – June 2015 | IIT Bombay

- Worked on creating curricula for the MNIST and the Basic Shapes data set, following up on the initial paper on curriculum learning, a new approach to training machine learning models.
- A curriculum is a sequence of increasingly complex subsets of the training data. The idea is to design these sets so that training on the initial "easy" sets can help to find good approximate solutions, which are treated as start points for training over the complete dataset.
- Implemented and analysed various schemes in Theano. The initial project report can be found here

ADOBE | RESEARCH INTERN | CAUSAL IMPACT MODELING

April 2015 – July 2015 | Bangalore

- Researched literature to synthesize a problem statement aiming to predict the causal relationship of individual marketing emails in a sequence of such mails, on customer purchases
- Used data from Adobe's clients to query **~200 GBs** efficiently, and prototyped a statistical model using SQL and R
- **Filed a patent** with the US Patent office, and was offered a **pre-placement offer** from Adobe, for this work

UNIVERSITY OF WISCONSIN, MADISON | S.N. BOSE SCHOLAR | FORMAT CONVERSION OF NASA IMAGES

May 2014 – July 2014 | Madison, Wisconsin, USA

- Wrote software to convert 1,2 and 4-byte images to a new format
- Programs had to handle inter-architecture endianness issues; using Linux system tools with byte-level C programming

NP-COMPLETENESS OF LCPS | R & D PROJECT | PROF. ANKUR KULKARNI

December 2014-January 2015 | IIT Bombay

- Proved the NP-completeness of the Linear Complementarity Problem using a reduction from the Independent Set problem
- This was inspired by a proof that reduced Independent Set to the Integer Linear Program. You can find the report here

ACADEMICS

- One of only 45 engineering students across the country to be awarded the **SN Bose scholarship**, sponsored by the Department of Science and Technology (DST), for a research internship in the USA (2014)
- One of top ten students of the batch to be awarded a branch change to Computer Science. (2012-13)
- Awarded **AP grade** (top 1% of the class) for exceptional performance in Calculus, Economics, Data Analysis and Interpretation, Introduction to Chemical Engineering, Psychology and Philosophy (2012-13)
- Awarded **Institute Academic Prize** by IIT Bombay for being one of the top ten among ~900 students (2012-13)
- Ranked **1192nd** in the IIT JEE out of 0.5 million and **494th** in the AIEEE out of a million students (2012)

KEY PROJECTS

AUGMENTED LAGRANGIAN METHOD (ALM) | CONVEX OPTIMIZATION | PROF. GANESH RAMKRISHNAN

April 2015

- Implemented the ALM for the for Total Least squares optimization problem with structural constraints
- Analysed the behaviour of the algorithm for varying input size and parameters; implemented various heuristics for specific matrix structures, to bound the error; proposed improvements
- Was offered by the author to further work on the problem with a graduate student

KAPI | MATH NOTE TAKING APP | MICROSOFT code.fun.do

January 2014 – June 2014| IIT Bombay

- Created, in a team of 4, an app for fluid note-taking in technical classes
- The team wrote a parser to quickly and conveniently convert typed math into \LaTeX . This is done by recursively breaking down the text and parsing at token level. The app has an intuitive interface with previews, diagrams, hotkeys for switching in and out of math mode and save/export features.
- View the source here and the app video here

Won first prize in the all India Microsoft finalists forum (3 month contest) and the IIT Bombay leg (2 day hackathon)

VAAKYA | QUERY PROCESSING SYSTEM | INSTITUTE TECHNICAL SUMMER PROJECT

April 2013 – July 2013 | IIT Bombay

- Created, in a team of 4, a first of its kind website providing comprehensive information about IITB's academic affairs all at one location with an intuitive interface
- Wrote Python programs for crawling through the IITB network for various academic details about students and professors and linked them with charts.
- Access the poster here and the video here

Awarded **best Web And Coding Project** by STAB (student technical body) under ITSP '13

VIDEO CHAT APPLICATION | NETWORKS CLASS PROJECT | PROF. VARSHA APTE

November 2014 | IIT Bombay

- Cross-platform multi-threaded P2P application with options to send stylized text, capture and transfer pictures, auto-delete capability, short videos and live A/V chat
- Features included friend lists, tab control for multiple chats, broadcast messages, notifications regarding status of messages(typing or read) and server storage in case the receiver was offline

SMALL C COMPILER | COMPILERS CLASS PROJECT | PROF. AMITABHA SANYAL

April 2015 | IIT Bombay

- Developed a compiler for a C-language subset supporting all major functionality, such as function calls, recursion, multidimensional arrays, function overloading, nesting of function calls and arrays etc., using Flex++ and Bison++
- Used efficient register allocation policy to make best use of the instruction set architecture

ONLINE COURSE RECOMMENDER | DATABASE CLASS PROJECT | PROF. NAND LAL SARDA

November 2014 | IIT Bombay

- Developed a website to recommend courses to users. Implemented the backend using SQL
- Conceived a ranking of available courses to intelligently recommend courses by predicting user interests and course ratings
- Implemented dynamic crawling to search for courses matching interests not available at query time in the database

TEXT TO SPEECH CONVERTER | ARTIFICIAL INTELLIGENCE COURSE | PROF. PUSHPAK BHATTACHARYA

January 2015 – March 2015| IIT Bombay

- Used the Baum Welch algorithm for training the underlying HMM and the Viterbi algorithm for determining the most probable phoneme sequence
- Compared this with a neural network implementation and identified the most frequently mismatched pairs using a confusion matrix

TRANSFORMER ROBOT SIMULATION | COMPUTER GRAPHICS COURSE PROJECT | PROF. PARAG CHAUDHARI

August 2014 – November 2014| IIT Bombay

- Modeled, textured and animated (via forward kinematics) a transformer robot from scratch with OpenGL

FOOSBALL IN BOX2D | SOFTWARE SYSTEMS LAB PROJECT | PROF. PARAG CHAUDHARI

January 2013 – March 2013| IIT Bombay

- Developed a two player foosball game which allowed both players to switch between rods and rotate them to strike the ball using joint mechanisms, using the Box2D physics engine in C++.

SEMINARS

HERBRAND'S THEOREM | ARTIFICIAL INTELLIGENCE COURSE | PROF. PUSHPAK BHATTACHARYA

January 2015 – March 2015 | IIT Bombay

Spoke to an audience of **100** on Herbrand's theorem with it's applications to first-order logic. Graded 10/10.

APPLYING Q-LEARNING TO GAMES | MARKOV DECISION PROCESS COURSE | PROF. VEERARUNA KAVITHA

January 2016 – March 2016 | IIT Bombay

Implemented, analysed and predicted behaviour of the algorithm on certain games.

RELEVANT COURSES

COMPUTER SCIENCE

Paradigms and Abstractions, Discrete Math, Automata theory, Machine Learning, Artificial Intelligence, Convex Optimization, Linear Optimization, Parallel Computation, Advanced Machine Learning*, Reinforcement learning*

OTHER

Game Theory, Statistics, Probability and Random Processes, Markov Decision Processes, Real Analysis, Complex Analysis, Numerical Analysis, Abstract Algebra, Data Visualization, Statistical Modeling

* to be completed by December 2016

POSITIONS OF RESPONSIBILITY

INSIGHT, THE IIT-B STUDENT MEDIA BODY | CHIEF EDITOR

April 2015 – March 2016 | IIT Bombay

- Led 3-tier team of 150+; 10,000 students + 650 faculty readers; 60+ print, 140+ web and 50+ video posts
 - Achieved 30% y-o-y outreach increase on FB (70k likes), 370k+ web views and 1.1 million YouTube views
 - Initiated new **microsites** for major projects, comprehensive sector-wise career articles for 1600+ final-years, student media data blog (10k+ views), freshers' survey to understand pain points
 - Conceptualized and executed the inaugural **PG** Freshers' newsletter and two department newsletters
 - Restructured workflow to improve output by **establishing** design and web teams
 - Heavily covered by media (**20+** bodies); discussed in IITB **Senate** (PhD length article) and public fora
- Awarded the **Institute Organizational Colour** for my work during the tenure

IITBLITZKRIEG, THE IIT-B LITERARY ARTS CLUB | CONVENER

April 2012 – March 2013 | IIT Bombay

- Ran Don Quizote, Asia's largest summer quiz blog, which got **15,000** hits in two months
- Helped conduct **70+** club events at Institute level, setting several of them myself

TEACHING ASSISTANT

- **NUMERICAL ANALYSIS**
 - Guided 45 students by conducting weekly problem-solving sessions (2015)
 - Assisted the instructor in checking of test papers
- **MACHINE LEARNING**
 - Responsible for setting and correcting assignments and help sessions (2016)
 - Assisted the instructor in checking of test papers

EXTRA CURRICULAR

- Spoken Tutorial
 1. Did a supervised learning project analysing the efficacy of dubbed C++ video tutorials under the **Spoken Tutorial** initiative
 2. Created test material and visited various schools in Mumbai and a Pune college, to see how well students learnt from the material, analysing the effect of changing language of instruction
- Mood Indigo coordinator: One of two handling Speaking Arts Competitions for Asia's largest college cultural fest (2013)
- TerraQuiz semifinalist: international environment quiz organized by TERI and Ministry of Environment and Forests (2010)
- Won the IIT Bombay Sci-Tech quiz (2012)