KALPESH KRISHNA

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EDUCATION

Indian Institute of Technology Bombay, *Mumbai, India* July '18
B.Tech in Electrical Engineering (*Minor* in Computer Science & Engineering)
Major GPA: **9.74/10** (**2nd** *among 66 students*) (Minor GPA: 10/10)

Thesis: **Constraint-Driven Learning in NLP Applications** (under *Preethi Jyothi*)
Conducted a literature survey on machine learning models utilizing posterior distribution constraints, in the context of Part-of-Speech tagging, named-entity recognition and sentiment classification. Successfully implemented and matched the results of a popular CNN-based sentiment classification baseline. Currently working on extending this architecture using a "student-teacher" distillation framework using perceptron / PA algorithms, inspired by CMU's Harnessing Deep Neural Networks with Logic Rules.

PUBLICATIONS

- **K. Krishna**, S. Toshniwal & K. Livescu
Hierarchical Multitask Learning for CTC-based Speech Recognition
(*submitted to* ***SLT 2018***)
- **K. Krishna**, L. Lu, K. Gimpel & K. Livescu
A Study of All-Convolutional Encoders for Connectionist Temporal Classification
ICASSP 2018 (*Awarded SPS Travel Grant*) `arXiv:1710.10398 [cs.CL]`

EXPERIENCE

Toyota Technological Institute at Chicago May '17 - July '17
Visiting Student under Karen Livescu, Liang Lu and Kevin Gimpel *Chicago, IL*

· Designed, implemented (in TensorFlow) and analyzed CTC-based end-to-end pure 1-D and 2-D ResNet-style CNN architectures to speed up character-based conversational Speech Recognition systems. Implemented the lexicon-free language model beam-search decoding algorithm. Achieved **2.5x better** training time, **16x better** decoding time and competitive results against LSTM baselines. Built web tools in Flask to increase research & engineering productivity. Submitted a paper to ICASSP-2018.

Mozilla Foundation May '16 - August '16
Google Summer of Code student under Armen Zambrano *Mumbai, India / London, UK*

· Selected for the prestigious Google Summer of Code program (16% proposals selected in 2016) to work on Mozilla's Continuous Integration framework. Collaborated with multiple teams to fix deficiencies in Firefox's testing dashboard Treeherder and task-execution framework TaskCluster. Wrote the first version of Action Tasks, optimizing it using basic graph algorithms. Attended Mozilla's conference at London to discuss Action Tasks, Mozilla's automation and Quarter of Contribution.

SCHOLASTIC ACHIEVEMENTS

- Received the Institute Academic Prize for standing 2^{nd} in the sophomore year 2015-16.
- Awarded AP grade (Top 1% of class) in *Computer Programming*, *Basic Biology* and *Data Analysis*.
- Selected for JSALT '17, organized by JHU's Center for Language and Speech Processing[2].
- **Top 10** at the Astronomy Olympiad's Indian Selection Camp for IOAA '14, (∼20000 applicants).

[1]Use URL martiansideofthemoon.github.io in case hyperlinks don't work
[2]Couldn't attend due to clashing college schedule

- All India Rank 2 *(out of 132k)* in ICSE '12, All India Rank 93 in JEE Advanced '14 *(out of 126k)* and All India Rank 34 in JEE Mains '14 *(out of 1.4M candidates)*.
- Selected for the Kishore Vaigyanik Protsahan Yojana Award '14 (1000 out of 20000 applicants).

PROJECTS

Neural Language Models December '16 - April '17
R&D Project under Preethi Jyothi *Computer Science & Engineering, IIT Bombay*

Implemented (in TensorFlow) and matched the results of popular language modelling baselines (with PTB). Designed several novel neural language modelling architectures at word, sub-word and character level, aimed at morphologically rich languages. Designed and analyzed a new "model-mimicking" loss function which leveraged *n*-gram statistics. Conducted experiments comparing the role of stochastic optimizers in language modelling. Submitted this research work as a short-paper to EMNLP-2017.

Macro Actions in Reinforcement Learning October '17 - Present
RL under Shivaram Kalyanakrishnan *Computer Science & Engineering, IIT Bombay*

· Applied the Fine Grained Action Repetition framework to the SARSA(λ) algorithm in the Half-Field Offense (Robocup) problem. Compared its performance with four alternative action repetition SARSA(λ) variants. Exploring relation of action repetition with reduced discount factor for MDPs.

Blind Dehazing October '17 - Present
Digital Image Processing under Ajit Rajwade *Computer Science & Engineering, IIT Bombay*

· Implemented a single image dehazing algorithm to recover airlight, depth maps and dehazed images using the Dark Channel Prior algorithm. Exploiting the relative degradation (due to haze) of recurring patches across different depths in the image, based on Blind Dehazing Using Internal Patch Recurrence.

Brittle Fracture Simulation January '17 - April '17
Advanced Graphics under Parag Chaudhuri *Computer Science & Engineering, IIT Bombay*

· Built a physics framework for simulating cracks and fractures in brittle objects using explicit solver algorithms like Forward-Euler and Runge-Kutta-4, based on Graphical Modelling & Animation of Brittle Fractures. Visualized this simuation using Paraview and added global illumination using PovRay.

Mini-Arbitrary Function Generator January '17 - April '17
Electronic Design Lab under Shalabh Gupta *Electrical Engineering, IIT Bombay*

· Designed and implemented a digital circuit (in VHDL) to receive UART signals via a custom GNURadio module. Users could specify an input signal via GNURadio, which would be sampled and sent to a Altera Max-V FPGA which played out the signal at a fixed sample frequency (upto 5 MHz). Interfaced this with a Texas Instruments transmitter circuit and successfully carried out BPSK communication.

Processor Design July '16 - November '16
Microprocessors under Virendra Singh *Electrical Engineering, IIT Bombay*

· Designed, implemented and simulated (in VHDL) a six-stage pipelined RISC processor and a multi-cycle RISC processor based on the IITB-RISC instruction set. Wrote an assembler for IITB-RISC.

Pyraminx Solver March '15 - April '15
Computer Programming under Kavi Arya *Computer Science & Engineering, IIT Bombay*

· Built an Android app using blob detection to identify configurations of a Pyraminx. Implemented a least-move optimal solver module using graph algorithms. Built a front-end interface using Allegro.

Mozilla & Open Source September '15 - August '16

· Contributed to several open source projects for Mozilla (list). Took part in the 2nd Quarter of Contribution and built a webapp (wptview), to compare automation test results across different Firefox builds, using Google's Lovefield (IndexedDB library). Mentored three new Mozilla contributors.

Mood Indigo October '15 - December '15

· Contributed towards developing the Android app for Mood Indigo, Asias largest college cultural festival. The app got 4000 installations and rated 4.6 on 5 on the Playstore.

Pickup (Taxi Sharing Service) March '15 - September '15

· Built RESTful APIs and designed an ER Model Database using an MVC Framework Laravel. Developed efficient algorithms utilizing the Google Directions API for automatic passenger pair-ups.

RELEVANT COURSES

- **Computer Science** - Data Structures & Algorithms, Computer Networks, Computer Graphics, Advanced Computer Graphics, Digital Image Processing[3], Operating Systems[3], Discrete Structures[4].
- **Machine Learning** - Reinforcement Learning[3], Convex Optimization[4], R&D Project, Machine Learning (Coursera).
- **Electrical Engineering** - Probability & Random Processes, Data Analysis & Interpretation, Information Theory[4], Control Systems, Digital Signal Processing, Microprocessors.
- **Mathematics** - Applied Real Analysis[3], Multivariable & Vector Calculus, Linear Algebra, Differential Equations I & II, Complex Analysis, Matrix Computations.

TECHNICAL SKILLS

- **Strong** - Python (with TensorFlow & OpenCV), C/C++, JavaScript, VHDL
- **Familiar** - MATLAB, PHP (Laravel), Arduino, Java (Android)
- **Tools** - TensorFlow, Git, Mercurial, Quartus, LaTeX

RESPONSIBILITIES & TALKS

- **Manager, Web and Coding Club** (2016-17) - Lead a team of 14 sophomores, part of one of the biggest college technical clubs in India, to conduct hobbyistic programming activities in the institute. Lead the development of a wiki, a programming guide. Won *Institute Organizational Color 2016-17*.
- **Institute Student Mentor** - Mentoring 12 freshmen and 6 sophomores, helping them get accustomed to the institute life. Helping 1 junior undergraduate overcome academic difficulties.
- **Teaching Assistant** -*Computer Programming* in Fall '16 and *Linear Algebra* in Spring '17. Conducted a special help session for *Computer Programming* in Fall '17.
- **Talks** - TTIC's NLP paper-reading group, various talks on open source contribution at IIT Bombay.

EXTRACURRICULAR

- **Cargill Global Scholar 2016-18** - Selected by the International Institute of Education and Cargill (largest private corporation in USA) for a global leadership program. Attended a leadership seminar in Amsterdam (August '17) where we presented a case-study on Sustainable Agriculture in India.
- Times of India, NIE **Student of the Year** '11 for all round performance.

[3]Courses taken in Fall 2017

[4]Tentative Course for Spring 2018

- **Karate** - Black Belt (1st Dan) trained in Kyokushin Kai for seven years. Winner at District level.
- **Abacus & Mental Arithmetic** - Aloha Grand Master. Winner at National and State level.
- Stood **2nd** (as part of a 4-person team) at the Microsoft code.fun.do Hackathon 15.
- I enjoy cycling, blogging, StackOverflow contribution, star gazing and collecting Rubik's puzzles.

REFERENCES

Preethi Jyothi
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Karen Livescu
Associate Professor
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