

# KALPESH KRISHNA

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## EDUCATION

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**University of Massachusetts, Amherst** Sept '18 - Present  
*MS/PhD* in Computer Science (advised by [Prof. Mohit Iyyer](#))  
**UMass CICS Fellowship 2018-19**

**Indian Institute of Technology Bombay, Mumbai, India** July '14 - July '18  
*B.Tech* in Electrical Engineering (*Minor* in Computer Science & Engineering)  
Major GPA: **9.74/10** (**2<sup>nd</sup>** among 66 students) (Minor GPA: 10/10)  
**Sharad Maloo Memorial Gold Medalist** for outstanding all-round excellence.

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](#).

## PAPERS

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- Trick or TReAT: Thematic Reinforcement for Artistic Typography  
*P. Tendulkar, K. Krishna, R. Selvaraju, D. Parikh*  
arXiv:1903.07820 [cs.CV]
- Revisiting the Importance of Encoding Logic Rules in Sentiment Classification  
*K. Krishna, P. Jyothi & M. Iyyer*  
**EMNLP 2018** (*oral presentation, short paper*)  
arXiv:1808.07733 [cs.CL]
- Hierarchical Multitask Learning for CTC-based Speech Recognition  
*K. Krishna, S. Toshniwal & K. Livescu*  
arXiv:1807.06234v2 [cs.CL]
- A Study of All-Convolutional Encoders for Connectionist Temporal Classification  
*K. Krishna, L. Lu, K. Gimpel & K. Livescu*  
**ICASSP 2018** (*Awarded SPS Travel Grant*)  
arXiv:1710.10398v2 [cs.CL]

## EXPERIENCE

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**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*

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<sup>1</sup>Use URL [martiansideofthemoon.github.io](http://martiansideofthemoon.github.io) in case hyperlinks don't work

- 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

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- Received the Institute Academic Prize for standing 2<sup>nd</sup> 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](#)<sup>2</sup>.
- Top 10** at the Astronomy Olympiad's Indian Selection Camp for IOAA '14, (~20000 applicants).
- 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

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### 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 Kalyan Krishnan](#)*

*Computer Science & Engineering, IIT Bombay*

- Applied the [Fine Grained Action Repetition](#) framework to the SARSA( $\lambda$ ) algorithm in the [Half-Field Offense \(Robocup\)](#) problem. Compared its performance with four alternative action repetition SARSA( $\lambda$ ) 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 simulation 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

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<sup>2</sup>Couldn't attend due to clashing college schedule

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

*Microprocessors under [Virendra Singh](#)*

July '16 - November '16

*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

*Computer Programming under [Kavi Arya](#)*

March '15 - April '15

*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](#), Asia's 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

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

## TECHNICAL SKILLS

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- **Strong** - Python (with TensorFlow & OpenCV), C/C++, JavaScript, VHDL
- **Familiar** - MATLAB, PHP (Laravel), Arduino, Java (Android)
- **Tools** - TensorFlow, Git, Mercurial, Quartus, L<sup>A</sup>T<sub>E</sub>X

## RESPONSIBILITIES & TALKS

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- **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*.

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<sup>3</sup>Courses taken in Fall 2017

<sup>4</sup>Tentative Course for Spring 2018

- **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

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- **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.
- **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

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### **Preethi Jyothi**

Assistant Professor

Computer Science & Engineering, IIT Bombay

[webpage](#)  $\diamond$  [email](#)

### **Karen Livescu**

Associate Professor

Toyota Technological Institute at Chicago

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### **Liang Lu**

Senior Applied Scientist

Microsoft, Bellevue

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### **Kevin Gimpel**

Assistant Professor

Toyota Technological Institute at Chicago

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