

# Satwik Kottur

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*Curriculum Vitae*

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EDUCATION	<b>Carnegie Mellon University</b> , Pittsburgh, USA <i>Ph.D. Student</i> , Department of Electrical and Computer Engineering, • Advisor: Prof. José M. F. Moura • Interests: Computer Vision, Deep Learning, Natural Language Processing • GPA: 4.00/4 <b>Indian Institute of Technology Bombay</b> , Mumbai, India <i>Bachelor of Technology</i> , Department of Electrical Engineering, • Advisor: Prof. Subhasis Chaudhuri • <b>Honors</b> in Electrical Engineering, <b>Minor</b> in Computer Science and Engineering • GPA: 9.52/10	<b>2014 - present</b> <b>2010 - 2014</b>

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## Research

PUBLICATIONS	<ul style="list-style-type: none"><li>• Manzil Zaheer*, <b>Satwik Kottur*</b>, Zichao Yang, José M. F. Moura, Amr Ahmed, Alex Smola, Canopy – Fast Sampling with Cover Trees, <i>(Submitted to Conference on Artificial Intelligence and Statistics (AISTATS), 2017)</i></li><li>• <b>Satwik Kottur</b>, Vitor Carvalho, Exploring Personalized Neural Conversational Models, <i>(Submitted to AAAI Conference on Artificial Intelligence, 2017)</i></li><li>• <b>Satwik Kottur</b>, Ramakrishna Vedantam, José M. F. Moura, Devi Parikh, Visual Word2Vec (vis-w2v): Learning Visually Grounded Word Embeddings from Abstract Scenes, <i>IEEE Conference on Computer Vision and Pattern Recognition, 2016</i></li><li>• Manzil Zaheer, Micheal Wick, <b>Satwik Kottur</b>, Jean-Baptiste Tristan, Comparing Gibbs, EM and SEM for MAP Inference in Mixture Models, <i>OPT: NIPS Workshop on Optimization for Machine Learning, 2015.</i></li><li>• Evgeny Toropov, Liangyan Gui, Shanghang Zhang, <b>Satwik Kottur</b>, José M. F. Moura, Traffic Flow from a Low Frame Rate City Camera, <i>Big Data Processing and Analysis (special session) in IEEE International Conference on Image Processing (ICIP), 2015.</i></li></ul> <p>* = equal contribution</p>
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RESEARCH EXPERIENCE

### Cover Tree based Fast Sampler

*Guide: Prof. José M. F. Moura and Prof. Alex Smola*

**Fall '16**

Proposed a sampler based on cover trees that is exact for inference in latent variable models. Evaluated its effectiveness against other approaches, on both synthetic and real datasets, achieving speedup for storage cost of cover tree. This work has been submitted to Conference on Artificial Intelligence and Statistics (AISTATS), 2017.

### Exploring Personalized Neural Conversational Models

Guide: Dr. Vitor Carvalho

Summer '16

Summer Internship, Snapchat Research, Venice, USA

Performed quantitative comparison of existing generative neural conversational models on multiple datasets. Proposed a new model that is both personalized and context-aware, and showed improvements in text generation and retrieval. This work has been submitted to AAAI Conference on Artificial Intelligence, 2017.

### Learning Visually Grounded Word Embeddings

Guide: Prof. José M. F. Moura and Prof. Devi Parikh

Fall '15

Formulated a method to learn visually grounded word embeddings that capture visual semantics using abstract scenes. Showed improvements in tasks that are ostentatiously in text but benefit from semantic relatedness learnt from visual grounding.

### Traffic Flow from a Low Frame Rate City Camera

Guide: Prof. José M. F. Moura

Spring '15

Traffic flow is a rich source of information about cities, that are being equipped with video cameras. Formulated an approach with background subtraction, scene geometry, car detection, and counting, to detect traffic flow from an online low quality, low frame rate city video camera.

### AUVSI and ONR'S International Robosub Competition

SSC Pacific TRANSDEC, San Diego, USA

Design and Development of Autonomous Underwater Vehicle (AUV), IIT Bombay

Guides: Prof. Hemendra Arya and Prof. Leena Vachhani

Spring '12 - Spring '13

Designed and implemented robust algorithms for processing underwater images to aid navigation via visual feedback through on-board cameras. These are constrained by limited on-board computation power. Formulated approaches include adaptive identification and correction of color casts, edge-saliency based color segmentation and adaptive enhancement.

Co-authored 'System Design and Implementation of Autonomous Underwater Vehicle' for

- Presentation at American Society of Mechanical Engineers(ASME), International Undergraduate Research and Design Expo 2012, Houston, USA
- AUVSI and ONRs 15<sup>th</sup>, 16<sup>th</sup> Robosub Competition Journal Paper (2012, 2013)

TECHNICAL  
EXPERIENCE

## Academic Experience and Achievements

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SCHOLASTIC  
ACHIEVEMENTS

- Awarded Carnegie Institute of Technology Dean's Fellowship to pursue graduate studies
- Awarded Viterbi-India Scholarship to pursue research in summer at Viterbi School of Engineering
- Won bronze medal at International Olympiad for Astronomy and Astrophysics (2010), Beijing
- Secured AIR 6 in IITJEE - 2010 (achieved the best score in physics) among 4.7 Lakh students
- Selected for Orientation-Cum-Selection camp for International Junior Science Olympiad (IJSO-2008) and International Astronomy Olympiad (IAO-2009), in top 30 among 45 thousand students
- Secured High Distinction in Australian National Chemistry Olympiad (2008,2009)

KEY COURSE  
PROJECTS

### Spoken Dialog Systems with Audio and Text

Instructor: Prof. Ruslan Salakhutdinov (10-807 Topics in Deep Learning)

Fall '16 (present)

Modeling dialog systems that converse with humans using both speech and text. Responses are often dependent on both text and audio cues that highlight emotion. Working on generative models that account for such cues in conversation.

### Stochastic Expectations Maximization for Latent Variable Models

Instructor: Prof. Ryan Tibshirani (10-725 Convex Optimization)

Fall '15

Worked on a variant of EM algorithm making it asynchronous and embarrassingly parallel and

thus useful for latent variable models. Designed inference procedure capable of leveraging modern computational resources like GPUs or cloud computing offering massive parallelism.

### Non-smooth Stochastic Optimization for MCMC

*Instructor: Prof. Eric Xing (10-708 Probabilistic Graphical Models)*

**Spring '15**

Proposed techniques to handle and sample from non-smooth energy functions in stochastic gradient Hybrid Monte Carlo (HMC), without losing the benefits of stochasticity especially for large datasets. Studied and analyzed the properties both theoretically and empirically.

### Detecting Text in Natural Images

*Instructor: Prof. Martial Hebert (16-720 Computer Vision)*

**Fall '14**

Intelligent systems often need to read text in their surroundings. Studied an algorithm to locate and identify image regions containing text, that uses stroke width transform, and analyzed the success and failure cases to get a clearer understanding.

#### RELEVANT COURSES

- **Graduate:** Topics in Deep Learning, Visual Learning and Recognition, Computer Vision, Geometry-based methods in Vision, Introduction to Machine Learning, Probabilistic Graphical Models, Convex Optimization, Intermediate Statistics.
- **Undergraduate:** Pattern Recognition, Machine Learning, Advanced Computer Graphics, Image Processing, Digital Signal Processing, Advanced topics in Signal Processing, Speech Processing, Graph Theory, Data Structures and Algorithms.

#### TECHNICAL SKILLS

- *Languages:* C/C++, Python, Lua, Java, Verilog, HTML, CSS, JavaScript
- *Packages:* OpenCV, OpenGL, OpenCL, CUDA, MySQL, MATLAB
- *Operating System:* ROS (Robot Operating System), GNU/Linux, Windows
- *Deep Learning Packages:* Caffe, Torch

#### Extracurricular Activities

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##### MUSIC

- Trained in Indian Classical and Western Classical Violin for 12 years and performed over hundred concerts in Birmingham (U.K.), Beijing, Pittsburgh, New Delhi, Pune, Bangaluru, etc.
- Secured Distinction in Certificate course (South Indian Classical Violin) for overall excellence
- Lead violinist of musical band Saptak and have won People's Choice Award, Mumbai and Battle of the Bands, IIT Bombay as the best musical group
- Performed in events like Institute Classical Night, Institute Cultural Night, Swar Sandhya, Surbahaar and Performing Arts Festival (PAF) which see huge audience from students, faculty and employees of IIT Bombay

##### OFFICES

#### Vice President, ECE Graduate Organization, Carnegie Mellon University

Responsible for planning and conducting events and activities for the social and psychological welfare of graduate students of ECE department, beyond their academic life.

##### MENTORSHIP

#### Department Academic Mentorship Program, Electrical Engineering, IIT Bombay

Selected from over 50 applicants from the department on the basis of balanced academics, extracurriculars and mentoring skills. Counseling students with severe academic problems to surmount emotional and social difficulties and improve overall performance.

##### SPEAKER

Conducted various sessions on Image Processing and OpenCV at beginner, intermediate and advanced levels for undergraduate and graduate students at IIT Bombay

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