

# Satwik Kottur

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*Curriculum Vitae*

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CONTACT INFORMATION	Ph.D. Student Department of Electrical and Computer Engineering Carnegie Mellon University	+1-412-557-1267 <a href="mailto:skottur@andrew.cmu.edu">skottur@andrew.cmu.edu</a> <a href="https://satwikkottur.github.io/">https://satwikkottur.github.io/</a>
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>
WORK EXPERIENCE	<b>Research Intern</b> , <i>Facebook AI Research (FAIR)</i> , Menlo Park, USA • Mentor: Marcus Rohrbach • Worked on visual dialog models that reason explicitly by inducing programs <b>Research Intern</b> , <i>Snap Research</i> , Venice, USA • Mentor: Vitor Carvalho, Xiaoyu Wang • Worked on context-aware conversational models that allow user-personalization	<b>Summer '17</b> <b>Summer '16</b>

## Research

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SELECTED PUBLICATIONS	<ul style="list-style-type: none"><li>• <b>Natural Language Does Not Emerge ‘Naturally’ in Multi-Agent Dialog.</b> Satwik Kottur, José M. F. Moura, Stefan Lee, Dhruv Batra, <i>Conference on Empirical Methods in Natural Language Processing (EMNLP)</i>, 2017 (<b>Best Short Paper Award</b>)</li><li>• <b>Learning Cooperative Visual Dialog Agents with Deep Reinforcement Learning.</b> Abhishek Das*, Satwik Kottur*, José M. F. Moura, Stefan Lee, Dhruv Batra, <i>International Conference on Computer Vision (ICCV)</i>, 2017 (<b>Oral</b>)</li><li>• <b>Canopy – Fast Sampling with Cover Trees.</b> Manzil Zaheer*, Satwik Kottur*, José M. F. Moura, Amr Ahmed, Alex Smola, <i>International Conference on Machine Learning (ICML)</i>, 2017</li><li>• <b>Exploring Personalized Neural Conversational Models.</b> Satwik Kottur, Xiaoyu Wang, Vitor Carvalho, <i>International Joint Conference on Artificial Intelligence (IJCAI)</i>, 2017</li><li>• <b>Visual Dialog.</b> Abhishek Das, Satwik Kottur, Khushi Gupta, Avi Singh, Deshraj Yadav, José M. F. Moura, Devi Parikh, Dhruv Batra, <i>IEEE Conference on Computer Vision and Pattern Recognition (CVPR)</i>, 2017 (<b>Spotlight</b>)</li><li>• <b>Visual Word2Vec (vis-w2v): Learning Visually Grounded Word Embeddings from Abstract Scenes.</b> Satwik Kottur*, Ramakrishna Vedantam*, José M. F. Moura, Devi Parikh, <i>IEEE Conference on Computer Vision and Pattern Recognition (CVPR)</i>, 2016</li></ul>
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\* = equal contribution

RESEARCH  
EXPERIENCE

**Emergence of Language in Multi-Agent Dialog**

*Guides: Prof. Dhruv Batra and Prof. José Moura*

**Spring '17**

Characterized emergent language between two agents, which interact and solve a cooperative task. Showed that 'natural' (grounded and compositional) language does not emerge naturally but only with certain restrictions on their communication capacity. This work has been awarded the **best short paper** at EMNLP, 2017.

**Visual Dialog**

*Guides: Prof. Devi Parikh, Prof. Dhruv Batra, Prof. José Moura* **Spring '16 - Spring '17**

Proposed a novel high-level AI task at the intersection of language and vision called 'Visual Dialog' along with collection of a large dataset and formulation of evaluation metrics to benchmark progress. Trained models using supervised learning that were further fine-tuned via reinforcement learning after appropriately recasting visual dialog as a cooperative image guessing game. This work have been accepted in parts to both CVPR, 2017 (**spotlight**) and ICCV, 2017 (**oral**).

**Cover Tree based Fast Sampler**

*Guides: Prof. Alex Smola and Prof. José Moura*

**Fall '16 - Spring'17**

Proposed a fast and scalable sampler based on cover trees that performs exact inference for discrete latent variable models. Compared its effectiveness to other approaches, resulting in a favorable speed-space tradeoff. This work has been accepted to ICML 2017.

**Exploring Personalized Neural Conversational Models**

*Guides: Vitor Carvalho and Xiaoyu Wang*

**Summer '16**

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 accepted to IJCAI, 2017.

**Learning Visually Grounded Word Embeddings**

*Guides: Prof. Devi Parikh and Prof. José Moura*

**Fall '15**

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. This work has been accepted to CVPR, 2016.

TECHNICAL  
EXPERIENCE

**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.

**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**

Modeled dialog systems that converse with humans using both speech and text. Responses are often dependent on both text and audio cues that highlight emotion. Worked on generative models and showed improvements after accounting 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.

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, TensorFlow

OTHER ACADEMIC  
EXPERIENCES

**Teaching Assistant**, Signals and Systems (18-290), Carnegie Mellon University

**Fall '17**

*Instructors: Prof. Aswin Sankaranarayanan and Prof. Richard Stern*

Conducted weekly tutorials and office hours for a class of 100+ students

**Teaching Assistant**, Differential Equations (MA-108), IIT Bombay

**Spring '14**

*Instructors: Prof. Akhil Ranjan*

Conducted weekly tutorials, graded papers and set homeworks for a class of 60+ students

**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, Bangalore, 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