

# SHIKHAR SHARMA

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Research Scientist, Maluuba Research

<http://www.shikharsharma.com/>

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## RESEARCH INTERESTS

- Deep Learning
- Attention models
- Machine Learning
- Task-oriented dialogue
- Recurrent Neural Networks
- Computer Vision

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## RESEARCH STATEMENT

My long-term research interest lies in advancing the capabilities of current artificial intelligence systems. I am highly interested in neural network architectures augmented with memory and attention mechanisms.

My recent research deals with task-oriented dialogue systems, which stand to gain significant advantage from using memory and attention similar to how we humans do. Prior to this, I have worked on visual attention models for action recognition and video description. I have broad interests in deep learning research in natural language processing and computer vision, which I believe are important research areas on the path to true artificial intelligence.

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## EDUCATION

### University of Toronto

M.Sc. in Computer Science with the Deep Learning and Machine Learning group

- Thesis supervisor: *Prof. Ruslan Salakhutdinov*

*Sep'14 - Feb'16*

GPA: 3.83/4

### Indian Institute of Technology (IIT), Kanpur

B.Tech. in Computer Science

*Jul'10 - May'14*

GPA: 9.3/10

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## PUBLICATIONS

### Theses

Shikhar Sharma. 2016. "Action Recognition and Video Description using Visual Attention." Masters Thesis, University of Toronto

### Journal papers

Ashesh Jain, Shikhar Sharma, Thorsten Joachims, Ashutosh Saxena. 2015. "Learning preferences for manipulation tasks from online coactive feedback." *The International Journal of Robotics Research (IJRR)*, 34, 1296-1313

Ashesh Jain, Shikhar Sharma, Ashutosh Saxena. 2016. "Beyond geometric path planning: Learning context-driven trajectory preferences via sub-optimal feedback." *Robotics Research: The 16th International Symposium (ISRR)*. Springer International Publishing, 319-338

### Conference and arXiv papers

Shikhar Sharma, Jing He, Kaheer Suleman, Hannes Schulz, Philip Bachman. 2016. "Natural Language Generation in Dialogue using Lexicalized and Delexicalized Data." [arXiv:1606.03632](https://arxiv.org/abs/1606.03632) [cs.CL]

Shikhar Sharma, Ryan Kiros, Ruslan Salakhutdinov. 2016. "Action Recognition using Visual Attention." *International Conference on Learning Representations (ICLR) Workshop*

Shikhar Sharma, Ryan Kiros, Ruslan Salakhutdinov. 2015. "Action Recognition using Visual Attention." *Neural Information Processing Systems (NIPS): Time Series Workshop*

## RESEARCH EXPERIENCE

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### **Maluuba Research**

*Research Scientist*

*Mar'16 - Present  
Montreal, Quebec, Canada*

I am working on end-to-end trainable models for task-oriented dialogue systems with the dialogue group on Maluuba's travel dataset. Prior to this, I worked on improving the natural language generation component of task-oriented dialogue systems over the then state-of-the-art by using lexicalized slot values.

### **University of Toronto**

*Graduate Research Assistant*

*Sep'14 - Feb'16  
Toronto, Ontario, Canada*

Working together with Prof. Ruslan Salakhutdinov and Jamie Ryan Kiros, my masters thesis focused on soft-attention based recurrent neural networks for action recognition and video description generation.

### **Cornell University**

*Research Intern*

*May'13 - Jul'13  
Ithaca, New York, USA*

I worked with Prof. Ashutosh Saxena and Ashesh Jain on learning preferences over trajectories on robots such as the Baxter. Our approach required a non-expert user for training and the preferences we learned were governed by objects and human interactions in the environment.

## AWARDS AND SCHOLASTIC ACHIEVEMENTS

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<b>2014</b>	Department Entrance Scholarship (CS) of CAD\$10,000 at University of Toronto for 2014-2016
<b>2013</b>	Selected for the prestigious Cornell IIT-Internship Program, 2013
<b>2012</b>	IIT Kanpur Academic Excellence Award for 2011-12 for distinctive academic achievements
<b>2011</b>	O.P. Jindal Engg. and Mgmt. Scholarship for excellence in academics and leadership
<b>2011</b>	IIT Kanpur Academic Excellence Award for 2010-11 for distinctive academic achievements
<b>2010</b>	Awarded the CBSE Merit Scholarship for Professional Studies - AIEEE for 2010-2014
<b>2010</b>	All India Rank 434 in IIT-Joint Entrance Examination (amongst 0.48 million candidates)

## KEY RESEARCH PROJECTS

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### **A dialogue system from human-human dialogues**

*Dialogue group*

*Jun'16 - Present  
Maluuba Research, Canada*

- Organized and supervised data collection and annotation with data analysts: 19,000+ turns in total
- Generalized the state tracking task to frame tracking, which requires adding memory
- Designed and implemented tools to parse and preprocess the dataset
- Implementing a baseline and a natural language understanding module which extracts, anonymizes slot values

### **A natural language generator for task-oriented dialogue systems**

*Dialogue group*

*Mar'16 - May'16  
Maluuba Research, Canada*

- Organized and supervised data collection using crowdsourcing and annotation with data analysts
- Used lexicalized slot values with slot labels in a recurrent encoder-decoder framework
- Trained a language model with similar decoder architecture and transferred weights
- Obtained improvement over state-of-the-art approaches on BLEU-4, METEOR, ROUGE.L & CIDEr scores

### **Action Recognition and Video Description using Visual Attention**

*Masters Thesis supervised by Prof. Ruslan Salakhutdinov*

*Sep'15 - Feb'16  
University of Toronto, Canada*

- Proposed a soft attention model to generate descriptions of videos in YouTube2Text dataset
- Used a Long Short-Term Memory based Recurrent encoder and decoder framework
- Built upon our previous work on action recognition published at NIPS and ICLR workshops

**Mentions**      Talk by Prof. Gunhee Kim at NVIDIA GTCx, Seoul 2016: <https://goo.gl/LAJz9z>

## Action Recognition using Visual Attention

Feb'15 - Aug'15

Research Project with Prof. Ruslan Salakhutdinov

University of Toronto, Canada

- Proposed a soft attention model to perform action recognition in video datasets like HMDB-51, Hollywood2
- Used GoogLeNet to extract features and an attention mechanism to dynamically pool the features
- Performed the classification task using a Recurrent Neural Network based on Long Short-Term Memory units
- Compared our models with relevant baselines and state-of-the-art Deep Learning based models
- Presented an extensive qualitative analysis of possibly how the attention model selected glimpses

**Project page** <http://shikharsharma.com/projects/action-recognition-attention/>

**Source code** <https://github.com/kracwarlock/action-recognition-visual-attention/>

**Mentions** Talk by Prof. Ruslan Salakhutdinov at Deep Learning Summer School, Montreal 2016

## Speech Recognition using Deep Neural Networks and Hidden Markov Models

Jan'14 - Apr'14

B.Tech. Project with Prof. Harish Karnick

IIT Kanpur, India

- Used MFCC and its first and second order derivatives as features for the Deep Neural Network
- The DNN was integrated with a Hidden Markov Model which was used for the final classification
- Trained and evaluated on ISOLET and an IIT Kanpur dataset of roughly 120,000 Hindi audio recordings

## Learning Trajectory Preferences for Manipulators via Iterative Improvement

May'13 - Jul'13

Research Project with Prof. Ashutosh Saxena

Cornell University, USA

- Learnt preferences over trajectories for 7 Degree of Freedom robot manipulators of Baxter Research Robot
- The algorithm requires the user to incrementally improve over the trajectory currently proposed by the robot
- Theoretical regret bounds of our algorithm match the asymptotic rates of optimal trajectory algorithms
- The robot was used to perform grocery checkout tasks

**Project page** <http://pr.cs.cornell.edu/coactive/>

**YouTube demo** <https://www.youtube.com/watch?v=uLktpkd7ojA>

**Mentions** Cornell University CS News (<https://goo.gl/owFPss>),  
TechCrunch (<https://goo.gl/y2hW12>), KurzweilAI (<https://goo.gl/KyfN9U>)

## Logic Studio (collaboration of Microsoft Research, Redmond and IIT Kanpur)

Apr'12 - Jul'12

Research Project with Dr. Sumit Gulwani, Prof. Amey Karkare, Prof. Subhajit Roy

IIT Kanpur, India

- Focused on creating an Intelligent Tutoring System for teaching First Order Logic
- Utilized the Stanford CoreNLP Parser to parse and retrieve meta-data, dependencies between words
- Generated logical formulae consisting of appropriate quantifiers, first order logic predicates and connectives
- Generated new questions by replacing determiners in sentences from our corpus

## TECHNICAL SKILLS

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**Programming Languages** Python, C, C++  
**Machine Learning tools** Keras, Theano, Tensorflow, Matlab  
**Web Programming** HTML, PHP, CSS, JavaScript, JQuery, MySQL

## TEACHING EXPERIENCE

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**2015** Teaching Assistant for CSC411: Introduction to Machine Learning at University of Toronto  
**2015** Teaching Assistant for CSC321: Introduction to Neural Networks at University of Toronto  
**2014** Teaching Assistant for CSC309: Programming on the Web at University of Toronto

## LINKS

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**Website** <http://www.shikharsharma.com/>  
**GitHub** <https://github.com/kracwarlock>  
**LinkedIn** <https://ca.linkedin.com/in/sharmashikhar>  
**Scholar** <https://scholar.google.ca/citations?user=bLA7DYwAAAAJ>

## EXTRA-CURRICULAR ACHIEVEMENTS AND ACTIVITIES

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- Secured third place among 275 participants in Firewall (ethical hacking competition) in Phoenix 2013 - Delhi Technological University's Technical Festival
- Awarded the Judges Choice Award at Yahoo! HackU 2012 for a "Tweet Map and Sentiment Analyzer" built on node.js, socket.io, Google APIs and JavaScript
- Secured second place in Coldfire (ethical hacking competition) in Effervescence 2012 - IIIT Allahabad's Technical cum Cultural Festival
- Winner, Infobahn (Web Designing competition) at Spectrum 2012, IIT Kanpur
- Held lectures on programming and organized programming competitions for Programming Club at IIT Kanpur.
- Organized and prepared the problem statements for CodeSprint, an ethical hacking competition which saw a lot of participation from IIT Kanpur students
- Made a promotional video for PRAYAS (an IIT Kanpur students social initiative which teaches under-privileged children) as a course project in ART105 Introduction to the Art of Video Making