

## RESEARCH INTERESTS

---

Grounded Language Learning, Human-robot-Dialog, Dialog Systems, Natural Language Processing, Machine Learning

## EDUCATION

---

### PhD, University of Texas at Austin

Computer Science

Advisor: Raymond J. Mooney

Thesis: Dialog as a Vehicle for Lifelong Learning of Grounded Language Understanding Systems

Austin, TX, USA

Aug. 2015 – Aug. 2020

### B.Tech.(Hons.), Indian Institute of Technology, Madras

Major: Computer Science and Engineering; Minor: Operations Research

Advisor: Balaraman Ravindran

Thesis: Improving aggregate diversity in recommendation systems

Chennai, India

Aug. 2011 – May 2015

## PUBLICATIONS AND PATENTS

---

- “Dialog Policy Learning for Joint Clarification and Active Learning Queries”  
*Aishwarya Padmakumar and Raymond J. Mooney*  
To Appear in Proceedings of the 35th AAAI Conference on Artificial Intelligence (AAAI 2021).
- “Dialog as a Vehicle for Lifelong Learning”  
*Aishwarya Padmakumar and Raymond J. Mooney*  
Position Paper Track at the SIGDIAL Special Session on Physically Situated Dialogue (RoboDial 2.0), July 2020.
- “Jointly Improving Parsing and Perception for Natural Language Commands through Human-Robot Dialog”  
*Jesse Thomason, Aishwarya Padmakumar, Jivko Sinapov, Nick Walker, Yuqian Jiang, Harel Yedidsion, Justin Hart, Peter Stone, and Raymond J. Mooney.*  
In The Journal of Artificial Intelligence Research (JAIR), Vol. 67 (2020), pp. 327-374.
- “Improving Grounded Natural Language Understanding through Human-Robot Dialog”  
*Jesse Thomason, Aishwarya Padmakumar, Jivko Sinapov, Nick Walker, Yuqian Jiang, Harel Yedidsion, Justin Hart, Peter Stone, and Raymond J. Mooney.*  
In Proceedings of the International Conference on Robotics and Automation (ICRA), 2019.  
Also presented at the SIGDIAL Special Session on Physically Situated Dialogue (RoboDIAL), 2018.  
Also presented at the RSS Workshop on Models and Representations for Natural Human-Robot Communication (MRHRC), 2018.
- “Learning a Policy for Opportunistic Active Learning”  
*Aishwarya Padmakumar, Peter Stone, and Raymond J. Mooney.*  
In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-18), Brussels, Belgium, November 2018.
- “Interaction and Autonomy in RoboCup@Home and Building-Wide Intelligence”  
*Justin Hart, Harel Yedidsion, Yuqian Jiang, Nick Walker, Rishi Shah, Jesse Thomason, Aishwarya Padmakumar, Rolando Fernandez, Jivko Sinapov, Raymond Mooney and Peter Stone.*  
In Artificial Intelligence (AI) for Human-Robot Interaction (HRI) symposium, AAAI Fall Symposium Series, Arlington, Virginia, October 2018.
- “Opportunistic Active Learning for Grounding Natural Language Descriptions”  
*Jesse Thomason, Aishwarya Padmakumar, Jivko Sinapov, Justin Hart, Peter Stone, and Raymond J. Mooney.*

In Proceedings of the 1st Annual Conference on Robot Learning (CoRL-17), Mountain View, California, November 2017.

- “Integrated Learning of Dialog Strategies and Semantic Parsing”  
**Aishwarya Padmakumar**, *Jesse Thomason and Raymond J. Mooney*  
In proceedings of the 15th European chapter of the Association for Computational Linguistics (EACL '17)
- “Automated Linguistic Personalization of Targeted Marketing Messages Mining User-Generated Text on Social Media”  
*Rishiraj Saha Roy, Aishwarya Padmakumar, Guna Prasad Jeganathan and Ponnurangam Kumaraguru*  
In proceedings of the 16th International Conference on Intelligent Text Processing and Computational Linguistics (CICLing 15) (*Best Paper Award*)
- “Linguistic Personalization of Messages for Targeted Campaigns”  
*Rishiraj Saha Roy, Guna Prasad Jeganathan, Aishwarya Padmakumar and Ponnurangam Kumaraguru*  
USPTO Application No. 14/566,181, filed on 10 December 2014 (*Patent pending*)

## OTHER ACADEMIC PROJECTS

---

### Grounding Referring Expressions Using Multimodal Transformers

Jan 2019 - Mar 2019

- *The University of Texas at Austin*

Mentor: Prof. Ray Mooney

Explored the use of a multimodal transformer consisting of alternating self and cross attention layers for grounding referring expressions in images. The system depended on extracting candidate bounding boxes or segments, and was found to underperform state-of-the-art models primarily due to limitations in the candidate generation phase.

### Grounding Referring Expressions Using Joint Embeddings

October 2018 – December 2018

- *The University of Texas at Austin*

Mentor: Prof. Ray Mooney

Learning to project image and word embeddings to a joint space in which images are close to words they apply to and vice versa. The model was found to be comparable to using independent 1 vs all classifiers for grounding referring expressions in images.

### Varying Ability to Observe in a Partially Observable World

October 2016 – December 2016

- *The University of Texas at Austin*

Mentor: Prof. Peter Stone

An attempt to extend belief monitoring in Bayes-Adaptive POMDPs to allow for an observation function that varies with time. Some proposed heuristic solutions based on recency weighting were found to work for cases where the changes in the observation function are not continuous. <sup>1</sup>

### Longer RNNs

October 2016 – November 2016

- *The University of Texas at Austin*

Mentor: Prof. Philipp Krähenbühl

We attempted to improve the performance of RNNs on modeling long term dependencies by two methods - allowing for different weight matrices across time steps, and introducing residual connections. <sup>2</sup>

### Face to Age

September 2016 – October 2016

- *The University of Texas at Austin*

Mentor: Prof. Philipp Krähenbühl

We fine-tuned VGGNet to predict the year in which given yearbook photographs were taken. We compared the performance of different loss functions and visualized pixels relevant for classification. <sup>3</sup>

### Unsupervised Text Summarization Using Sentence Embeddings

February 2016 – May 2016

- *The University of Texas at Austin*

Mentor: Prof. Ray Mooney

We performed text summarization using clustering of sentence embeddings, learned to embed paraphrases near each other. We compared extractive and abstractive variants, as well as different embedding algorithms. <sup>4</sup>

### Visual Question Answering using Additional Localization Cues

February 2016 – May 2016

- *The University of Texas at Austin*

Mentor: Prof. Kristen Grauman

---

<sup>1</sup>The report can be found at <http://aishwaryap.github.io/ut/RLProject.pdf>

<sup>2</sup>The report can be found at <http://aishwaryap.github.io/ut/DLProject2.pdf>

<sup>3</sup>The report can be found at <http://aishwaryap.github.io/ut/DLProject1.pdf>

<sup>4</sup>The report can be found at <http://aishwaryap.github.io/ut/NLPPProject.pdf>

We attempted to improve a baseline VQA model by providing additional cues in the form of a bounding box obtained by natural language object retrieval on the image with the question as query, and a bounding box corresponding to a region which humans find interesting (high saliency). <sup>5</sup>

### Modeling Cooking Tutorials using Hidden Markov Models

August 2015 – December 2015

- *The University of Texas at Austin*

Mentor: Prof. Scott Niekum

This project aimed at recovering latent structure present in different web tutorials for the same task. We attempted to model cooking tutorials using HMMs and explored the use of different language models for observation probabilities. <sup>6</sup>

### Improving Aggregate Diversity in Recommender Systems

July 2014 – May 2015

- *Indian Institute of Technology, Madras*

Mentor: Prof. Balaraman Ravindran

This project was aimed at designing a new metric to evaluate aggregate diversity of recommendation systems, which is a measure of how often different items in the inventory get recommended. Different formulations were used to then optimize this metric. <sup>7</sup>

### Reinforcement Learning for Coreference Resolution

Jan 2015 – May 2015

- *Indian Institute of Technology, Madras*

Mentor: Prof. Balaraman Ravindran

This project explored the use of Reinforcement Learning techniques to exploit structural information when performing coreference resolution, as opposed to modelling it as a classification task, resulting in improved precision. <sup>8</sup>

### Diversity in Text Summarization Using LSA

Jul 2014 – Nov 2014

- *Indian Institute of Technology, Madras*

Mentor: Prof. Sutanu Chakraborty

This project improved upon techniques that make use of Latent Semantic Analysis for text summarization by discounting sentences similar to those previously selected. <sup>9</sup>

### Identifying Points for Active Learning in an Induced Hypergraph

Jan 2014 – May 2014

- *Indian Institute of Technology, Madras*

Mentor: Prof. Balaraman Ravindran

Explored the use of influencers in a hypergraph induced from a relational database using attribute values as candidate active learning points. <sup>10</sup>

### Wait-free Binary Search Tree

Jan 2014 – May 2014

- *Indian Institute of Technology, Madras*

Mentor: Prof. Shankar Balachandran

Designed a wait-free binary search tree that provided theoretical guarantees of wait freedom at the cost of periodic cleanup operations and a monitoring process. <sup>11</sup>

## PROFESSIONAL EXPERIENCE

---

### Amazon

Nov 2020 – Present

- *Sunnyvale, California*
  - Applied Scientist II at Alexa AI
  - Research areas: Open domain dialogue systems, Multimodal dialogue, general conversational AI research

### Google

May – Aug 2018

- *Mountain View, California*
  - Research intern in the Deep Dialogue team at Google Research.
  - Worked on designing end-to-end models to enable a robot to navigate follow natural language route instructions in simulated home environments.

### Facebook

June – Aug 2017

- *Menlo Park, California*
  - Research intern in Facebook Applied Machine Learning.
  - Evaluated different models for supervised training of a task-oriented dialog system

---

<sup>5</sup>The report can be found at <http://aishwaryap.github.io/ut/VRProject.pdf>

<sup>6</sup>The report can be found at <http://aishwaryap.github.io/ut/RLFDProject.pdf>

<sup>7</sup>The thesis can be found at <http://aishwaryap.github.io/iitm/BTPThesis.pdf>

<sup>8</sup>The report can be found at <http://aishwaryap.github.io/iitm/RLProject.pdf>

<sup>9</sup>The report can be found at <http://aishwaryap.github.io/iitm/NLPPProject.pdf>

<sup>10</sup>The report can be found at <http://aishwaryap.github.io/iitm/SocialNetworkAnalysisProject.pdf>

<sup>11</sup>The report can be found at <http://aishwaryap.github.io/iitm/ConcurrentProgrammingProject.pdf>

- **Adobe Research** May – July 2014  
*Bangalore, India*
  - Research intern with the goal of exploiting word usage patterns mined from Twitter data to personalize text of ad messages for different user segments.
  - Results patented and published at CICLing 2015, where we received the best paper award.
- **Google** May – July 2013  
*Bangalore, India*
  - Obtained through Google BOLD Programme for sophomore students.
  - Added a feature to the Google Trader application to enable users to save their searches.
  - Involved the use of map-reduce pipelines, remote procedure calls and dependency injections.
- **SAP Labs India** June – July 2012  
*Bangalore, India*
  - Web operations work - revamping the website for Charitra, a partner NGO of SAP.
  - Back-end: Java, Storage: HANA-DB - A corporate In-memory database, Front-end: HTML, CSS, Javascript

## PROFESSIONAL SERVICE

---

- **Conference Reviewing**
  - Association for Computational Linguistics (ACL) 2019, 2020
  - Conference on Empirical Methods in Natural Language Processing (EMNLP) 2019, 2020
  - Conference on Neural Information Processing Systems (NeurIPS) 2020
  - AAAI Conference on Artificial Intelligence (AAAI) 2019
  - Conference on Robot Learning (CoRL) 2019
  - Conference on Computational Natural Language Learning (CoNLL) 2019
- **Workshop Reviewing**
  - ACL Advances in Language and Vision Research (ALVR) 2020
  - NAACL Student Research Workshop (SRW) 2019
  - NAACL Grounded Communication for Robotics (RoboNLP) 2019

## DEPARTMENT SERVICE

---

- Organizer: UT Connecting Language Acquisition with Machine Perception Reading Group (Fall 2018 - Fall 2019)

## AWARDS

---

- **Swati / Jayalakshmi Memorial Award (2015)**: Female student with best academic record at the end of pre-final semester in the B.Tech programme, IIT Madras.
- **Kishore Vaigyanik Protsahan Yojana (2011)**: Fellowship awarded by the Department of Science and Technology, Govt. of India to promote interest in the basic sciences.

## COURSEWORK

---

- **Graduate** : Deep Learning Seminar, Reinforcement Learning, Natural Language Processing, Visual Recognition, Robot Learning From Demonstration, Semantics I, Semantics II, Distributed Computing, Advanced Networking Protocols
- **Undergraduate (AI related)** : Reinforcement Learning, Indexing and Searching in Large Datasets, Natural Language Processing, Data Mining, Social Network Analysis, Introduction to Machine Learning, Introduction to Game Theory, Computational Neuroscience
- **Undergraduate (Core Computer Science)**: Concurrent Programming, Distributed Algorithms, Principles of Software Engineering, Cryptography and Network Security, Computer Networks, Operating Systems, Introduction to Database Systems, Language Translators (Compilers), Topics in Design and Analysis of Algorithms, Data Structures and Algorithms, Language Machines and Computations, Computer Organization, Discrete Mathematics for Computer Science

- **Undergraduate (Mathematics):** Probability, Statistics and Stochastic Processes, Basic Graph Theory, Calculus I and II
- **Undergraduate (other):** Computer System Design, Advanced Operations Research, Fundamentals of Operations Research, Paradigms of Programming, Principles of Economics, Principles of Communication, Switching Theory and Digital Design

## SKILLS

---

- **Languages :** Python, C++, Matlab, PHP, Java
- **Toolkits/Software/Frameworks :** Tensorflow, Caffe, ROS