# Somak Aditya

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## RESEARCH INTERESTS

My current interests revolve around developing hybrid statistical and symbolic models that can perform higher-level reasoning by leveraging background knowledge. I am deeply motivated by interdisciplinary efforts and I am a believer of the deep potential impacts of the joint efforts of symbolic reasoning and probabilistic modeling in the field of Artificial Intelligence.

## EDUCATION

*Doctor of Philosophy*, Computer Science · **Arizona State University**, Tempe, AZ
Dissertation Title: Knowledge and Reasoning for Image Understanding · 2014-2018
Advisors: Prof. Chitta Baral, Dr. Yezhou Yang
GPA 4.0 (out of 4.0)

*Master of Engineering*, Computer Science · **Indian Institute of Science**, Bangalore
Dissertation Title: Generic Incremental K-Means Clustering · 2009-2011
Advisor: Professor M. Narasimha Murty
GPA 7.3 (out of 8.0), $2^{nd}$ in Class

*Bachelor of Engineering*, Computer Science · **Jadavpur University**, Kolkata
CGPA 8.87 (out of 10), $7^{th}$ in Class · 2005-2009

## PROFESSIONAL EXPERIENCE

| | |
|---|---|
| Nov 2021 – Present | Assistant Professor, IIT KGP Computer Science |
| Feb 2020 – Nov 2021 | Postdoctoral Researcher, Microsoft Research India |
| Sep 2018 – Feb 2020 | Research Scientist, Adobe Research India |
| May 2017 – Aug 2017 | Research Intern, Verisk Analytics, New Jersey |
| May 2015 – Aug 2015 | Research Intern, IBM Research Lab, India |
| Dec 2011 – Jul 2014 | Specialist Software III, Strand Life Sciences Pvt. Ltd., India |
| Jul 2011 – Nov 2011 | Senior Software Engineer, Yahoo R&D India |

## TEACHING EXPERIENCE

*Courses Taught, Department of Computer Science, IIT Kharagpur*

- CS60092 Information Retrieval                                    Spring 2021-22
- CS60010 Deep Learning (PGDBA)                            Spring 2021-22
- Programming and Data Structures Lab                    Spring 2021-22

*Teaching Assistant, Department of Computer Science, Arizona State University*    2014 –
2016

- CSE-576 Natural Language Processing                    Fall 2015 and 2016
- CSE-471 Introduction To Artificial Intelligence              Spring 2016
- CSE-310 Data Structures and Algorithms                      Spring 2015

## Grants, Fellowships, & Academic Achievements

| S.No | Name of Award | Awarding Agency | Year |
|------|---------------|-----------------|------|
| 1 | Google Cloud Credits Award (USD 5k) | Google India | 2022 |
| 2 | University Graduate Fellowship (USD 4k) | Arizona State University | 2018 |
| 3 | University Graduate Fellowship (USD 2.5k) | Arizona State University | 2017 |
| 4 | University Graduate Fellowship (USD 2k) | Arizona State University | 2016 |
| 5 | CIDSE Doctoral Fellowship (USD 15k) | Arizona State University | 2014 |
| 6 | MHRD Scholarship | MHRD, India | 2009 |
| 7 | GATE CS All India Rank 15 | GATE 2009 | 2009 |
| 8 | WBJEE Engg Rank 105 | WBJEE 2005 | 2005 |

## Patents

1. Somak Aditya and Atanu Sinha. Creating a knowledge graph based on text-based knowledge corpora. 2021 (Filed 2019, *Pending USPTO 16656163*)

2. Somak Aditya, Kushal Chawla, Sharmila Reddy Nangi, Abhinav Mishra, Bhavy Khatri and Pranil Joshi. Predicting joint intent-slot structure. 2021 (Filed 2019, *Pending USPTO 16797164*)

## Publications

### Journals

[1] Somak Aditya, Yezhou Yang, Chitta Baral, Yiannis Aloimonos, and Cornelia Fermüller. "Image Understanding using Vision and Reasoning through Scene Description Graph". In: *Computer Vision and Image Understanding (CVIU)* (2017). ISSN: 1077-3142. DOI: https://doi.org/10.1016/j.cviu.2017.12.004.

## Conference Proceedings

[1] Karthikeyan K, Shaily Bhatt, Pankaj Singh, Somak Aditya, Sandipan Dandapat, Sunayana Sitaram, and Monojit Choudhary. "Multilingual CheckList: Generation and Evaluation". In: arXiv, 2022. DOI: 10.48550/ARXIV.2203.12865.

[2] Anirudh Srinivasan, Gauri Kholkar, Rahul Kejriwal, Tanuja Ganu, Sandipan Dandapat, Sunayana Sitaram, Balakrishnan Santhanam, Somak Aditya, Kalika Bali, and Monojit Choudhury. "LITMUS Predictor: An AI Assistant for Building Reliable, High-Performing and Fair Multilingual NLP Systems". In: *AAAI Demonstrations 2022*. AAAI. 2022.

[3] Vishesh Agarwal, Somak Aditya, and Navin Goyal. "Analyzing the Nuances of Transformers' Polynomial Simplification Abilities". In: *MATH-AI Workshop*. ICLR. May 2021.

[4] Karthikeyan K, Aalok Sathe, Somak Aditya, and Monojit Choudhury. "Analyzing the Effects of Reasoning Types on Cross-Lingual Transfer Performance". In: *Multilingual Representation Learning Workshop*. EMNLP. Nov. 2021.

[5] Pratik Joshi*, Somak Aditya*, Aalok Sathe*, and Monojit Choudhury. "TaxiNLI: Taking a Ride up the NLU Hill". In: *CoNLL*. Nov. 2020, pp. 41–55.

[6] Somak Aditya and Atanu Sinha. "Uncovering Relations for Marketing Knowledge Representations". In: *StarAI Workshop, AAAI 2020*. 2020.

[7] Somak Aditya, Rudra Saha, Yezhou Yang, and Chitta Baral. "Spatial knowledge distillation to aid visual reasoning". In: *2019 IEEE WACV*. IEEE. 2019, pp. 227–235.

[8] Somak Aditya, Yezhou Yang, and Chitta Baral. "Integrating Knowledge and Reasoning in Image Understanding". In: *IJCAI, 2019*. 2019.

[9] Somak Aditya, Yezhou Yang, and Chitta Baral. "Explicit Reasoning over End-to-End Neural Architectures for Visual Question Answering". In: *AAAI 2018*. 2018.

[10] Somak Aditya, Yezhou Yang, Chitta Baral, and Yiannis Aloimonos. "Combining knowledge and reasoning through probabilistic soft logic for image puzzle solving". In: *UAI 2018*. 2018, pp. 238–248.

[11] Somak Aditya. "Explainable Image Understanding Using Vision and Reasoning". In: *AAAI 2017 Doctoral Consortium*. AAAI Press, 2017, pp. 5028–5029.

[12] Somak Aditya, Chitta Baral, Yezhou Yang, Yiannis Aloimonos, and Cornelia Fermuller. "DeepIU: An Architecture for Image Understanding". In: *Advances of Cognitive Systems*. 2016.

[13] Somak Aditya, Yezhou Yang, Chitta Baral, Cornelia Fermuller, and Yiannis Aloimonos. "Visual Commonsense for Scene Understanding Using Perception, Semantic Parsing and Reasoning". In: *2015 AAAI Spring Symposium Series*. 2015.

[14] Somak Aditya, Chitta Baral, Nguyen H Vo, Joohyung Lee, Jieping Ye, Zaw Naung, Barry Lumpkin, Jenny Hastings, Richard Scherl, Dawn M Sweet, et al. "Recognizing social constructs from textual conversation". In: *NAACL*. 2015.

[15] Arpit Sharma, Nguyen H Vo, Somak Aditya, and Chitta Baral. "Towards addressing the winograd schema challenge: building and using a semantic parser and a knowledge hunting module". In: *IJCAI*. AAAI Press. 2015, pp. 1319–1325.

[16] Arpit Sharma, Nguyen Vo, Somak Aditya, and Chitta Baral. "Identifying various kinds of event mentions in k-parser output". In: *EVENTS Workshop, NAACL.* 2015, pp. 82–88.

**Informal Publications**

[1] Ishan Tarunesh, Somak Aditya, and Monojit Choudhury. "Trusting RoBERTa over BERT: Insights from CheckListing the Natural Language Inference Task". 2021.

[2] Ishan Tarunesh, Somak Aditya, and Monojit Choudhury. "LoNLI: An Extensible Framework for Testing Diverse Logical Reasoning Capabilities for NLI". 2021.

[3] Somak Aditya, Yezhou Yang, Chitta Baral, Cornelia Fermuller, and Yiannis Aloimonos. "From Images to Sentences through Scene Description Graphs using Commonsense Reasoning and Knowledge". 2015.

## INVITED TALKS & SEMINARS

📄 *Evolution of Representation and Reasoning in the Era of Deep Learning*   *2022*
Rakuten Institute of Technology
📄 *Inspirations from Logic and Language to (Re)Evaluate NLP Systems*   *2021*
Microsoft Research India Speech & NLP Group
📄 *The Pervasiveness of Reasoning from Images to Text*   *2021*
MILA Philosophy of NLP Reading Group
📄 *The Interplay between Deep Learning, Logic, and Reasoning*   *2021*
CSIR and IEEE SPS Deep Learning Summer School
📄 *Explicit Knowledge and Reasoning in the era of Deep Learning*   *2021*
IIT Hyderabad CSE+AI Faculty Candidate Seminar
📄 *Explicit Knowledge and Reasoning in the era of Deep Learning*   *2021*
IIT Kharagpur CSE+AI Faculty Candidate Seminar

## CONFERENCE PRESENTATIONS

📄 *TaxiNLI: Taking a ride up the NLU Hill*   *2020*
CoNLL 2020 Talk
📄 *Integrating Knowledge and Reasoning in Image Understanding*   *2019*
Macau, China, IJCAI 2019 Talk and Poster
📄 *Combining Knowledge and Reasoning through Probabilistic Soft Logic for Image Puzzle Solving*   *2018*
Monterey, California, UAI 2018 Talk and Poster
📄 *Explicit Reasoning over End-to-End Neural Architectures*   *2018*
Hilton, New Orleans, Louisiana, AAAI 2018 Technical Talk
📄 *Explicit Reasoning over End-to-End Neural Architectures*   *2018*

Arizona State University, Tempe, USA, 2018 Southwest Robotics Symposium

📄 *Explainable Image Understanding using Vision and Reasoning*      *2016*
Hilton Union Square, San Fransisco, CA, USA, AAAI 2017 Doctoral Consortium

📄 *Visual Commonsense for Scene Understanding Using Perception,*      *2015*
*Semantic Parsing and Reasoning*
Stanford University, California, USA, 2015 AAAI Spring Symposium Series

## PROFESSIONAL SERVICES

- Organizer

  - CVPR 2022: Open-Domain Retrieval Under a Multi-Modal Setting* (proposal accepted). (with colleagues from Arizona State University, FAIR, DeepMind, Microsoft Azure, IDIAP)

  - IndoML 2021 & 2022: Second and Third Edition of Indian Symposium on Machine Learning (with colleagues from IIT Gandhinagar, IIT KGP, Google Research, Univ. Warwick; http://indoml.in/).

  - CIKM 2021: Knowledge Injection in Neural Networks (with colleagues from Intel Labs, University of College London, Arizona State University; https://sites.google.com/view/kinn2021/)

  - IJCAI 2021: Is Neuro-symbolic SOTA still a myth for Natural Language Inferencing (with colleagues from IBM Research, KU Leuven, MSR India, UT Austin; https://nsnli.github.io/)

  - KR 2018: Integrating learning of Representations and models with deductive Reasoning that leverages Knowledge (https://sites.google.com/view/r2k2018/home)

- Panelist: IJCAI 2019 Doctoral Consortium Career Panel

- Senior PC Member: AAAI (2023)

- PC Member: ACML (2022), EMNLP, ACL, AAAI, IJCAI (2020, 2021, 2022); NAACL, EACL (2021), IEEE MASS 2022

  - Workshops: MathAI4ED Workshop NeurIPS 2021, MathAI Workshop ICLR 2021, LANTERN-COLING (2020, 2021), Cognitive Vision 2019 (ACS at MIT)

- Conference Reviewer: ICRA (2020), IJCAI (2017, 2016)

- Journal Reviewer: ACML Journal Track, IEEE TIP, AIJ, CVIU, The Visual Computer, Robotics and Autonomous Systems (RAS), Pattern Recognition, Neurocomputing

## PROJECTS (During PostDoc)

*Natural Language Inferencing: Evaluation and Enhancement*
Advisors: Dr. Monojit Choudhury      Microsoft Research India
The aim is to propose fine-grained evaluation of Natural Language Inference systems

across well-defined Linguistic and Logical capabilities. Through extensive evaluation, we aspire to expose if Neural Network-based systems trained using the current data-driven paradigm is fundamentally insufficient across certain reasoning capabilities, and whether Neuro-symbolic mechanisms can step in to fill the void.

*Interactive Evaluation and Explanation*
Collaborators: Dr. Monojit Choudhury, Dr. Amit Deshpande     Microsoft Research India
Interactive prover systems provide a framework where verifier and prover interact to find a proof. Such interactive protocols may inspire human-machine interactions to find related errors of language models based on a set of given errors, behavioral performance (such as CheckList report-card) and the model API. Similar interaction can be enabled to find post-hoc example-based explanations.

*Symbolic Reasoning abilities of Deep Neural Networks*
Collaborators: Dr. Navin Goyal                     Microsoft Research India
Automated Theorem Proving and symbolic Mathematics tasks presents very specific well-defined challenges. For example, a step in an integration may involve finding a sub-expression to operate, finding the next operation, and executing the operation on a mathematical expression to output new expression. Transformers and Graph Neural Nets have performed impressively, but there is to much to learn about its strengths and short-comings. The goal here is to extensively evaluate the state-of-the-art architectures on synthetic symbolic tasks and propose informed enhancements based on the evaluation.

# PROJECTS (During PhD)

*Understanding images and videos using a combination of Computer Vision, Statistical and Logical Reasoning*
Advisors: Prof. Chitta Baral, Dr. Yezhou Yang          Arizona State University
Collaborator: Prof. Yiannis Aloimonos       University of Maryland, College Park
i) Solving Image Riddles using Vision and Reasoning, ii) Visual Question Answering using Deep Learning and Probabilistic Soft Logic, iii) Image Caption Generation Through Knowledge Graphs from Images, iv) Integrating Spatial Knowledge for Visual Reasoning

*Compositional and Generative modeling of Images from text*
Advisors: Dr. Yezhou Yang                    Arizona State University
Collaborator: Dr. Maneesh Kr. Singh            Verisk Analytics, New Jersey
The goal of the project is to learn a generative model of natural images that abides by properties of compositionality with respect to an input condition (text or features).

*Building a Knowledge Parser for Formal Representation of English Text*
Advisor: Prof. Chitta Baral                      Arizona State University
Parsing Natural Language Text and Creating a Knowledge Graph using a combination of Rule-based and Machine Learning Techniques.

*Integrating Statistical and Logical Approaches in Recognizing Social Constructs from Textual Conversation*

Advisor: Prof. Chitta Baral                                    Arizona State University

Our goal was to recognize high-level social constructs such as Leadership and Status from textual conversation using an approach that integrates statistical methods and symbolic logic based methods.

## REFERENCES

**Prof. Chitta Baral**
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Arizona State University.
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**Prof. Yezhou Yang**
Assistant Professor
Arizona State University.
✉ yz.yang@asu.edu

**Prof. Yiannis Aloimonos**
Professor
University of Maryland, College Park.
✉ yiannis@cs.umd.edu

**Dr. Monojit Choudhury**
Principal Researcher
Microsoft Research India
✉ monojitc@microsoft.com