

# Somak Aditya

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## RESEARCH INTERESTS

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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

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*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<sup>nd</sup> in Class

*Bachelor of Engineering*, Computer Science **Jadavpur University**, Kolkata  
CGPA 8.87 (out of 10), 7<sup>th</sup> in Class 2005-2009

## PROFESSIONAL EXPERIENCE

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Nov 2021 – Present	Assistant Professor (Grade I), 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

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Assistant Professor, Department of Computer Science, IIT Kharagpur 2021 - Present

- Autumn 2023: **CS60050** Machine Learning (156 students; with Prof. Sudeshna Sarkar), **CS19003** PDS Lab
- Spring 2023: **CS60092** Information Retrieval (72 students), **CS19003** PDS Lab
- Autumn 2022: **CS10003** Programming and Data Structures Theory (**196** students), **CS19003** PDS Lab (99 Students)
- Spring 2022: **CS60092** Information Retrieval (70 students), **CS19003** PDS Lab (92 Students), **CS60010** Deep Learning (PGDBA) (with Prof. Sudeshna Sarkar)

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

- Fall 2015 and 2016: CSE-576 Natural Language Processing (100 students), Spring 2016: CSE-471 Introduction To Artificial Intelligence (100 students), Spring 2015: CSE-310 Data Structures and Algorithms (150 students)

## 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

## RESEARCH GRANTS

- Microsoft Accelerate Foundation Models Grant (2023) (USD 10000, *May-Dec '23*)
- Learning from Rules and Data for Image Analytics - SERB SRG (INR 26.5L, *Sep '22*)
- The Role of Feedback in Vision-Language enabled Embodied Agents towards Application to Disaster Management - IIT KGP FSRG (INR 25L, Approved *Jan 2023*, Sanctioned *Mar 2023*)
- Toloka AI Annotation grant USD 300, *Jan 2023*

## 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 Inference (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
- Area Chair: EMNLP 2023
- Senior PC Member: AAAI (2024, 2023)
- PC Member: ECAI (2023), ICLR (2023), ACML (2022), ARR, EMNLP, ACL, AAAI, IJCAI (2020, 2021, 2022, 2023); NAACL, EACL (2021), IEEE MASS 2022
  - Workshops: MathAI4ED Workshop NeurIPS 2021, MathAI Workshop (NeurIPS 2022, 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

## Patents

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1. Somak Aditya and Atanu Sinha. [Creating a knowledge graph based on text-based knowledge corpora](#). 2021 (Filed 2019, *Granted 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, *Granted USPTO 11475220*)

## Publications

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### Journals

- [1] Ishan Tarunesh, Somak Aditya, and Monojit Choudhury. “LoNLI: An Extensible Framework for Testing Diverse Logical Reasoning Capabilities for NLI”. In: *Language Resources and Evaluation (LREV) - In Print* (2023). URL: <https://arxiv.org/abs/2112.02333>.

- [2] 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] Deepanway Ghosal, Somak Aditya, and Monojit Choudhury. “Generating Intermediate Steps for NLI with Next-Step Supervision”. In: *AACL-IJCNLP (Long Paper)*, 2023. doi: [10.48550/ARXIV.2208.14641](https://arxiv.org/abs/2208.14641). URL: <https://arxiv.org/abs/2208.14641>.
- [2] Pengfei Hong, Rishabh Bhardwaj, Navonil Majumdar, Somak Aditya, and Soujanya Poria. “ReMask: A Robust Information-Masking Approach for Domain Counterfactual Generation”. In: *ACL (Long Paper)*, 2023. arXiv: [2305.02858](https://arxiv.org/abs/2305.02858) [cs.CL].
- [3] Atharva Naik, Soumitra Das, Jyothi Vedurada, and Somak Aditya. “SYNC: Efficient Neural Code Search Through Structurally Guided Hard Negative Curricula”. In: *AACL-IJCNLP (Long Paper)*, 2023.
- [4] Deepanway Ghosal, Somak Aditya, Sandipan Dandapat, and Monojit Choudhary. “Vector Space Interpolation for Query Expansion”. In: *AACL-IJCNLP (Short Paper)*, 2022.
- [5] Karthikeyan K, Shaily Bhatt, Pankaj Singh, Somak Aditya, Sandipan Dandapat, Sunayana Sitaram, and Monojit Choudhary. “Multilingual CheckList: Generation and Evaluation”. In: *AACL-IJCNLP Findings (Long Paper)*, 2022. doi: [10.48550/ARXIV.2203.12865](https://arxiv.org/abs/2203.12865).
- [6] 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.
- [7] Vishesh Agarwal, Somak Aditya, and Navin Goyal. “Analyzing the Nuances of Transformers’ Polynomial Simplification Abilities”. In: *MATH-AI Workshop*. ICLR. May 2021.
- [8] 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.
- [9] Pratik Joshi\*, Somak Aditya\*, Aalok Sathe\*, and Monojit Choudhury. “TaxiNLI: Taking a Ride up the NLU Hill”. In: *CoNLL*. Nov. 2020, pp. 41–55.
- [10] Somak Aditya and Atanu Sinha. “Uncovering Relations for Marketing Knowledge Representations”. In: *StarAI Workshop, AAAI 2020*. 2020.
- [11] 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.
- [12] Somak Aditya, Yezhou Yang, and Chitta Baral. “Integrating Knowledge and Reasoning in Image Understanding”. In: *IJCAI, 2019*. 2019.

- [13] Somak Aditya, Yezhou Yang, and Chitta Baral. “Explicit Reasoning over End-to-End Neural Architectures for Visual Question Answering”. In: *AAAI 2018*. 2018.
- [14] 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.
- [15] Somak Aditya. “Explainable Image Understanding Using Vision and Reasoning”. In: *AAAI 2017 Doctoral Consortium*. AAAI Press, 2017, pp. 5028–5029.
- [16] Somak Aditya, Chitta Baral, Yezhou Yang, Yiannis Aloimonos, and Cornelia Fermuller. “DeepIU: An Architecture for Image Understanding”. In: *Advances of Cognitive Systems*. 2016.
- [17] 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.
- [18] 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.
- [19] 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.
- [20] 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] 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

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📖 <i>AI Hype &amp; Progress under the Lens of Reasoning</i> Ashoka University AI @ ASHOKA Workshop	2023
📖 <i>Evolution of Representation and Reasoning in the Era of Deep Learning</i> Rakuten Institute of Technology	2022
📖 <i>Inspirations from Logic and Language to (Re)Evaluate NLP Systems</i> Microsoft Research India Speech & NLP Group	2021
📖 <i>The Pervasiveness of Reasoning from Images to Text</i> MILA Philosophy of NLP Reading Group	2021
📖 <i>The Interplay between Deep Learning, Logic, and Reasoning</i> CSIR and IEEE SPS Deep Learning Summer School	2021

📖 <i>Explicit Knowledge and Reasoning in the era of Deep Learning</i> IIT Hyderabad CSE+AI Faculty Candidate Seminar	2021
📖 <i>Explicit Knowledge and Reasoning in the era of Deep Learning</i> IIT Kharagpur CSE+AI Faculty Candidate Seminar	2021

## PROJECTS (During PostDoc)

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### *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 too much to learn about its strengths and shortcomings. 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)

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### *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

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### **Prof. Chitta Baral**

Professor & Chair  
Arizona State University.  
✉ [chitta@asu.edu](mailto:chitta@asu.edu)

### **Prof. Yezhou Yang**

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Arizona State University.  
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### **Prof. Yiannis Aloimonos**

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### **Dr. Monojit Choudhury**

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Scientist  
Turing (Microsoft) India  
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