Arkil **Patel**

Research Fellow, Microsoft Research

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Interests

Natural Language Processing, Machine Learning

Education

July 2020 | **Birla Institute of Technology and Science Pilani** | **Goa, India**
Aug 2016 | B.E. (Hons.), Computer Science | CGPA : 9.03/10
Graduated with *Distinction*, Department *Top 10%*

Experience

Present | **Microsoft Research** | **Bangalore, India**
May 2021 | *Research Fellow | Advisor: Dr. Navin Goyal*
Developing models capable of generalizing compositionally on semantic parsing tasks. Also designing modular models that can generalize systematically on grounded language understanding tasks.

Aug 2020 | *Research Intern | Advisor: Dr. Navin Goyal*
Worked on a semantic parsing task: automatically solving math word problems. Analyzed the capabilities of state-of-the-art neural models and exposed the deficiencies in existing datasets.

Dec 2019 | **Microsoft Research** | **Bangalore, India**
Jun 2019 | *Research Intern | Advisor: Dr. Navin Goyal*
Worked on theoretically analysing the abilities of Transformers. Also worked on developing models for semantic parsing.

Jul 2018 | **Bhaskaracharya Institute for Space Applications and GeoInformatics** | **Gandhinagar, India**
May 2018 | *Summer Research Intern | Advisor: Krunal Patel*
Designed an application to extract text from a low quality image of a newspaper article. Extended the application with a custom Named Entity Recognizer to show important information from the text.

Publications

Revisiting the Compositional Generalization Abilities of Neural Sequence Models [pdf]
Arkil Patel, Satwik Bhattamishra, Phil Blunsom, Navin Goyal
Under Review at ACL 2022

Are NLP Models really able to Solve Simple Math Word Problems? [pdf] [code]
Arkil Patel, Satwik Bhattamishra, Navin Goyal
2021 Conference of North American Chapter of the Association for Computational Linguistics [NAACL'21]

On the Computational Power of Transformers and Its Implication in Sequence Modeling [pdf] [code]
Satwik Bhattamishra, Arkil Patel, Navin Goyal
2020 Conference on Computational Natural Language Learning [CoNLL'20]

VehicleChain: Blockchain-based Vehicular Data Transmission Scheme for Smart City [pdf]
Arkil Patel, Naigam Shah, Trupil Limbasiya, Debasis Das
2019 IEEE International Conference on Systems, Man and Cybernetics **[Oral]** [SMC'19]

Selected Projects

Analysing the Compositional Generalization capabilities of Neural Sequence Models Sep'21 - Present
Project Advisor: *Dr. Navin Goyal*

- Showed that neural sequence models such as LSTMs and Transformers do have some inductive biases that enable them to generalize compositionally in the setting defined by SCAN, Colors and COGS datasets.
- Examined the learned embeddings of models to understand how they are able to generalize.
- Investigated the extent to which the bias exists by experimenting with different training distributions, model capacities and analysing transferability. Word under submission at **ACL'22**.

Span-based Incremental Parsing for Compositional Generalization May'21 - Present

Project Advisor: *Dr. Navin Goyal*

- Designed a method that traverses the input sequence one span at a time and incrementally generates the output.
- Our proposed method only attends to the local context that is relevant for generating each output block and provides a compositional inductive bias.
- Our method performs competitively when compared to state-of-the-art models on several compositional generalization benchmarks such as COGS, SyGNS and SCAN.

Grounded Language Understanding Jul'21 - Present

Project Advisor: *Dr. Navin Goyal*

- Exploring the domain of situated language learning.
- Designing modular models that can solve systematic generalization in grounded language understanding tasks such as gSCAN and ReaSCAN.

Semantic Parsing: Automatically Solving Math Word Problems Jun'19 - Present

Project Advisor: *Dr. Navin Goyal*

- Currently working on building robust and interpretable models to automatically solve math word problems.
- Conducted various experiments to show that existing models rely on shallow heuristics to solve the problem. Also created a challenge set to enable better evaluation of models. Work published at **NAACL'21**.

Neuroscience inspired modelling for NLP Jan'20 - May'20

Project Advisor: *Prof. Basabdatta Bhattacharya*

- Studied Spiking Neural Networks (SNNs) and explored their applications.
- Implemented a Recurrent SNN architecture on a sentence classification task.

Blockchain Based Data Transmission Scheme for VANETs May'18 - Jan'19

Project Advisor: *Dr. Debasis Das*

- Designed a novel protocol for secure communications in a vehicular ad-hoc network (VANET).
- The proposed protocol uses a blockchain with ECC encryption for higher security at lower computational cost.
- Our paper for this work was accepted for oral presentation at **IEEE SMC'19**.

Teaching Assistantship

May 2020 **January 2020**	**Neural Networks and Fuzzy Logic** *Instructor-in-charge: Prof. Basabdatta Sen Bhattacharya* Responsible for conducting tutorials for teaching the theory behind Deep Learning models. Also responsible for teaching implementation of DL models in PyTorch and designing the programming assessments.	**BITS F312**
May 2019 **January 2019**	**Data Mining** *Instructor-in-charge: Prof. Hemant Rathore* Responsibilities included conducting the programming tutorials to teach implementation of ML algorithms and designing the programming assessments.	**CS F415**
May 2019 **January 2019**	**Database Systems** *Instructor-in-charge: Prof. Debasis Das* Assisted the faculty in conducting labs for a class of 200+ students and designed the questions for regular lab assessments as well as the final lab evaluation.	**CS F212**

Honours and Awards

2016 - 2020	**Institute Merit Scholarship,** awarded to top 10% students in the batch	BITS Goa, India
2012 - 2020	**National Talent Search Scholarship,** awarded to top 1000 students in the country	New Delhi, India

Skills

Languages	Python, C++, C, Java, SQL, MATLAB, Verilog
Frameworks	PyTorch, TensorFlow, Keras
Relevant Coursework	Machine Learning, Neural Networks and Fuzzy Logic, Data Mining, Data Structures and Algorithms, Object Oriented Programming, Linear Algebra, Probability and Statistics, Multivariate Calculus, Discrete Mathematics

Academic Service

Reviewer	ACL Rolling Review, AAAI-2022
Sub-Reviewer	EMNLP-2021, NAACL-2021