Hossein Rajaby Faghihi

PH.D. NATURAL LANGUAGE PROCESSING RESEARCH SCIENTIST

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https://scholar.google.com/citations?user=S-GLfiIAAAAJ

Education

Michigan State University - Ph.D. in Computer Science — *Michigan, USA - Aug 2019 - Present*

- **Advisor**: Dr. Parisa Kordjamshidi **GPA**: 4.0 **Thesis:** Exploiting Semantic Structures toward Procedural Reasoning on Text

Sharif University of Technology - Ms.C. in Computer Engineering — *Tehran, Iran - Aug 2016 - Aug 2018*

- **Thesis:** A Framework for situation recognition in Smart Environments

AmirKabir University of Technology - Bs.C. in Computer Science — *Tehran, Iran - Aug 2012 - Aug 2016*

- **GPA**: 3.94 Best Student Award in Computer Science

Work Experience

Michigan State University - Graduate Research Assistant — *Michigan, USA - Aug 2019 - Present*

- Led a team of more than 12 researchers in designing and implementing a neuro-symbolic framework using PyTorch, leveraging Declarative Learning-Based Programming language to integrate domain knowledge into neural networks effectively.
- Developed cutting-edge models to enhance the comprehension of procedural texts by pretrained language models, resulting in improved procedural reasoning capabilities.
- Created and curated challenging tasks and datasets to evaluate language models' spatial reasoning capabilities.
- Employed language models (Roberta, T5, GPT-X) and adapted them to solve complex reasoning tasks.
- Published more than 6 lead-authored research papers at major conferences, such as NAACL 2021, EMNLP 2021, ACL 2020, AAAI 2023, and EACL 2023.

Apple Inc. - Research Intern — *Seattle, USA - May 2022 - August 2022*

- Improving the performance of existing models for Siri intent detection by 30% through various techniques. This involved addressing data imbalance, applying data clustering based on sentence representations, and leveraging language models.
- Contributed to the development of novel data augmentation techniques to enhance the performance and robustness of Siri intent detection.

Dataminr - Research Intern — *Remote, USA - May 2021 - August 2021*

- Led the design and implementation of a knowledge-based clustering pipeline for timeline extraction and summarization of local crisis events on Twitter.
- Published a groundbreaking paper as the lead author at EMNLP 2022, introducing a novel timeline extraction method and benchmark.

Recent Projects

Michigan State University - DomiKnows: Declarative Learning-based Programming — *- Aug 2019 - Present*

- Designed DomiKnowS, a declarative learning-based programming framework. DomiKnowS integrates prior domain knowledge into neural networks to enhance their performance and ensure their reliability.
- Developed built-in functionalities and a shared interface for seamless integration of more than 5 knowledge integration methods.
- Utilized Python, PyTorch, OWL, Integer Linear Programming, Gurobi, and other technologies to build and enhance the framework.
- Demonstrated significant improvements in over 12 tasks by integrating prior domain knowledge into deep neural architectures.

Michigan State University - Neuro-Symbolic Procedural Reasoning — *- Dec 2019 - Present*

- Developed novel neuro-symbolic methods for tracking entities in procedural instructions using datasets such as Propara, Recipes, and RecipeQA.
- Explored techniques to enhance language models' comprehension of temporal and sequential information in procedural texts, including encoding time-relevance, proposing novel matching mechanisms, leveraging multi-modal correlations, and integrating semantic parsing with neural models.
- Conducted research on concept understanding and consistency in large text generation models for procedural reasoning.

Dataminr - Crisis Timeline Extraction and Summarization — *- May 2021 - July 2022*

- Implemented a combination of information extraction, clustering, and classification techniques to effectively extract and summarize crisis timelines.

Michigan State University - Spatial Reasoning with Large Language Models — *- Jan 2020 - Aug 2020*

- Developed an automatically generated dataset for enhancing the spatial reasoning ability of pretrained language models through transfer learning.
- Curated the first human evaluation set for this task.

Skills

AI	Logical Reasoning, Machine Learning, Deep Learning, Natural Language Processing, Graph-based ML, Integer Linear Programming, Transformers, Large Language Models (LLMs), Generative AI, Neuro-Symbolic AI
NLP & Vision	Prompt Engineering and Tuning, In-Context Learning, LangChain, Multi-Modal Learning, Temporal and Spatial Reasoning, Semantic Parsing, Common-Sense Reasoning, Information Retrieval, Question-Answering, Neural Module Learners
ML Frameworks	PyTorch, TensorFlow, Hugging Face, Pytorch-Geometric, Scallop, ProbLog
Programming & Tools	Python, Java, C++, JavaScript, MySQL, PostgreSQL, MongoDB, Redis, Git, Docker

Recent Publications

- The Role of Semantic Parsing in Understanding Procedural Text, H Faghihi et al. *(EACL'23)*
- GLUECons: A Generic Benchmark for Learning Under Constraints, H Faghihi et al. *(AAAI'23)*
- CrisisLTLSum: A Benchmark for Local Crisis Event Timeline Extraction and Summarization, H Faghihi et al. *(EMNLP'22)*
- DomiKnowS: A Library for Integration of Symbolic Domain Knowledge in Deep Learning, H Faghihi et al. *(EMNLP'21)*
- TSLM: Teaching Language Models to Understand The Flow of Events, H Faghihi et al. *(NAACL'21)*
- SPARTQA: A Textual Question Answering Benchmark for Spatial Reasoning, R Mirzaee, H Faghihi et al. *(NAACL'21)*
- Latent Alignment of Procedural Concepts in Multimodal Recipes, H Faghihi et al. *(ALVR Workshop ACL'20)*
- Inference-Masked Loss for Deep Structured Output Learning, Q Guo, H Faghihi et al. *(IJCAI'20)*