

## Education

### IUST • Iran University of Science and Technology

Tehran, Iran : 2019 - present

#### M.Sc. IN COMPUTER ENGINEERING MAJOR : ARTIFICIAL INTELLIGENCE

- Co-supervised by Prof. Mohammad Taher Pilehvar and Prof. Behrouz Minaei.
- Thesis: Analyzing the geometry of embedding space in transformer-based models.

### IUST • Iran University of Science and Technology

Tehran, Iran : 2014 - 2019

#### B.Sc. IN COMPUTER ENGINEERING MAJOR : COMPUTER NETWORKING

- Supervised by Prof. Vesal Hakami.
- Thesis: Optimizing Content Placement in Cache-enabled Small Base Stations: A Game Theoretic Multi-agent Learning Approach.

## Research Interests

- Natural Language Processing
- Natural Language Understanding (NLU)
- Robustness of NLP models
- Analysis and Interpretability of Deep models
- Representation Learning

## Publications

- **Sara Rajaei**, and Mohammad Taher Pilehvar. "An Isotropy Analysis in the Multilingual BERT Embedding Space." 2021, [pre-print].
- Houman Mehrafarin\*, **Sara Rajaei**\*, and Mohammad Taher Pilehvar. "On the Importance of Data Size in Probing Fine-tuned Models." 2021, [pre-print].
- **Sara Rajaei**, and Mohammad Taher Pilehvar. "How Does Fine-tuning Affect the Geometry of Embedding Space: A Case Study on Isotropy." Accepted in the 2021 Conference on Empirical Methods in Natural Language Processing (**Findings of EMNLP 2021**), [pdf].
- **Sara Rajaei**, and Mohammad Taher Pilehvar. "A Cluster-based Approach for improving Isotropy in Contextual Embedding Space." Accepted in the 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing (**ACL-IJCNLP 2021, Oral presentation**), [pdf].
- Zahra Rashidi, Vesal Hakami, Parmida Granmayeh, **Sara Rajaei**. "Multi-Agent Learning Algorithms for Content Placement in Cache-Enabled Small Cell Networks: 4G and 5G Use Cases." 2021, [pre-print].

\*: *Equal contribution.*

## Research Experience

### Graduate Research Assistance :

NLP Lab, IUST

Feb 2020 - present

- Working on robustness of pre-trained Language Models (LMs)
- Working on probing linguistic knowledge in LMs
- Working on Analyzing the geometry of contextual embedding space
- Supervised by Prof. Mohammad Taher Pilehvar

### Research Assistance :

Institute for Research in Fundamental Sciences (IPM)

Jun - Jul 2021

- Worked on the adversarial attacks and robustness of NLP models
- Supervised by Prof. Mohammad Sabokrou

### Undergraduate Research Assistant :

Computer Networks Lab, IUST

Jul 2019 - April 2020

- Formulating the content placement problem in cache-enabled small cell networks as a potential game.
- Implementing reinforcement learning algorithms for the incomplete information environment.
- Proposing a multi-agent approach for content placement.
- Supervised by Prof. Vesal Hakami

### Undergraduate Research Assistant :

Information Technology Lab, IUST

Oct 2015 - Feb 2017

- Worked on Computational offloading in Mobile Cloud Computing
- Developed a benchmark including an android application and a server-side service.
- Supervised by Prof. Zeinab Movahedi

## Teaching Experience

### Head Teaching Assistant :

IUST

Sep 2021 - present

- Natural Language Processing (Instructor: Dr. Minaei)
  - Gave a lecture on seq2seq models, transformers, and advanced topics in NLP.
- Neural Networks (Instructor: Dr. Mozayani)

### Teaching Assistant :

Neuromatch academy Deep Learning (NMA-DL) summer school

Aug 2021

- Mentored 7 groups on several Deep Reinforcement Learning projects

### Graduate Teaching Assistant :

IUST

Feb - Jul 2021

- Deep learning (Instructor: Dr. Mohammadi)
- Game theory (Instructor: Dr. Hakami)
- Advanced topics in data mining (Instructor: Dr. Minaei)

### Head Teaching Assistant :

IUST

Sep 2020 - Feb 2021

- Neural Networks (Instructor: Dr. Mozayani)
- Natural Language Processing (Instructor: Dr. Minaei)
  - Gave a lecture on seq2seq models, transformers, and advanced topics in NLP.

## Industrial Experience

### Full stack developer :

Amid Rayaneh Sharif Co. (ARSH)

Jul 2018 - Oct 2018

- SIMAP project developer (The biggest research information management system of faculty members in Iran used in prestigious universities, research institutes, and scientific and research centers)

### Student Internship :

Arya Hamrah Samaneh Co. (AHS)

Jun - Sep 2017

- Worked on Cloud Computing Services

## Selected Projects

### Adaptive pruning in transformer-based models

Summer 2021 - present

- Working on the over-parameterized NLP models to decrease the inference time.
- Proposing a novel approach to prune large pre-trained models based on individual samples.
- Combination of several pruning strategies, including token and dimension pruning.
- The proposed approach can be used layer-wise or as a global supervisor to prune large models.

### Transfer Learning in NLP

Spring 2020

- We proposed and implemented two extensions to the adapter module (Houlsby et al.) to investigate the effect of parameter sharing of adapters across BERT model.
- Our proposed approaches have even fewer parameters with comparable performance on 21 tasks compared to the original one.
- The code, report, and pre-trained adapters for designing new experiments are available here.

### Word Sense Disambiguation in BERT

Winter 2020

- We implemented the approach introduced by Huang et al. (2019) and validated the results on different datasets.
- We investigated the proposed approach in different settings and models, such as XLNet and RoBERTa.
- Our results demonstrate the outstanding benefits of using external knowledge resources on WSD task.

## Certificates

### Fifth IPM Advanced School on Computing: Artificial Intelligence

Sep 2021

- by Institute for Research in Fundamental Sciences, Iran

### Mexican NLP Summer School 2021

Jun. 2021

- Co-located event with NAACL 2021, online

### Fourth IPM Advanced School on Computing: Artificial Intelligence

Aug 2020

- by Institute for Research in Fundamental Sciences, Iran

### Resource-aware Machine Learning - 5th International Summer School

Aug 2020

- by TU Dortmund, Germany

### DeepLearning.AI TensorFlow Developer Professional Certificate

Apr - Jun 2020

- by deeplearning.ai, Coursera
- Introduction to TensorFlow for Artificial Intelligence, Machine Learning, and Deep Learning
- Convolutional Neural Networks in TensorFlow
- Natural Language Processing in TensorFlow
- Sequences, Time Series and Prediction

## Skills and Languages

### Skills:

- Tensorflow, Keras, PyTorch, Numpy, matplotlib
- **Proficient in:** Python, C++, MATLAB
- **Familiar with:** C#, SQL

### Languages:

- Farsi, Native
- English, Fluent (TOEFL: 101)
- French, limited
- Arabic, limited

## Professional Experience

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### Reviewer

- ACL Rolling Review 2021.
- BlackBoxNLP 2021.

### Invited Talks

- A Cluster-based Approach for improving Isotropy in Contextual Embedding Space. At IPM, Jun. 2021.
- Isotropy of Semantic Spaces. At TelAS, Apr. 2021.

### Volunteer Services

- Volunteer student at EMNLP 2021.
- Computer Engineering Scientific Student Association of IUST 2016-2017.
- Yarigaran Club of Sharif University of Technology 2016-2018.
  - Organizing Educational Programs for Child Labourers.