Naji Shajarisales

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Work Experience

X, the moonshot factory (Formerly Google X)

ML Engineer *2022-Current*

ML Modeling and Software engineering

Microsoft Research, Redmond, WA

ML Research Internship *2021*

A Causal Understanding of Churning

Pandora Media, Oakland, CA

ML Research Internship *2019*

Modeling User Behavior in Music Recommendation

Microsoft Research, Redmond, WA

ML Research Internship *2018*

Improving Modeling in Machine Teaching

Yahoo! Inc., Sunnyvale, CA

ML Research Internship *2017*

User Clicking Behavior in Native Search On Yahoo.com

My contribution to this work was partially included in [5].

Technical Skills

Programming: python, MATLAB, Java , C++, JavaScript

Frameworks: Tensorflow, PyTorch, SageMath, earth-engine, ArcGIS

Cloud & Infrastructure: GCP (Databases, Messaging, AI Platforms, Data Processing, Monitoring, Compute), Docker, Terraform

Tools & Collaboration: Git, Gerrit (Jenkins on Google), Selenium, MySQL

Patents

2024: **GEOLOCALIZING OBLIQUE AERIAL IMAGERY**. Filed in the United States Patent and Trademark Office (USPTO) on January 30, 2024 as application no. 63/627,004. Inventors: Naji Shajarisales et al.

2024: **GENERATING BOUNDING BOXES FOR GEOLOCALIZING OBLIQUE AERIAL IMAGERY**. Filed in the United States Patent and Trademark Office (USPTO) on January 30, 2024 as application no. 63/627,014. Inventors: Naji Shajarisales et al.

Research Interests

Machine Learning & Artificial Intelligence: Recommendation Systems, Causal Inference, Time Series Analysis, Decision Making and Reinforcement Learning, Signal Processing, Kernel Methods, Neural Networks, Large Language Models (LLMs), ML paired with Geospatial Information Systems (GIS), Foundational Geospatial models.

Graph Theory: Spectral Graph Theory, Complex Networks

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*Authors appear in alphabetical order.

**All the authors had equal contribution.

Education

2015 – 2022
Carnegie Mellon University, PhD
Logic, Computation and Methodology
Advisors: Kun Zhang, Peter Spirtes, Barnabas Poczos

2017 – 2019
Carnegie Mellon University, MSc.
Machine Learning, MSc.
Advisors: Kun Zhang, Peter Spirtes, Barnabas Poczos

2015 – 2018
Carnegie Mellon University, MSc.
Logic Computation and Methodology, MSc.
Advisors: Kun Zhang, Peter Spirtes

2012 – 2014
International Max Planck Research School, M.Sc.
Neural and Behavioural Sciences

2006 – 2012
Sharif University of Technology, B.Sc.
Computer Science

2008 – 2012
Sharif University of Technology, B.Sc.
Mathematics

Research Experience

Carnegie Mellon University, Pittsburgh, USA

Ongoing Thesis Work *2016-present*

"Leveraging Learning from Positive and Unlabeled data (LPU) by any means", Advisors: Peter Spirtes, Kun Zhang

- It is commonplace in real-world classification problems(learning class y from features X, i.e. inferring $p(y|X)$) that annotated data from one class is either unavailable or very expensive to collect, while an abundance of unlabeled data is available. Classification in such cases is an ill-posed problem in its generality, and the task of Learning from Positive and Unlabeled (LPU) data aims to address this challenging problem, by imposing suitable constraints on the classification models. In this work we attempt to leverage LPU by modeling the annotation process carried out by experts with psychometric functions from the literature of psychophysics. A pre-print of our results is currently on arXiv [4].
- In [3] we tackle the problem of LPU by incorporating the knowledge from unlabeled data. Specifically we use the framework of "manifold regularization" to incorporate the knowledge about unlabeled data to restrict the family of functions representing the conditional distribution $p(y|X)$.

"Learning from Noisy Labels", Advisors: Peter Spirtes, Kun Zhang

- In this work [2] we attempt to amalgamate the results presented in [4, 3] to address a more general problem, i.e. learning to classify when we only have access to noisy labels. Particularly we offer a model for how false positive and false negatives examples are created by an expert/annotator, i.e. modeling the process that creates mistakes in the annotation process. We additionally discuss how one can improve learning from noisy labels by using the the marginal distribution of the feature space $p(X)$.

Brains, Minds and Machines, Summer School, Woods Hole, MA, USA

Summer School Project *2016*

"Human and Machine Judgements Comparison on Stability of Piles of Blocks", Advisor: Joshua Tenenbaum

- Designed an experiment using Pygame where subjects had to decide whether a given arrangement of a pile of blocks was stable or not.
- Compared the judgements of a CNN (inspired by AlexNet) with human judgements for different arrangements.

Max Planck Institute of Intelligent Systems, Tübingen, Germany

Research Internship+Collaboration *2014–Present*

"Group-invariant Contrasts For Flexible Causal Inference", Advisor: Michel Besserve

- Programmed the algorithm for causal discovery in brain recordings of rat hippocampus.
- Contributed to the group-theoretical results of this work which is to be submitted soon [6].
- Contributed to the theoretical results developed in [8].

Internship, Lab Rotation *2012–2013*

"2D Toy Model for Comparison Between Causal and Anticausal Learning Scenarios", Advisor: Dominik Janzing

- Designed and implemented a computationally efficient inference method for a toy model using dynamic programming in Python, for comparing semi-supervised learning under causal and anti-causal scenarios.
- The ideas in design of the algorithm and empirical results appeared in [11].

Master Thesis, Internship *2013–2014*

"A Novel Causal Inference Method for Time Series", Adivsors: Dominik Janzing, Michel Besserve

- Developed a new causal inference framework for linearly interacting weakly stationary time series [7, 12, 1].
- Implemented our algorithms using Python and Matlab and tested it on real-world data; causal discovery of neural interactions in rat hippocampus and echo detection for audio signals were among these examples.

Max Planck Institute of Biological Cybernetics, Tübingen, Germany

Internship, Lab Rotation *2013–2014*

"Hierarchical Bayesian Modeling (HBM)s and Multi-armed Bandit Problem", Advisor: Daniel Braun

- Implemented a toy model that tackles a simple adaptive control problem in Multi-Armed Bandits (MABs).
- Extended the inference rules and implemented an online Bayesian inference framework in Python, using particle filtering and relying on *Bayesian Control Rule*, a method developed by my advisor.

Sharif University of Technology, Tehran, Iran

Research Student *2012–2013*

"r-Orthogonality in Latin Squares", Advisor: Ebadollah Mahmoodian

- Derived some of theoretical results.
- Implemented algorithms for exhaustive search on the space of spectrum of Latin squares using SageMath.
- The published paper [10] counted as my thesis BSc. in mathematics.

Research Student, BSc. Thesis *2010–2011*

"Laplacian Spectral Characterisation of Trees", Advisor: Saeed Akbari

- Derived most of the theoretical results regarding the *Laplacian spectra* of specific families of trees.
- Used Mathematica to do algebraic calculations.
- These contributions were counted as my BSc. in computer science.

Course Projects

Carnegie Mellon University **Pittsburgh, PA**
Graduate Course Project, Convex Optimization, grade: 95/100 *2016-2017*
"Learning To Descend"

- Implementation of previous developments on learning how to optimize in TensorFlow and improving these methods.

Carnegie Mellon University **Pittsburgh, PA**
Graduate Course Project, Introduction to Machine Learning, grade: 97/100 *2015-2016*
"Counting the Displayed-equations in Pages of LaTeX-based PDFs using Holistic Convolutional Neural Nets"

- Implemented a CNN using Theano based on holistic neural networks.

Carnegie Mellon University **Pittsburgh, PA**
Graduate Course Project, Advanced Introduction to Machine Learning, grade: 100/100 *2015-2016*
"Incorporating Side Information in Tensor Completion"

- Had theoretical contributions to this work, specifically in designing the Kernels for measuring similarities between different modes of a tensor, in a tensor factorization problem based on a Bayesian approach.
- This novel collaborative filtering method is appeared in WWW conference 2016 [9].

Honors and Awards

Brains, Minds and Machines Summer School **Woods Hole, MA**
Travel scholarship to participate at the summer school *2016*

International Conference in Machine Learning (ICML) 2015 **Lille, France**
Travel scholarship to participate at the conference *2015*

Ardalan Scholarship at University College London (UCL), **London, UK**
Scholarship to pursue an MSc. in Advanced Neuroimaging in amount of £20,000 *2012*
Awarded for one person yearly among all Iranian applicants to study at a masters program in UCL

International Max Planck Research School **Tübingen, Germany**
Full Scholarship for Master Studies *2012*

Ranked 5th among almost 3000 students **Tehran, Iran**
National Graduate Entrance Exam For Computer Science *2011*

Silver Medal (ranked 2nd nation-wide) **Tehran, Iran**
National Mathematical Olympiad (NMO) *2006*

Talks

Telling Cause from Effect in Deterministic Linear Dynamical Systems — **Lille, France**
International Conference in Machine Learning (ICML) 2015 — *July, 2015*

Complex brain networks — **Tehran, Iran**
Institute for Research in Fundamental Sciences — *February, 2012*

On Laplacian Spectral Characterization of Graphs — **Tehran, Iran**
Institute for Research in Fundamental Sciences — *January, 2011*

Reviewer

Chaos: An Interdisciplinary Journal of Nonlinear Science

2017-present

Languages

Farsi: Native **English:** Fluent **Turkish:** Fluent **Azerbaijani:** Fluent