

# Hrayr Harutyunyan

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## EDUCATION

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### University of Southern California

PhD in Computer Science

Advisors: Aram Galstyan and Greg Ver Steeg

Aug. 2018 - present

Current GPA: 4.0

Coursework:

- CSCI 670: Advanced analysis of algorithms, Fall 2018
- EE 546: Mathematics of high-dimensional data, Fall 2018
- DSO 699: Statistical learning theory, Spring 2018
- CSCI 699: Advanced topics in deep learning, Spring 2018
- CSCI 699: Theoretical machine learning, Fall 2019
- CSCI 699: Topics in Discrete Optimization and Learning, Fall 2020

Teaching assistantship:

- CSCI 670: Advanced analysis of algorithms, Fall 2019
- CSCI 270: Introduction to Algorithms and Theory of Computing, Spring 2020

Research assistantship:

- Global analysis of weak signals for enterprise event detection, Fall 2018 to Fall 2019
- Learning with less labels, Spring 2020 to Fall 2022

### Yerevan State University

MSc in Discrete Mathematics and Theoretical Informatics

Thesis: Extension of linear CorEx for time series

Advisor: Anahit Chubaryan

Sept. 2016 - June 2018

GPA: 19.9/20

### Yerevan State University

BSc in Computer Science and Applied Mathematics

Thesis: Spoken language identification with deep learning

Advisor: Armen Andreasyan

Sept. 2012 - June 2016

GPA: 19.6/20

## EXPERIENCE

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### Google Research

*Research Intern, Student Researcher*

May 2022 - Aug. 2022, Sept. 2022 - Oct. 2022

*New York, NY, USA*

Project: Supervision complexity and its role in knowledge distillation

- Introducing a new theoretical perspective on knowledge distillation through a measure of alignment between the teacher-provided supervision and the student's neural tangent kernel.

### Amazon.com, Inc

*Applied Scientist Intern*

May 2021 - Aug. 2021

*Remote*

Project: Test error prediction and analysis via sample information measures

- Estimating the number of samples needed to reach a certain level of performance in a supervised learning task
- Finding which sub-populations of examples should be sampled more in order to achieve the goal efficiently

**Amazon.com, Inc**

*Applied Scientist Intern*

**May 2020 - Aug. 2020**

*Remote*

Project: Information content of samples

- Defining and estimating the unique information content of samples in supervised learning tasks

**YerevaNN Research Lab**

*Machine Learning Researcher*

**June 2016 - July 2018**

*Yerevan, Armenia*

- Establishing benchmarks for clinical prediction tasks
- Automated question answering using deep learning
- Representation learning with generative models

**USC Information Sciences Institute**

*Machine Learning Researcher, Intern*

**June 2017 - Sept. 2017**

*Marina Del Rey, CA, USA*

- Learning disentangled representations via synergy minimization
- Temporal covariance estimation using non-overlapping Gaussian latent factor models

## RESEARCH INTERESTS

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My main research direction is studying information stored in neural network weights or activations, and its connections to generalization, memorization, stability and learning dynamics. More broadly, I am interested in learning theory, generalization under domain shifts, unsupervised/self-supervised representation learning, and in the generalization phenomenon of deep neural networks.

## PUBLICATIONS AND PREPRINTS

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- [1] **H. Harutyunyan**, GV. Steeg, A. Galstyan.  
Formal limitations of sample-wise information-theoretic generalization bounds.  
*IEEE Information Theory Workshop, 2022*
- [2] T. Galstyan, **H. Harutyunyan**, H. Khachatrian, GV. Steeg, A. Galstyan.  
Failure Modes of Domain Generalization Algorithms.  
*CVPR, 2022*
- [3] KSM. Hossain, **H. Harutyunyan**, Y. Ning, B. Kennedy, N. Ramakrishnan, A. Galstyan.  
Identifying Geopolitical Event Precursors using Attention-based LSTMs.  
*Frontiers in Artificial Intelligence, 2022*
- [4] **H. Harutyunyan**, M. Raginsky, GV. Steeg, A. Galstyan.  
Information-theoretic generalization bounds for black-box learning algorithms.  
*NeurIPS, 2021*
- [5] **H. Harutyunyan**, A. Achille, G. Paolini, O. Majumder, A. Ravichandran, R. Bhotika, S. Soatto.  
Estimating informativeness of samples with Smooth Unique Information.  
*ICLR, 2021*
- [6] **H. Harutyunyan**, K. Reing, GV. Steeg, A. Galstyan.  
Improving Generalization by Controlling Label-Noise Information in Neural Network Weights.  
*ICML, 2020*
- [7] GV. Steeg, **H. Harutyunyan**, D. Moyer, A. Galstyan.  
Fast structure learning with modular regularization.  
*NeurIPS, 2019*
- [8] **H. Harutyunyan**, H. Khachatrian, DC. Kale, GV. Steeg, A. Galstyan.  
Multitask learning and benchmarking with clinical time series data.  
*Nature Scientific Data, 2019.*

- [9] **H. Harutyunyan**, D. Moyer, H. Khachatrian, GV. Steeg, A. Galstyan  
Efficient covariance estimation from temporal data.  
*arXiv:1905.13276, 2019*
- [10] S. Abu-El-Haija, B. Perozzi, A. Kapoor, N. Alipourfard, K. Lerman,  
**H. Harutyunyan**, GV. Steeg, A. Galstyan.  
MixHop: higher-order graph convolutional architectures via sparsified neighborhood mixing.  
*ICML, 2019*
- [11] GV. Steeg, R. Brekelmans, **H. Harutyunyan**, A. Galstyan.  
Disentangled representations via synergy minimization.  
*Allerton Conference on Communication, Control, and Computing (Allerton), 2017.*

## SKILLS

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<b>Programming Languages</b>	Python, C/C++
<b>Software &amp; Tools</b>	PyTorch, Tensorflow, Keras, MATLAB, Wolfram Mathematica
<b>Languages</b>	English, Armenian (native), Russian

## AWARDS, HONORS AND ACHIEVEMENTS

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<b>USC Annenberg Graduate Fellow</b>	2018
<b>ACM ICPC World Finals</b> , Finalist	2017
<b>Google HashCode</b> , Finalist	2017, 2018
<b>Russian Code Cup</b> , Finalist	2016
<b>Yerevan State University Gold Medal</b>	2016
For outstanding results in programming competitions	
<b>ACM ICPC Northeastern European Regional Contest</b>	
First Diploma, 17th place	2016
Second Diploma, 33th place	2015
Champion of Armenia	2013 - 2016
Champion of Southern Caucasus	2015, 2016
<b>Open Southern Caucasus Championship</b> , First Diploma	2013 - 2016
<b>Independence Cup of Armenia</b> , First Place	2013 - 2017
<b>International Olympiad in Informatics</b> , Bronze medal	2012
<b>National Olympiads in Physics, Mathematics and Informatics</b>	
2 First, 2 Second, 3 Third Degree Diplomas	2008 - 2012

## NOTABLE ACTIVITIES

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<b>FAST Foundation</b>	June 2021 - present
<i>NextGen Council Member</i>	
<b>Conference Reviewing</b>	
NeurIPS'20, ICML'21, NeurIPS'21, ICLR'21, ICML'22, ICLR'23	
<b>ACM ICPC Trainings at USC</b>	Fall 2018
<i>Lecturer</i>	
<b>Weekly Machine Learning Seminars</b>	Sept. 2017 - July 2018
<i>Co-organizer</i>	
Presented and discussed recent advances in machine learning.	

**National Olympiad in Informatics**

2013 - 2018

*Committee member*

Prepared tasks for the national Olympiad in informatics.

Trained students for international Olympiad in informatics.

**International Olympiad in Informatics**

2016

*Deputy leader of Armenian national team*

Trained students for the competition.

**INTERESTS**

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Reading, art house, billiards, skiing, chess, music, philosophy.