

# Homa Esfahanizadeh

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## RESEARCH VISION

My research interests broadly include coding and information theory, signal processing, and statistical learning. My research addresses various aspects of practical information systems, such as heterogeneity, scale-ability, failure possibilities, and privacy concerns. These issues are encountered in many modern applications such 5G communication networks, cloud computing, and autonomous driving. I tackle these practical problems from an information-theoretical perspective to propose efficient solutions and algorithms that have theoretical support. In particular, I have proposed several *low-latency* and *high-throughput* solutions for private machine learning, distributed coded computations, network coding, and error correction.

## EDUCATION

<b>Postdoc, EECS Department, MIT RLE Center</b> Massachusetts Institute of Technology (MIT) Advisor: Prof. Muriel Médard	Mar. 2020- Present
<b>Ph.D, Electrical Engineering, Signals and Systems</b> University of California, Los Angeles (UCLA) Advisor: Prof. Dolecek Thesis: Spatially-coupled codes for modern data storage systems	Sep. 2015- Dec. 2019
<b>M.Sc, Electrical Engineering, Communication Systems</b> University of Tehran (UT) Advisors: Prof. Lahouti, Prof. Hassibi Thesis: Topological interference management in multiple unicast networks through index coding	Sep. 2012- Jul. 2015
<b>B.Sc, Electrical Engineering, Telecommunications</b> University of Tehran (UT) Advisor: Prof. Lahouti Thesis: Fixed-point implementation of turbo decoder on DSP	Sep. 2008- Jul. 2012

## RESEARCH EXPERIENCES

<b>Post-Doctoral Research Associate, MIT</b> I work in the Research Laboratory of Electronics (RLE). My research focuses on developing coding schemes to increase reliability, improve efficiency, and provide security for low-latency networks, distributed systems, and machine learning algorithms.	Mar. 2020 - present
<b>Graduate Student Researcher, UCLA</b> I worked in the Laboratory for Robust Information Systems (LORIS). I presented algorithms for the efficient analysis and design of error-correcting codes for modern storage systems.	Sep. 2015 - Jan. 2020
<b>Graduate Student Researcher, University of Tehran</b> I worked in the Wireless Multimedia Communication (WMC) Laboratory. I elaborated the optimum mapping between the problems Network Coding, Index Coding, and Matrix Completion.	Aug. 2013 - July 2015

## TEACHING EXPERIENCE

Guest Lecturer for

- **Principles of Digital Communication**, Massachusetts Institute of Technology (MIT), Fall 2021.
- **Probability and statistics**, University of California, Los Angeles (UCLA), Fall 2017.

Course Teacher Assistant for

- **Mathematical Foundations of Data Storage Systems**, University of California, Los Angeles (UCLA), Summer 2019.
- **Probability and statistics**, University of California, Los Angeles (UCLA), Fall 2017.
- **Communication systems**, University of California, Los Angeles (UCLA), Spring 2017.
- **Wireless multimedia communication theory**, University of Tehran, Spring 2013 and Spring 2014.

Laboratory Instructor Assistant for

- **Multimedia Communication Laboratory intended for undergraduate and graduate students**, University of Tehran, Spring 2014.
- **Microprocessor Laboratory intended for undergraduate students**, University of Tehran, Fall and Spring 2012 -2013.

## INTERNSHIP EXPERIENCE

- Decoder design of LDPC codes for 5G cellular networks using Reinforcement Learning, Samsung Semiconductor Inc., San Diego, CA, Summer 2018.

## HONORS AWARDS

- Awarded Dissertation Year Fellowship (DYF), University of California, Los Angeles (UCLA), ECE Department, 2018.
- Received Memorable paper award at the Non-Volatile Memories Workshop (NVMW) for the paper “A three-stage approach for designing non-binary spatially-coupled codes for Flash memories”, March 2018.
- Awarded university fellowship, University of California, Los Angeles (UCLA), ECE Department, 2015.
- Ranked as top 10 percent among the B.Sc. students of Electrical Engineering in the year 2012, University of Tehran.
- Ranked as third in national robocup soccer simulation competition, Iran, 2006.
- Participated as the selected junior team among Iranian high school students for the rescue league in robocup international champion, Bremen, Germany, 2006.

## REVIEW ACTIVITIES

- PC member: Non-Volatile Memories Workshop (NVMW) 2021.
- Journal reviewer: Elsevier Physical Communication, IEEE Communications Letters, IEEE Transactions on Communications (TCOM), IEEE Transactions on Information Theory (T-IT), IEEE Transactions on Magnetics (TMAG), and IEEE Journal on Selected Areas in Information Theory (JSAIT).
- Conference reviewer: at IEEE conferences: ISIT, ITW, NVMW, and Intermag.

## JOURNAL PUBLICATIONS

- A. Cohen, G. Thiran, **H. Esfahanizadeh**, M. Médard (equal contribution), “Stream Distributed Coded Computing,” *IEEE Journal on Selected Areas in Information Theory (JSAC-IT) as a Special Issue on Coded Computing*, 2021.
- Alejandro Cohen, **H. Esfahanizadeh**, B. Sousa, J. P. Vilela, M. Luís, D. Raposo, F. Michel, S. Sargento, and M. Médard, “Bringing Network Coding into SDN: A Case-study for Highly Meshed Heterogeneous Communications,” *IEEE Communications Magazine (COMMAG)*, 2021.
- **H. Esfahanizadeh**, L. Tautz, and L. Dolecek, “Multi-Dimensional Spatially-Coupled Code Design: Enhancing the Cycle Properties,” *IEEE Transactions on Communications (TCOM)*, 2020.
- **H. Esfahanizadeh**, A. Hareedy, and L. Dolecek, “Finite-Length Construction of High Performance Spatially-Coupled Codes via Optimized Partitioning and Lifting,” *IEEE Transactions on Communications (TCOM)*, 2019.
- **H. Esfahanizadeh**, A. Hareedy, Ruiyi Wu, Rick Galbraith, and L. Dolecek, “Spatially-Coupled Codes for Channels with SNR Variation,” *IEEE Transactions on Magnetics (TMAG)*, 2018.
- **H. Esfahanizadeh**, A. Hareedy, and L. Dolecek, “Spatially-Coupled Codes Optimized for Magnetic Recording Applications,” *IEEE Transactions on Magnetic*, 2017.
- B. Amiri, A. Reisizadeh, **H. Esfahanizadeh**, J. Kliever, and L. Dolecek, “Optimized Design of Finite-Length Separable Circulant-Based Spatially-Coupled Codes: An Absorbing Set-Based Analysis,” *IEEE Transactions on Communications (TCOM)*, 2016.

## CONFERENCE PUBLICATIONS

- **H. Esfahanizadeh**, E. Ram, Y. Cassuto, and L. Dolecek, “Spatially Coupled Codes with Sub-Block Locality: Joint Finite Length-Asymptotic Design Approach,” *IEEE International Symposium on Information Theory (ISIT)*, 2020.
- L. Tautz, **H. Esfahanizadeh**, and L. Dolecek, “Non-Uniform Windowed Decoding for Multi-Dimensional Spatially-Coupled LDPC Codes,” *IEEE International Symposium on Information Theory (ISIT)*, 2020.
- **H. Esfahanizadeh**, Ruiyi Wu, and L. Dolecek, “A Finite-Length Construction of Irregular Spatially-Coupled Codes,” *IEEE Information Theory Workshop (ITW)* (invited paper), 2019.
- **H. Esfahanizadeh**, A. Hareedy, and L. Dolecek, “Multi-Dimensional Spatially-Coupled Code Design Through Informed Relocation of Circulants,” *Allerton Conference on Communication, Control, and Computing (ALLERTON)*, 2018.
- A. Hareedy, **H. Esfahanizadeh**, and L. Dolecek, “Spatially-Coupled Code Design for Partial-Response Channels: Optimal Object-Minimization Approach,” *IEEE Global Communications Conference (GLOBECOM)*, 2018.
- A. Hareedy, **H. Esfahanizadeh**, and L. Dolecek, “High Performance Non-Binary Spatially-Coupled Codes for Flash Memories,” *IEEE Information Theory Workshop (ITW)*, 2017.
- **H. Esfahanizadeh**, A. Hareedy, and L. Dolecek, “A Novel Combinatorial Framework to Construct Spatially-Coupled Codes: Minimum Overlap Partitioning,” *IEEE International Symposium on Information Theory (ISIT)*, 2017.

- **H. Esfahanizadeh**, A. Hareedy, and L. Dolecek, “The Finite Length Analysis of Spatially-Coupled Codes for 1-D Magnetic Recording Channels,” *Asilomar Conference on Signals, Systems, and Computers (ASILOMAR)*, 2016.
- **H. Esfahanizadeh**, F. Lahouti, and B. Hassibi, “A matrix completion approach to linear index coding problem,” *IEEE Information Theory Workshop (ITW)*, 2014.

## REFERENCES

Massachusetts Institute of Technology (MIT)

- Prof. Muriel Médard: [medard@mit.edu](mailto:medard@mit.edu)
- Prof. Manya Ghobadi: [ghobadi@csail.mit.edu](mailto:ghobadi@csail.mit.edu)

University of California, Los Angeles (UCLA)

- Prof. Lara Dolecek: [dolecek@ee.ucla.edu](mailto:dolecek@ee.ucla.edu)