Soheil Eshghi

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Interests Optimal **dynamic** data-driven decision-making in complex networked systems.

Appointments

2016–Current Postdoctoral Associate, ***Yale Institute for Network Science***, New Haven, CT.
With Prof. Leandros Tassiulas, I work on complex decision-making for social groups for DAIS ITA (7 papers) and helped write grants to ARL, ARO, and NIH.

2015–16 Postdoctoral Associate, ***ECE Dept., Cornell University***, Ithaca, NY.
With Profs. Qing Zhao & Lang Tong, I derived optimal coordinated influence control policies for the NS CTA (1 paper) and co-wrote a book on charge scheduling of electric vehicles.

2011–15 Research Assistant, ***ESE Dept., University of Pennsylvania***, Philadelphia, PA.
Under the supervision of Profs. Saswati Sarkar & Santosh Venkatesh, I conducted research on the optimal control of epidemics, with applications to epidemiology, network security, and delay-tolerant network message delivery.

Summer 2014 Research Intern, ***EM Dept., NEC Labs America (NECLA)***, Cupertino, CA.
With Dr. Rakesh M. Patil, I proposed optimal stochastic smart-grid management policies focused on pricing grid-scale batteries (1 paper, 1 patent application, 1 invention record).

Education

2011–15 PhD **University of Pennsylvania**, *Electrical & Systems Engineering*, *GPA: 3.84*.
Thesis: Optimal Control of Epidemics in the Presence of Heterogeneity.
I showed how heterogeneity affects epidemic spread, and is critical to control efforts.
Committee: **Saswati Sarkar**, S. Venkatesh, G. Pappas, V. Preciado, O. Milenkovic (UIUC)

2011–13 MSc **University of Pennsylvania**, *Electrical Engineering*, *GPA: 3.77*.

2006–10 BSc **Sharif University of Technology (IRI)**, *Electrical Engineering*, *GPA: 3.74*.

Selected awards

Feb. 2017 **Third Place**, *Datahack*, Yale Institute for Network Science, New Haven, CT.

Mar. 2015 **Runner Up**, *Fels National Public Policy Challenge*, Philadelphia, PA.

Mar. 2015 **Winner**, *Penn Public Policy Challenge*, Philadelphia, PA.

Oct. 2010 **PhD Research Fellowship**, *University of Pennsylvania*, Philadelphia, PA.

Jun. 2006 **Best combined result in Iranian national university entrance exam history:**.

- $\mathbf{1}^{st}$**/600,000**, Azad Math-Physics,
- $\mathbf{15}^{th}$**/400,000**, National Math-Physics,
- $\mathbf{1}^{st}$**/250,000**, National Foreign Langs.

This led to awards from Iran's President, and Ministers of Education, and Higher Education, as well as a **scholarship** from the Iranian National Elite Foundation.

Teaching certificates

2017 **Expressing Your Enthusiasm: an Oral Communication Workshop for STEM Graduate Students and Postdocs**, *Yale University*.
5-workshop series on effectively communicating research to a lay audience

2016 **Building Mentoring Skills for an Academic Career**, *Cornell University*.
6-workshop series exploring various aspects of mentoring relationships in academia

2014 **Course in College Teaching**, *University of Pennsylvania*.
Set of 10 hands-on teaching workshops focused on active learning and student engagement

Teaching assistantships

Cornell Markov Decision Processes (graduate), Digital Signal Processing

Penn Fourier Analysis, Digital Signal Processing (graduate)

Sharif EE Principles, Logic & Analog Circuits, Computer Structure, Microprocessors Lab

PhD thesis

Description I showed how heterogeneity significantly affects the spread of epidemics, and how it should be leveraged to control their spread. I developed a taxonomy of heterogeneity in epidemic spread: heterogeneity can manifest itself in the contact rates (structure) of the network, in the resources available to agents, and in the epidemic itself. For each case, I mathematically modeled a real-world process, validated the model, identified the control mechanisms and constraints, and characterized optimal control strategies for the use of those resources. In each case, I used simulation and real-world trace data to show how the structures I analytically derived can significantly affect the spread and cost of epidemics.

Entrepreneurial and volunteer experience

2014–16 **Founder and Advisor**, *SmartTrack*, Philadelphia, PA.
- As part of a pro-bono student project at the University of Pennsylvania, and in collaboration with stakeholders, I helped develop an app-based solution for managing inventory (e.g., textbooks) for large, low-income school districts such as the School District of Philadelphia.
- We won the Penn Public Policy Challenge, and placed second nationally ($5K prize each).
- Our work has been featured in numerous publications, including *Governing* magazine
- We were one of 9 out of 300 teams accepted to EDSi accelerator at Penn
- Our solution is being used in Camden public schools and Philadelphia charter schools
- We have raised over $125,000 in total

2015–16 **VP of Education**, *Cornell Graduate Consulting Club*, Ithaca, NY.
- I created & curated a 7 event series for 12 select participants to improve consulting skills
- I led a team of 6 students to devise a marketing plan for a local mobile tourism startup

2014–15 **Co-chair**, *Penn Graduate Case Competition*, Philadelphia, PA.
- I organized the logistics, client selection, case creation, and sponsorship with my team of 5 and MC'ed the event.
- We out-raised our max cost projections by 110% and increased diversity of participants
- The winning proposal was implemented by client within 3 months

2014 **Convener**, *Penn ESE PhD Student Colloquium*, Philadelphia, PA.

Memberships IEEE (2008–Current), IEEE Control Systems Society (2014–Current)

Journal publications

Published

[3] **TAC-17** **Eshghi, S.,** Sarkar, S., Venkatesh, S.S., *Visibility-aware optimal contagion of malware epidemics*, Trans. on Automatic Control, 62(10), 5205-5212.

[2] **ToN-16** **Eshghi, S.,** Khouzani, M., Sarkar, S., Venkatesh, S.S., *Optimal patching in clustered epidemics of malware*, Trans. on Networking , 24(1), 283-298.

[1] **TAC-15** **Eshghi, S.,** Khouzani, M., Sarkar, S., Shroff, N., Venkatesh, S.S., *Optimal energy-aware DTN epidemic routing*, Trans. on Automatic Control , 60(6), 1554-1569.

Submitted

[3] TNSE-18 (major rev.) **Eshghi, S.,** Preciado, V.M., Sarkar, S., Venkatesh, S.S., Zhao, Q., D'Souza, R., Swami, A., *Spread, then Target, and Advertise in Waves: Optimal Budget Allocation Across Advertising Channels*, Trans. on Network Science & Engineering.

[2] L-CSS-18 (major rev.) Papakostas, D., **Eshghi, S.,** Katsaros, D., Tassiulas, L., *Distributed algorithms for multi-layer connected edge-dominating sets*, Control Systems Letters (L-CSS).

[1] ADHOC-17 (minor rev.) Katsaros, D., Papakostas, D., **Eshghi, S.,** Tassiulas, L., *Energy-efficient backbone formation in military multi-layer ad-hoc networks*, Ad Hoc Networks journal.

Patents

[1] Patil, R.M., Sharma, R., **Eshghi, S.**, *Optimal battery pricing and energy management for microgrids*, Patent no. 20160093002, Application no. 14/845412.

Conference publications

Published (Peer-Reviewed Conferences)

[8] CISS-18 **Eshghi, S.,** Tassiulas, L., *Innovation, cheating, and whistleblowing - a game theoretic perspective*, 52nd Annual Conference on Information Sciences and Systems.

[7] Allerton-17 **Eshghi, S.,** Williams, G.R., Colombo, G.B., Turner, L.D., Rand, D.G., Whitaker, R.M., Tassiulas, L., *Social group stability and fracture*, 55th Annual Allerton Conference on Communication, Control, and Computing.

[6] SocInf-17 Stein, S., **Eshghi, S.,** Maghsudi, S., Tassiulas, L., Bellamy, R.E., Jennings, N.R., *Heuristic algorithms for influence maximization in partially observable social networks*, International Workshop on Social Influence Analysis.

[5] DAIS-17 **Eshghi, S.,** Williams, G.R., Colombo, G.B., Turner, L.D., Rand, D.G., Whitaker, R.M., Tassiulas, L., *Mathematical models for social group behavior*, Workshop on Dist. Analytics InfraStructure and Algorithms for Multi-Org. Federations.

[4] DAIS-17 Stein, S., **Eshghi, S.,** Maghsudi, S., Tassiulas, L., Bellamy, R.E., Jennings, N.R., *Influence maximisation in partially observable social networks*, Workshop on Dist. Analytics InfraStructure and Algorithms for Multi-Org. Federations.

[3] KSCO-17 Mott, D., Kelley, T., Giammanco, C., **Eshghi, S.,** Zhang, Y., *A framework for modelling the effect of emotion on uncritical reasoning*, Workshop on Knowledge Systems for Coalition Operations.

[2] ACC-15 **Eshghi, S.,** Patil, R.M., *Optimal battery pricing and energy management for microgrids*, American Control Conference .

[1] Mobihoc-12 Khouzani, M., **Eshghi, S.,** Sarkar, S., Shroff, N., Venkatesh, S.S., *Optimal energy-aware epidemic routing in DTNs*, International Symposium on Mobile Ad Hoc Networking and Computing **(Acceptance rate = 20%)**.

Submitted

[2] CDC-18 Papakostas, D., **Eshghi, S.,** Katsaros, D., Tassiulas, L., *Distributed algorithms for multi-layer connected edge-dominating sets*, Conference on Decision and Control.

[1] CDC-18 **Eshghi, S.,** Tassiulas, L., *Whistleblowing games in networks*, Conference on Decision and Control.

Published (Posters & Invited Conferences)

[5] YaleDoD-17 **Eshghi, S.,** Tassiulas, L., *Efficient dynamic centrality metrics for election advertising - a case study*, Yale Day of Data 2017, Poster.

[4] ComNet-17 **Eshghi, S.,** Maghsudi, S., Restocchi, V., Stein, S., Tassiulas, L., *Heuristic algorithms for influence maximization in partially observable social networks*, International Conference on Complex Networks and their Applications, Poster.

[3] ITA-17 **Eshghi, S.,** Preciado, V.M., Sarkar, S., Venkatesh, S.S., Zhao, Q., D'Souza, R., Swami, A., *Spread, then target, and advertise in waves: optimal capital allocation across advertising channels*, Information Theory and Applications Workshop.

[2] ITA-15 **Eshghi, S.,** Sarkar, S., Venkatesh, S.S., *Visibility-aware contagion of malware epidemics*, Information Theory and Applications Workshop.

[1] ITA-12 Khouzani, M., **Eshghi, S.,** Sarkar, S., Venkatesh, S.S., *Optimal patching in clustered epidemics of malware*, Information Theory and Applications Workshop.

Invited talks

2017 Influence in social systems.
- **Yale University**, YINS Summer Seminar

2016 Optimal control of epidemics in the presence of heterogeneity.
- **Harvard University**, School of Public Health (Ctr for Communicable Disease Dynamics)
- **Georgetown University**, Biology Department (Bansal Lab)
- **University of Georgia**, Biology Department (Rohani Lab)
- **Penn State University**, Biology Department (Ctr for Infectious Disease Dynamics)
- **Yale University**, YINS Summer Seminar
- **University of Pennsylvania**, ESE Department (Complex Systems Group)

2015 Optimal control of epidemics in the presence of heterogeneity.
- **Cornell University**, ECE Department

2013 Optimal control of epidemics and opinions.
- **University of Pennsylvania**, ESE PhD Colloquium

Selected service

Reviewer for:

- AAMAS2018 (PC Member)

IEEE Transactions on:

- Automatic Control (TAC)
- Control of Networked Systems (TCNS)
- Inf. Forensics & Security (TIFS)
- Information Theory (T-IT)
- Mobile Computing (TMC)
- Networking (ToN)
- Network Science & Eng. (TNSE)
- Wireless Communications (TWC)

Other:

- Automatica
- PLOS Computational Biology
- ASME J. of Dynamic Systems (J-DS)
- IEEE Communication Letters
- IEEE Control Systems Letters (L-CSS)
- IEEE Access
- Performance Evaluation (Elsevier)
- Social Network Analysis & Mining (SNAM)

Conferences: WiOpt'16, MIM'16, NetSciCom'17, IFAC World Congress'17, CDC '18

Selected coursework – graduate

Optimization	Optimal Control, Dynamic Programming, Convex Optimization, Adv. Algorithms
Probability	Eng. Probability, Adv. Probability, Stochastic Processes, Random Process Models
Economics	Game Theory, Dynamic Games & Social Learning, Information Theory, Estimation
Networks	Dist. Dynamic Systems, Network Theory, EE Infrastructure, Green Buildings

Selected coursework – undergraduate

Control	Linear Control Systems, Linear Algebra, Numerical Methods
Mathematics	Engineering Mathematics, Ordinary Differential Equations, Probability
Signals	Speech Processing, Digital Signal Processing & Lab, Signals & Systems
Coding	C++ Programming, Machine Language & Architecture, Microprocessors
Networks	Wireless Communication, Digital Communication & Lab, Traffic Control
Energy	Power Systems Analysis, Electrical Machines (I, II, & Lab), Fields and Waves

Computer skills

Proficient:	C/C++ • R
Infrequently:	MATLAB (Simulink, CVX, GPOPS) • Python • SQL • Java
Past:	Assembly (x85, x51, PIC)

References

Prof. Saswati Sarkar
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Relation: PhD Advisor

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Associate Professor,
Department of Electrical & Systems Engineering,
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Relation: PhD Thesis Co-Advisor

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Relation: Committee Chair

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Relation: Postdoc Advisor

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Relation: Committee Member, Collaborator