Soheil Eshghi

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Education

2011–2015 **PhD**, *University of Pennsylvania*, Philadelphia, PA, *GPA: 3.84*.
Electrical and Systems Engineering

2011–2013 **MSc**, *University of Pennsylvania*, Philadelphia, PA, *GPA: 3.77*.
Electrical Engineering

2006–2010 **BSc**, *Sharif University of Technology*, Tehran, IRI, *GPA: 3.74*.
Electrical Engineering (Telecommunications focus)

PhD thesis

title *Optimal Control of Epidemics in the Presence of Heterogeneity*

Advisor Saswati Sarkar

Co-Advisor Santosh S. Venkatesh

Committee George J. Pappas, Victor M. Preciado, Olgica Milenkovic (UIUC)

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.

Awards

- **Runner Up**, *Fels National Public Policy Challenge*, Philadelphia, PA, USA — March '15
- **Winner**, *Penn Public Policy Challenge*, Philadelphia, PA, USA — March '15
- Research Fellowship for PhD studies, University of Pennsylvania — Oct. '10
- Iranian National Elite Foundation Scholarship — Sept '06
- Best combined result in the history of Iran's national university entrance exams: — June '06
  - **1**st**/600k** *Azad Math-Physics*
  - **1**st**/250k** *Nat. Foreign Languages*
  - **15**th**/400k** *Nat. Math-Physics*

  This led to awards from Iran's President, Minister of Higher Education, and Minister of Education

Research Experience

2015–current **Postdoctoral Associate**, *Cornell University*, Ithaca, NY.
Working with Professor Qing Zhao and Professor Lang Tong in the Electrical and Computer Engineering (ECE) department

- Writing a book on the charge scheduling of electric vehicles for NOW publications (with Zhe Yu and Prof. Lang Tong)
- Work on the control of influence in groups of teams as part of the Network Science CTA with Prof. Qing Zhao
- Work on the use of grid-level storage for stability and optimization of the electrical grid
- **Teaching sessions** of a graduate course on Digital Signal Processing, and **TA**-ing a graduate course on Markov Decision Processes
- Coursework on electrical market operation, with a focus on ERCOT
- Participation in a 6-week course on effective mentoring

2011–2015 **Research Assistant**, *University of Pennsylvania*, Philadelphia, PA.
Working with Professor Saswati Sarkar and Professor Santosh Venkatesh in the Electrical and Systems Engineering (ESE) department

- **Thesis Research** on the optimal control of epidemics, with applications to epidemiology, network security, and delay-tolerant network message delivery
- **Additional Research** on the control of influence on opinion networks and on electrical market operation
- **Teaching Assistant** for Fourier Analysis (ESE325), & Digital Signal Processing (ESE576) I held recitations, office hours, posed and graded homework & exam problems and projects
- Participation in a 3-month course on college teaching in 2014, leading to a certificate

2014–2014 **Research Intern**, *NEC Labs America*, Cupertino, CA.
Working with Dr. Rakesh M. Patil in the Energy Management (EM) department

- I proposed optimal stochastic smart-grid management policies focused on pricing grid-scale batteries
- We wrote a paper we presented at IEEE ACC and submitted a patent application and an additional invention record

2009–2009 **Research Intern**, *Iran Telecommunications Research Center*, Tehran, IRI.
Working with Dr. Mohammad Razavizadeh in the Wireless Communication department

- I worked as part of a team working on MIMO systems, focusing on useful results in random matrix theory, leading to an internal report.

Publications

Journals

1. **Eshghi, S.**, Khouzani, M., Sarkar, S., Venkatesh, S.S., "Optimal Patching in Clustered Epidemics of Malware", to appear in IEEE Transactions on Networking(**ToN**), 2015 (*Impact Factor* = 1.986)
2. **Eshghi, S.**, Khouzani, M., Sarkar, S., Shroff, N., Venkatesh, S.S., "Optimal Energy-Aware DTN Epidemic Routing", IEEE Transactions on Automatic Control (**TAC**), Vol. 60, no. 6, pp. 1554-1569, 2015 (*Impact Factor* = 3.167)
3. **Eshghi, S.**, Khouzani, M., Sarkar, S., Venkatesh, S.S., "Visibility-Aware Optimal Contagion of Malware Epidemics", *revise and resubmit*, IEEE Transactions on Automatic Control (**TAC**), July 2015 (*Impact Factor* = 3.167)

Books

1. Yu, Z., **Eshghi, S.**, Tong, L., "Charge Scheduling of Electric Vehicles", *invited submission - in progress*, Foundations and Trends, NOW Publications

Patents

1. **Eshghi, S.**, Patil, R. M, Sharma, R., "Optimal Battery Pricing and Energy Management for Microgrids", *submitted*, 2015

Conferences

1. **Eshghi, S.**, Patil, Rakesh M.,"Optimal Battery Pricing and Energy Management for Microgrids", American Control Conference (**ACC** '15), Chicago, IL, July 2015
2. **Eshghi, S.**, Sarkar, S., Venkatesh, S.S., "Visibility-Aware Contagion of Malware Epidemics", IEEE Information Theory and Applications Workshop (**ITA**), La Jolla, CA, February 2015
3. Khouzani, M., **Eshghi, S.**, Sarkar, S., Venkatesh, S., "Optimal Patching in Clustered Epidemics of Malwar", Presented at the IEEE Information Theory and Applications Workshop (**ITA**), San Diego, CA, February 2012
4. Khouzani, M., **Eshghi, S.**, Sarkar, S., Shroff, N., Venkatesh, S., "Optimal Energy-Aware Epidemic Routing in DTNs", Presented at the International Symposium on Mobile Ad Hoc Networking and Computing (**MobiHoc**), Hilton Head Island, SC, June 2012

Working Papers

1. **Eshghi, S.**, Preciado, V.M., Sarkar, S., Zhao, Q., "Optimal Control of Group Influence under Consensus Dynamics"
2. **Eshghi, S.**, Zhao, Q., "Optimal Activation of Groups for Global Opinion Control"
3. **Eshghi, S.**, Ghosh, A., Sarkar, S., "Multi-location Double Auctions in the Smartgrid"
4. **Eshghi, S.**, Bose, S.,"Adjustable Robust Stabilization of the Grid Using Storage"
5. **Eshghi, S.**, Tong, L., "Optimal Online Decentralized Charging of Electric Vehicles"

Selected Service

Reviewer for:
- IEEE Transactions on Automatic Control
- IEEE Transactions on Control of Networked Systems
- IEEE Transactions on Mobile Computing
- IEEE Transactions on Networking
- IEEE Transactions on Network Science and Engineering
- IEEE Transactions on Wireless Communications
- IEEE Communication Letters
- Automatica
- ASME Journal of Dynamic Systems
- IEEE WiOpt'16
- IEEE MIM'16

Convener of the Penn ESE Graduate Student Colloquium 2014 and Penn ESE Graduate Student Lunch 2013

Selected Coursework

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

Professional Experience

2014–Current **Founding Partner, CTO, Advisor**, *SmartTrack*, Philadelphia, PA.

- Our product targets inventory management for large, low-income school districts.
- We won the Penn Public Policy Challenge '15, and placed second in the National Public Policy Challenge '15.
- Among 9/300 teams accepted to EDSi accelerator ($25k seed funding so far)
- Interviewed and received support from local, state, and national politicians and educators
- Our work has been featured in numerous publications, including *Governing* magazine

2015–Current **VP of Education**, *Cornell Graduate Consulting Club*, Ithaca, NY.

- Created and curated an ongoing progression of 7 events to increase interest and improve consulting success in the membership
- Put together and MC'ed a panel of Advanced Degree consultants

2014–2015 **Co-chair**, *Penn Graduate Case Competition*, Philadelphia, PA.

- I organized the logistics, client selection, case creation, and sponsorship with my team and MC'ed the event.
- We out-raised our max cost projections by 110% and increased diversity of internal and external participants
- Winning proposal was implemented by client within 3 months

2014–2015 **Pro-bono Strategy Consultant**, *Res Novae Partners*, Philadelphia, PA.

We advised the CEO of a Penn Medicine diabetes startup on commercialization strategy & guided his firm through SBIR Phase II and VC fund-raising.

2008–2008 **Market Research Intern**, *STEP Consulting Engineers*, Tehran, IRI.

- I advised the CEO on 4 markets, including for pinch analysis (leading to their biggest contract in 5 years).

Languages

Farsi	**Native**	
English	**Fluent**	*iBT **117**, GRE **800-640-4.5**, CPE*
French, Arabic	**Basic**	*Reading*

Computer skills

15000 lines:	C/C++ • MATLAB (Simulink, CVX, GPOPS)
1000 lines:	Assembly (x85, x51, PIC) • R • Python • HTML
Freq. Used:	LaTeX• Excel • Powerpoint • Word • Beamer

References

Prof. Saswati Sarkar
(swati@seas.upenn.edu)
Professor of Electrical & Systems Engineering,
Department of Electrical & Systems Engineering,
University of Pennsylvania
200 S. 33rd Street, Philadelphia 19104
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Relation: PhD Thesis Advisor

Prof. Santosh S. Venkatesh
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Associate Professor of Electrical & Systems Engineering,
Department of Electrical & Systems Engineering,
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200 S. 33rd Street, Philadelphia 19104
(215) 898-9493
Relation: PhD Thesis Co-Advisor

Prof. Victor M. Preciado
(preciado@seas.upenn.edu)
Assistant Professor of Electrical & Systems Engineering
Department of Electrical & Systems Engineering,
University of Pennsylvania
200 S. 33rd Street, Philadelphia 19104
Relation: Committee Member & Collaborator

Dr. Rakesh M. Patil
(rakeshmp@nec-labs.com)
Senior Product Engineer
Solar City
Relation: Summer Research Mentor