

# EMRAH AKYOL

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EDUCATION      **University of California, Santa Barbara, ECE, Ph.D.**      **June 2011**  

- Thesis: Complexity and Delay Constrained Compression and Transmission of Information
- Advisor: Kenneth Rose

**Koç University, Istanbul, Turkey, ECE, MS**      **Aug. 2005**  

- MS thesis: Adaptive Scalable Video Coding
- Advisors: Murat Tekalp and Reha Civanlar

**Bilkent University, Ankara, Turkey, EE, BS**      **June 2003**

PROFESSIONAL APPOINTMENTS      **UIUC, Postdoctoral Research Associate & Lecturer**      **Sept. 2014 – present**  
Host: Tamer Başar & Cédric Langbort

**MIT, Visiting Scientist**      **Aug. 2016 – Sept. 2016**  
Host: Alex Pentland

**USC, Postdoctoral Research Associate**      **Oct. 2013 – Sept. 2014**  
Host: Urbashi Mitra

**UCSB, Assistant Specialist**      **July 2011 – Sept. 2014**  
Continued my doctoral work with Prof. Kenneth Rose.

**NTT DoCoMo Research Labs, Palo Alto, CA**      **Dec. 2006 – June 2007**  
Studied directional image transforms and their uses in intra-coding in H.264/AVC video compression standard and impact of royalty cost in video compression.

**Hewlett Packard Research Labs, Palo Alto, CA**      **May 2006–Dec. 2006**  
Developed a complexity scalable video codec in C++, based on the H.264/AVC video compression standard, and filed a patent with Dr. Debargha Mukherjee (now at Google).

**UCLA, Graduate Fellow**      **Sept. 2005 – June 2007**

TEACHING EXPERIENCE      UIUC: Instructor, ECE 210/211, Analog Signal Processing, Fall 2016

UCSB: Teaching assistant: Information Theory (graduate), Probability, Digital Signal Processing (graduate), and Signal Analysis. Grader: Signal Compression (graduate), Error Correcting Codes (graduate), Pattern Recognition (graduate). Guest Lecturer: Information Theory (2 lectures), Probability (6 lectures), Signal Compression (2 lectures).

Koç University: Teaching assistant: Digital Image-Video Processing (graduate), Digital Signal Processing (graduate), and Signal Analysis.

DOCTORAL  
STUDENT  
SUPERVISION

Mustafa Mehmetoglu, UCSB (2011-2016): Ph.D. Thesis: A Deterministic Annealing Framework for Global Optimization of Delay-Constrained Communication and Control Strategies

Mehdi Salehifar, UCSB (2012-2013): Optimal quantization of hidden Markov sources, rate-distortion theory

Songze Li, USC (2013-2014): Cooperative communication over MAC, network information theory

Xiaobin Gao, UIUC (2014-present): Sequential decision making under statistical uncertainty, stochastic networked control

Muhammed Sayin, UIUC (2015-present): Strategic communication, game theory

HONORS AND  
AWARDS

IEEE Senior Member–Signal Processing Society

Invited Panelist and Speaker at 5G and IoT Workshop at NCTU, Taiwan, 2016

Invited to the NSF Cyber-Physical Systems Program Review, 2015, 2016

Invited Participant at NSF-IPAM Graduate Summer School on Games and Contracts for Cyber-Physical Security, UCLA, July 2015

Invited Participant at NSF Early Career Investigators’ Workshop on Cyber-Physical Systems and Smart City, Seattle, April 2015

Invited Participant at Allerton’14 Rising Stars Session 2014

USC Postdoctoral Training & Travel Award 2014 (Amount: \$1500)

UCSB ECE Department Dissertation Fellowship 2010

UCSB Senate Doctoral Student Travel Grant 2010 (Amount: \$2000)

Turkish NSF (TUBITAK) Fellowship for graduate study at Stanford University, along with admission from Stanford (Declined) (2005).

UCLA Graduate Fellowship (2005)

Koc University Graduate Fellowship (2003-2005)

Bilkent University Undergraduate Fellowship (1999-2003)

Ranked 12th among 136,669 students in nationwide Post University Record Exam (2003)

Ranked 55th among 1,478,365 students in nationwide University Entrance Exam (1999)

Ranked 1st among 531,827 students in nationwide Science High Schools Exam (1996)

Ranked 28th among 452,192 students in nationwide Anatolian High Schools Exam (1992)

PROPOSAL  
WRITING  
EXPERIENCE

Sole PI, NSF Early Career Investigators’ Workshop on CPS and Smart City, “Strategic Sensing in the Smart City”, 2015 (Amount: \$2,000.00, accepted)

Leading Contributor to the NSF Proposal, PI: Urbashi Mitra, co-PI: Ashutosh Nayyar, CPS-1446901 “Energy and Delay: Network Optimization in Cyber Physical Human Sensing Systems”, 2014 (Amount: \$499,330.00, accepted)

Sole PI, USC Postdoctoral Scholar Research Grant, “Sensors that Make Sense: Unifying Estimation, Communications & Control for Energy Conservation”, 2014 (Amount: \$25,000.00, declined)

Leading Contributor to the NSF Proposal, PI: Kenneth Rose, CCF 1118075: “Analog Networking: Distributed Source-Channel Approaches to Delay and Resource Constrained Communications”, 2011 (Amount: \$302,132.00, accepted)

Contributor to the NSF Proposal, PI: Kenneth Rose, CCF-1016861: “An Integrated Framework for Distributed Source Coding and Dispersive Information Routing”, 2010 (Amount: \$419,314.00, accepted)

4. **E. Akyol**, K. Rose, and T. Başar, “Optimal Coordination and Communication Strategies in Networked Cyber-Physical Systems with Adversarial Elements”, *IEEE Transactions on Signal and Information Processing over Networks, Special Issue on Distributed Signal Processing for Security and Privacy in Networked Cyber-Physical Systems*, in review.
3. M.S. Mehmetoglu, **E. Akyol**, and K. Rose, “Deterministic Annealing Optimization for Witsenhausen’s and Related Decentralized Stochastic Control Problems”, *IEEE Transactions on Automatic Control*, in review
2. X. Gao, **E. Akyol**, and T. Başar, “Optimal Communication Scheduling and Remote Estimation over an Additive Noise Channel”, *IFAC Automatica*, in review
1. M. Sayin, **E. Akyol**, and T. Başar, “Hierarchical Multi-stage Gaussian Signaling Games: Strategic Communication and Control”, *IFAC Automatica*, in review

14. **E. Akyol**, C. Langbort, and T. Başar, “Information-Theoretic Approach to Strategic Communication as a Hierarchical Game”, *Proceedings of the IEEE, Special Issue on Principles and Applications of Science of Information*, forthcoming (February 2017).
13. **E. Akyol** and U. Mitra, “Power-Distortion Metrics for Path Planning over Gaussian Sensor Networks”, *IEEE Transactions on Communications*, vol. 64, no. 3, pp.1220-1231, March 2016.
12. K. Viswanatha, **E. Akyol** and K. Rose, “Combinatorial Message Sharing and a New Achievable Region for Multiple Descriptions”, *IEEE Transactions on Information Theory*, vol. 62, no. 2, pp.769-792, February 2016.
11. M.S. Mehmetoglu, **E. Akyol**, and K. Rose, “Deterministic Annealing Based Optimization for Zero-Delay Source-Channel Coding in Networks”, *IEEE Transactions on Communications*, vol. 63, no. 12, pp.5089-5100, December 2015.
10. **E. Akyol**, K. Rose, and T. Başar, “Optimal Zero-delay Jamming Over an Additive Noise Channel”, *IEEE Transactions on Information Theory*, vol.61, no.8, pp.4331-4344, August 2015.
9. **E. Akyol**, K. Viswanatha, K. Rose, and T. Ramstad, “On Zero Delay Source Channel Coding”, *IEEE Transactions on Information Theory*, vol.60, no.12, pp.7473-7489, December 2014.
8. K. Viswanatha, **E. Akyol** and K. Rose, “An Achievable Rate Region for Joint Compression and Dispersive Information Routing for Networks”, *IEEE Transactions on Information Theory*, vol. 60, no. 9, pp.5433-5456, September 2014.
7. K. Viswanatha, **E. Akyol** and K. Rose, “The Lossy Common Information of Correlated Sources”, *IEEE Transactions on Information Theory*, vol.60, no.6, pp.3238-3253, June 2014.
6. **E. Akyol** and K. Rose, “On Constrained Randomized Quantization”, *IEEE Transaction on Signal Processing*, vol.61, no.13, pp. 3291-3302, July 2013.
5. **E. Akyol**, K. Viswanatha, and K. Rose, “On Conditions for Linearity of Optimal Estimation”, *IEEE Transactions on Information Theory*, vol. 58, no. 6, pp.3497-3508, June 2012.
4. **E. Akyol** and M. vander Schaar, “Compression-Aware Energy Optimization for Video Decoding Systems with Passive Power”, *IEEE Transactions on Circuits and Systems for Video Technology*, vol.18, no.9, pp.1300-1306, September 2008.
3. **E. Akyol** and M. vander Schaar, “Complexity Model Based Proactive Dynamic Voltage Scaling for Video Decoding Systems”, *IEEE Transactions on Multimedia*, vol.9, no.7, pp.1475-1492, November 2007.
2. **E. Akyol**, M. Tekalp, and R. Civanlar, “A Flexible Multiple Description Coding Framework for Adaptive Peer-to-peer Video Streaming”, *IEEE Journal of Selected Topics in Signal Processing*, vol.1, no.2, pp.231-245, August 2007.
1. **E. Akyol**, M. Tekalp, and R. Civanlar, “Content-aware Scalability Type Selection for Rate Adaptation of Scalable Video”, *EURASIP Journal on Advances in Signal Processing*, 2007.

## PATENTS

2. T. Nanjundaswamy, K. Viswanatha, **E. Akyol** and K. Rose, “Method and apparatus for layered compression of multimedia signals for storage and transmission over heterogeneous networks”, Provisional Patent, UC Case No. 2014-156, 2013.
1. **E. Akyol** and D. Mukherjee, “Scaling the Complexity of Video Encoding”, U.S. Patent, WO 2008/079353, 2008.

CONFERENCE  
PROCEEDINGS

61. **E. Akyol**, C. Langbort, and T. Başar, “Price of Transparency in Strategic Machine Learning”, *3rd Workshop on Fairness, Accountability, and Transparency in Machine Learning (FAT-ML) 2016*.
60. K. Mihcak, **E. Akyol**, T. Başar, and C. Langbort, “Scalar Quadratic-Gaussian Soft Watermarking Games”, *Conference on Decision and Game Theory for Security (GameSec) 2016*.
59. X. Gao, **E. Akyol**, and T. Başar, “On Remote Estimation with Communication Scheduling and Power Allocation”, *IEEE Conference on Decision and Control 2016*.
58. M. Sayin, **E. Akyol**, and T. Başar, “Strategic Control of a Tracking System”, *IEEE Conference on Decision and Control 2016*.
57. **E. Akyol**, C. Langbort, and T. Başar, “Strategic Communication in Multi-agent Systems”, *Asilomar Conference on Signals, Systems, and Computers 2016*.
56. X. Gao, **E. Akyol**, and T. Başar, “Joint Optimization of Communication Scheduling and Online Power Allocation in Remote Estimation”, *Asilomar Conference on Signals, Systems, and Computers 2016*.
55. M. Sayin, **E. Akyol**, and T. Başar, “On the Structure of Equilibrium Strategies in Dynamic Gaussian Signaling Games”, *IEEE Multi-Conference on Systems and Control 2016*.
54. **E. Akyol**, C. Langbort, and T. Başar, “On the Role of Side Information in Strategic Communication”, *IEEE International Symposium on Information Theory 2016*.
53. X. Gao, **E. Akyol**, and T. Başar, “On Remote Estimation with Multiple Communication Channels”, *IEEE American Control Conference 2016*.
52. M.S. Mehmetoglu, **E. Akyol**, and K. Rose, “Analog Multiple Descriptions: A Zero-Delay Source-Channel Coding Approach”, *IEEE International Conference on Acoustics, Speech, and Signal Processing 2016*.
51. X. Gao, **E. Akyol**, and T. Başar, “Optimal Estimation with Limited Measurements and Noisy Communication”, *IEEE Conference on Decision and Control 2015*.
50. **E. Akyol**, C. Langbort, and T. Başar, “Privacy Constrained Information Processing”, *IEEE Conference on Decision and Control 2015*, .
49. **E. Akyol**, C. Langbort, and T. Başar, “Strategic Compression and Transmission of Information”, *IEEE Information Theory Workshop 2015*.
48. X. Gao, **E. Akyol**, and T. Başar, “Optimal Sensor Scheduling and Remote Estimation over an Additive Noise Channel”, *American Control Conference 2015*.
47. **E. Akyol**, U. Mitra, and A. Nayyar, “Controlled Sensing and Event Based Communication for Remote Estimation”, *Allerton 2014*, .
46. **E. Akyol** and U. Mitra, “On Source-Channel Coding over Gaussian Sensor Networks for Path Planning”, *Allerton 2014*, .
45. **E. Akyol** and U. Mitra, “Source-Channel Coding over Gaussian Sensor Networks with Active Sensing”, *IEEE Globecom 2014*.
44. **E. Akyol**, U. Mitra, E. Tuncel, and K. Rose, “Source Coding in the Presence of Exploration-Exploitation Tradeoff”, *IEEE International Symposium on Information Theory 2014*.
43. **E. Akyol**, U. Mitra, E. Tuncel, and K. Rose, “On Scalable Coding in the Presence of Decoder Side Information”, *IEEE International Symposium on Information Theory 2014*.
42. M.S. Mehmetoglu, **E. Akyol**, and K. Rose, “A Deterministic Annealing Approach to Witsenhausen’s Counterexample”, *IEEE International Symposium on Information Theory 2014*.
41. S. Li, **E. Akyol**, and U. Mitra, “Power Allocation for Gaussian Multiple Access Channel with Noisy Cooperative Links”, *IEEE International Conference on Acoustics, Speech, and Signal Processing 2014*.

40. M.S. Mehmetoglu, **E. Akyol**, and K. Rose, "Optimization of Zero-delay Mappings for Distributed Coding by Deterministic Annealing", *IEEE International Conference on Acoustics, Speech, and Signal Processing 2014*.
39. M. Salehifar, **E. Akyol**, K. Viswanatha, and K. Rose, "On Optimal Coding of Hidden Markov Sources", *IEEE Data Compression Conference 2014*.
38. **E. Akyol**, K. Rose, and T. Başar "On Optimal Jamming Over an Additive Noise Channel", *IEEE Conference on Decision and Control 2013*.
37. **E. Akyol**, and K. Rose, "Optimal Jamming Over Additive Noise: Vector Source-Channel Case", *51st Allerton Conference on Communication, Control, and Computing 2013*.
36. **E. Akyol**, K. Rose, and T. Başar, "On Communication over Gaussian Sensor Networks with Adversaries: Further Results", *Conference on Decision and Game Theory for Security (GameSec)*, 2013.
35. M.S. Mehmetoglu, **E. Akyol**, and K. Rose, "A Deterministic Annealing Approach to Optimization of Zero Delay Source-Channel Codes", *IEEE Information Theory Workshop 2013*.
34. **E. Akyol**, K. Rose, T. Başar "Gaussian Sensor Networks with Adversarial Nodes", *IEEE International Symposium on Information Theory 2013*.
33. **E. Akyol**, K. Viswanatha, K. Rose, and T. Ramstad, "On Zero Delay Source-Channel Coding: Functional Properties and Linearity Conditions", *IEEE International Symposium on Information Theory 2013*.
32. K. Viswanatha, **E. Akyol**, and K. Rose, "On The Role of Common Codewords in Quadratic Gaussian Multiple Description Coding", *IEEE International Symposium on Information Theory 2013*.
31. **E. Akyol**, K. Viswanatha, and K. Rose, "On Random Binning versus Conditional Codebook Methods in Multiple Descriptions Coding", *IEEE Information Theory Workshop 2012*.
30. K. Viswanatha, **E. Akyol**, T. Nanjundaswamy and K. Rose, "On Common-Information and the Encoding of Sources that are Not Successively Refinable", *IEEE Information Theory Workshop 2012*.
29. K. Viswanatha, **E. Akyol**, and K. Rose, "A New Achievable Region for Gaussian Multiple Descriptions Based on Subset Typicality", *IEEE Information Theory Workshop 2012*.
28. **E. Akyol**, K. Viswanatha, and K. Rose, "Linearity Conditions for Optimal Estimation From Multiple Noisy Measurements", *IEEE Statistical Signal Processing Workshop 2012*.
27. **E. Akyol** and K. Rose, "On Linear Transforms in Zero-delay Gaussian Source Channel Coding", *IEEE International Symposium on Information Theory 2012*.
26. **E. Akyol**, K. Viswanatha, and K. Rose, "Combinatorial Message Sharing and Random Binning for Multiple Description Coding", *IEEE International Symposium on Information Theory 2012*.
25. K. Viswanatha, **E. Akyol**, and K. Rose, "Lossy Common Information of Two Dependent Random Variables", *IEEE International Symposium on Information Theory 2012*.
24. **E. Akyol** and K. Rose, "Towards Optimality in Multiterminal Transform Coding", *IEEE Data Compression Conference 2012*.
23. **E. Akyol** and K. Rose, "On Constrained Randomized Quantization", *IEEE Data Compression Conference 2012*.
22. K. Viswanatha, **E. Akyol**, and K. Rose, "A Strictly Improved Achievable Region for Multiple Descriptions Using Combinatorial Message Sharing", *IEEE Information Theory Workshop 2011*.
21. K. Viswanatha, **E. Akyol**, and K. Rose, "An Optimal Transmit-Receive Rate Tradeoff in Gray-Wyner Network and Its Relation to Common Information", *IEEE Information Theory Workshop 2011*.
20. **E. Akyol** and K. Rose, "A Necessary and Sufficient Condition for Transform Optimality in Source Coding", *IEEE International Symposium on Information Theory 2011*.

19. K. Viswanatha, **E. Akyol**, and K. Rose, "An Achievable Rate Region for Distributed Source Coding and Dispersive Information Routing", *IEEE International Symposium on Information Theory 2011*.
18. K. Viswanatha, **E. Akyol**, and K. Rose, "Combinatorial Message Sharing for a Refined Multiple Descriptions Achievable Region", *IEEE International Symposium on Information Theory 2011*.
17. **E. Akyol**, K. Viswanatha, and K. Rose, "On Optimal Multidimensional Estimation: Linearity Conditions", *IEEE Statistical Signal Processing Workshop 2011*.
16. **E. Akyol**, K. Viswanatha, and K. Rose, "On Conditions for Linearity of Optimal Estimation", *IEEE Information Theory Workshop 2010*.
15. K. Viswanatha, **E. Akyol**, and K. Rose, "On Optimum Communication Cost for Joint Compression and Dispersive Information Routing", *IEEE Information Theory Workshop 2010*.
14. K. Viswanatha, **E. Akyol**, and K. Rose, "Distributed source coding and dispersive information routing: An integrated approach with networking and database applications", *European Signal Processing Conference*, 2010.
13. K. Viswanatha, **E. Akyol**, and K. Rose, "Towards Optimum Cost in Multi-hop Networks with Arbitrary Network Demands", *IEEE International Symposium on Information Theory 2010*.
12. **E. Akyol**, K. Rose, and T. Ramstad, "Optimized Analog Mappings for Distributed Source Channel Coding", *IEEE Data Compression Conference 2010*.
11. **E. Akyol**, K. Rose, and T. Ramstad "Optimal Mappings for Joint Source Channel Coding", *IEEE Information Theory Workshop 2010*.
10. **E. Akyol** and K. Rose, "On Transform Coding with Dithered Quantizers", *IEEE Data Compression Conference 2009*.
9. **E. Akyol** and K. Rose, "Nonuniform Dithered Quantization", *IEEE Data Compression Conference 2009*.
8. **E. Akyol**, O. Guleryuz, and R. Civanlar, "Royalty Cost Based Optimization for Video Compression", *IEEE International Conference on Image Processing 2007*.
7. **E. Akyol**, D. Mukherjee, and Y. Liu, "Complexity Control for Real Time Video Coding", *IEEE International Conference on Image Processing 2007*.
6. **E. Akyol** and M. van der Schaar, "Buffer Constrained Proactive Dynamic Voltage Scaling for Video Decoding Systems", *IEEE International Conference on Image Processing 2007*.
5. **E. Akyol**, M. Tekalp, and R. Civanlar, "Adaptive Peer to Peer Video Streaming with Flexible Multiple Description Coding", *IEEE International Conference on Image Processing 2006*.
4. **E. Akyol**, M. Tekalp, and R. Civanlar, "Optimum Bit Allocation in Scalable Multiple Description Video Coding", *European Signal Processing Conference 2005*.
3. **E. Akyol**, M. Tekalp, and R. Civanlar, "Scalable Multiple Description Video Coding with Flexible Number of Descriptions", *IEEE International Conference on Image Processing 2005*.
2. **E. Akyol**, M. Tekalp, and R. Civanlar, "Optimum Scaling Operator Selection in Scalable Video Coding", *Picture Coding Symposium 2004*.
1. **E. Akyol**, M. Tekalp, and R. Civanlar, "Motion Compensated Temporal Filtering Within the H.264/AVC Standard", *IEEE International Conference on Image Processing 2004*.

## SERVICE

**Invited Reviewer for Journals:** Proceedings of the IEEE, IEEE Transactions on Signal Processing, IEEE Transactions on Information Theory, IEEE Transactions on Communications, IEEE Transactions on Automatic Control, Games Journal, IEEE Transactions on Image Processing, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Multimedia, IEEE Selected Topics in Signal Processing, IEEE Journal on Selected Areas in Communications, Special Elsevier Signal Processing: Image Communications

Member: IEEE Information Theory, Signal Processing, Control Systems Societies

## Organizer:

- Special session “Strategies and Games” at Information Theory and Applications Workshop, San Diego, CA 2015.
- Special session “Networked Source and Source-Channel Coding” at Information Theory and Applications Workshop, San Diego, CA 2014.

## INVITED TALKS

“Statistical Physics Based Optimization for Stochastic Control Problems”, Los Alamos National Laboratories, New Mexico, Aug. 2016.

“A Tale of Five Cities: A Data Compression Tour of My Research Experience”, Sharp Laboratories, Camas, WA, July 2016.

“Strategic Communication in Multi-agent Systems with Applications to Smart City”, 5th Midwest Workshop on Control and Game Theory, Purdue University, April 2016.

“Networked Strategic Communication”, Information Theory and Applications Workshop, San Diego, CA, Feb 2016.

“Some Models of Strategic Information Transmission in Crowdsourcing Apps”, Google Tech Talk, Mountain View, CA Oct. 2015.

“Communication and Control in Strategic Environments”, 4th Midwest Workshop on Control and Game Theory, Iowa State University, April 2015, NSF Early Career Investigators’ Workshop on CPS and Smart City, Seattle, April 2015.

“Optimal Strategies for Information Processing in Smart Systems”, Columbia University, April 2015.

“Strategic Compression and Transmission of Information”, ITA Workshop, San Diego, CA Feb 2015.

“On the Use of Information Theoretic Tools in Controls”, USC Control Workshop Dec 2014.

“New Results in Successive Coding”, ITA Workshop, UC San Diego Feb 2014.

“Networked Source Coding in the Presence of Exploration versus Exploitation Tradeoff”, Stanford University, Jan 2014, University of Southern California, Jan 2014.

“Networked Information Processing: New Compression, Processing and Control Paradigms for Networks”, Purdue University, Oct. 2013, UC San Diego May 2013, Mississippi State University, April 2013, Communications, Networks and Systems Seminar-University of Southern California, April 2013.

“On Complexity and Delay Constrained Communications”, Mitsubishi Electric Research Laboratories, Cambridge, Boston, June 2010, Hewlett-Packard Laboratories, Palo Alto, CA, May 2010