VIVEK K GOYAL

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EDUCATION AND ACADEMIC HONORS

University of California, Berkeley, California:
- M.S. in Electrical Engineering, May 1995
- Ph.D. in Electrical Engineering, December 1998
- Eliahu Jury Award (presented to "a graduate student or recent alumnus for outstanding achievement in Systems, Communications, Control, or Signal Processing") 1998

University of Iowa, Iowa City, Iowa:
- B.S.E. with highest distinction, with honors in Electrical Engineering, May 1993
- B.S. with highest distinction in Mathematics, May 1993
- John Briggs Memorial Award (annual award for the top graduate of the University) 1993
- Distinguished Student Leader Certificate 1992
- Phi Beta Kappa and Tau Beta Pi inductee

National Science Foundation Graduate Fellowship 1993
National Defense Science and Engineering Graduate Fellowship 1993
Tau Beta Pi Graduate Fellowship 1993
Rhodes Scholarship, State Finalist 1992
Barry M. Goldwater Scholarship recipient (250 awarded nationally) 1990

POSTGRADUATE RESEARCH AND TEACHING APPOINTMENTS

Professor – Boston University, Department of Electrical and Computer Engineering. March 2020–present.
Visiting Scholar – Harvard University, John A. Paulson School of Engineering and Applied Sciences. September 2024–present.
Associate Chair of Doctoral Programs – Boston University, Department of Electrical and Computer Engineering. September 2021–August 2024.
Associate Professor – Boston University, Department of Electrical and Computer Engineering. August 2016–February 2020.
Senior Software Engineer – Nest (Google/Alphabet). July 2014–May 2017. Contributed to integration of technology from 3dim Tech (acquired startup) and a variety of signal processing and machine perception challenges.
Assistant Professor – Boston University, Department of Electrical and Computer Engineering. January 2014–July 2014.
Adviser – 3dim Tech. January 2013–July 2014.
Research Scientist – Massachusetts Institute of Technology, Research Laboratory of Electronics. (Principal Investigator of the Signal Transformation and Information Representation group.) July 2012–March 2016.
Esther and Harold E. Edgerton Associate Professor – Massachusetts Institute of Technology, Department of Electrical Engineering and Computer Science. July 2008–June 2012.
Esther and Harold E. Edgerton Assistant Professor – Massachusetts Institute of Technology, Department of Electrical Engineering and Computer Science. July 2007–June 2008.
Assistant Professor – Massachusetts Institute of Technology, Department of Electrical Engineering and Computer Science. January 2004–June 2007.
Visiting Professor – École Polytechnique Fédérale de Lausanne Centre Bernoulli, June–July 2006.
Visiting Scholar – University of California, Berkeley, Department of Electrical Engineering and Computer Sciences. July 2003–December 2003.
Senior Research Engineer – Digital Fountain. May 2001–February 2003. Supervisor: Dr. Michael Luby, Co-Founder and Chief Technology Officer. Contributions included design, analysis, simulation, implementation, and IETF-standardization of WEBRC congestion control mechanisms; assorted other protocol and algorithm designs, including those for a performance enhancing proxy; extensive performance modeling; and competitive analyses.
Member of Technical Staff – Mathematics of Communications Research, Bell Laboratories, Lucent Technologies. September 1998–April 2001. Research primarily in the general area of source coding and information transmission. Developed several techniques for and applications of multiple description (MD) coding, including an MD version of the Bell Labs Perceptual Audio Coder and a robust speech coder for long-range cordless telephones.

MENTORING HIGHLIGHTS

14 completed PhD graduates include:

- **Andrea B. Colaço** [J38,J53,B4,C92,C96,C97,C100,C104,C105,C108,C109,C111,C112,C113,C114] – Co-founder of 3dim (acquired by Google); leading contributor to Daydream; Senior Staff Engineering Manager with Google
  - Featured in a documentary titled *The Future Makers*, in a trilogy on Great Unsung Women of Computing: The Computers, The Coders and The Future Makers
- **G. Ahmed Kirmani** [J38,J40,J53,J56,B4,C86,C92,C96,C97,C100,C103,C104,C105,C108,C109,C110,C111,C112,C113,C114,C116] – Co-founder of 3dim (acquired by Google); leading contributor to Daydream; Engineering Manager, Meta
- **Joshua Rapp** [J64,J68,J69,J74,J76,J77,J78,J93,J99,C124,C125,C127,C129,C135,C137,C139] – Postdoctoral Researcher, Stanford University; Research Scientist, Mitsubishi Electric Research Laboratories
- **Sheila Seidel** [J79,J83,J84,J85,J89,J90,C128,C139,C140,C143,C144] – Lead Research Scientist, Analog Devices, Inc.
- **Lav R. Varshney** [J32,J35,J36,J42,J43,J48,J61,J62,J71,B3,C34,C37,C41,C48,C50,C63,C65,C67,C70,C74,C76,C77,C85,C90,C95] – Associate Professor of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign; White House Fellow
- **Daniel S. Weller** [J33,J34,J45,J49,C59,C71,C79,C81,C82,C87,C93,C99] – Senior Manager of AI/Algorithms Engineering, KLA

Other mentees include:

- **Pier Luigi Dragotti** [J12,C19] – Professor of Signal Processing, Imperial College London
- **Alyson K. Fletcher** [J16,J18,J19,J28,J41,J46,J63,B2,C24,C26,C27,C28,C29,C30,C31,C32,C33,C35,C42,C47,C56,C58,C62,C66,C69,C72,C98] – Associate Professor of Statistics, Mathematics, Computer Science, and Electrical and Computer Engineering, University of California, Los Angeles
- **Behnam Jafarpour** [J27,J29,C57] – Professor of Chemical Engineering and Materials Science, Electrical and Computer Engineering, and Civil and Environmental Engineering, University of Southern California
- **Ulugbek S. Kamilov** [J47,C83,C84,C89] – Associate Professor of Computer Science and Engineering and of Electrical and Systems Engineering, Washington University in St. Louis
- **Jonathan A. Kelner** [J6,J11,C17] – Professor of Applied Mathematics, Massachusetts Institute of Technology
- **John Murray-Bruce** [J66,J72,J73,J77,J79,J81,J82,C121,C123,C128,C130,C132,C134,C137,C139,C144] – Assistant Professor of Electrical Engineering, University of South Florida
- **Hoover Rueda-Chacón** [J90,J97,J94,C142] – Assistant Professor of Computer Science, Universidad Industrial de Santander, Colombia.

Awards for supervised research include:

- BU Electrical and Computer Engineering Doctoral Achievement Award 2023, Sheila Seidel.
- BU Electrical and Computer Engineering 2022/2023 Undergraduate Outstanding Research Award, William Krska.
- CRA Outstanding Undergraduate Research Award Honorable Mention 2023, William Krska.
- IEEE Signal Processing Society Best PhD Dissertation Award 2021, Joshua Rapp.
- CLEO 2021 Student Poster Contest First-Place, Charles Saunders.
- Microscopy and Microanalysis Poster Award 2021, Luisa Watkins.
- IEEE Signal Processing Society Young Author Best Paper Award 2020, Joshua Rapp.
- BU Outstanding Electrical Engineering Dissertation Award 2020, Joshua Rapp.
- IEEE International Conference on Image Processing 2018 Best Student Paper Award, Joshua Rapp.
- Jin-Au Kong Award, Honorable Mention (best MIT PhD thesis in EE) 2015, G. Ahmed Kirmani.
- David Adler Memorial Prize (best MIT MEng thesis in EE), Second Place, 2013, Jonathan B. Mei.
- IEEE Sensor Array and Multichannel Signal Processing Workshop Student Paper Contest First Prize 2012, Joong B. Rhim.
- Jin-Au Kong Award, Honorable Mention (best MIT PhD thesis in EE) 2011, Lav R. Varshney.
- IEEE Data Compression Conference Capocelli Prize 2011, John Z. Sun.
- David Adler Memorial Prize (best MIT MEng thesis in EE) 2008, Vinith Misra.
- Ernst A. Guillemin Thesis Prize (best MIT SM thesis in EE) 2006, Lav R. Varshney.
- IEEE Data Compression Conference Capocelli Prize 2006, Lav R. Varshney.
- École Polytechnique Fédérale de Lausanne Best Masters Thesis Award 2000, Francois Mason.

Honors and Awards

Guggenheim Fellowship 2024
Frontiers of Science Award in Computational Optics, awarded by the International Congress for Basic Science 2023 for "Quantum-inspired computational imaging" (*Science*, 2018)
American Association for the Advancement of Science (AAAS) Fellow (class of 2022), *For distinguished contributions to the field of computational imaging and sensing, particularly for advancing the understanding of the information content of weak, mixed, and indirect optical measurements*
IEEE Signal Processing Society Outstanding Editorial Board Member 2021
Optica Fellow (class of 2020), *For outstanding inventions in computational imaging and sensing, including unprecedented demonstrations of the utility of weak, mixed, and indirect optical measurements*
IEEE Signal Processing Society Best Paper Award 2019
Best Poster Award, 2018 IEEE International Conference on Computational Photography
IEEE Signal Processing Society Best Paper Award 2017
IEEE Signal Processing Society Distinguished Lecturer, 2017–2018
Best Paper Award, 2014 IEEE International Conference on Image Processing
IEEE Fellow (class of 2014), *For contributions to information representations and their applications in acquisition, communication, and estimation*
MassChallenge 2013 Accelerator Gold Winner
MIT $100K Entrepreneurship Competition Launch Contest Grand Prize 2013
MIT $100K Entrepreneurship Competition Pitch Contest Grand Prize 2012
National Science Foundation CAREER Award 2007
IEEE Signal Processing Society Magazine Award 2002

Major Professional Service Activities: Ongoing

SIAM New England Section, founding officer, 2024–present.
CLP Advanced Imaging, Associate Editor, 2023–present.
Editorial Board of Foundations and Trends in Signal Processing, 2006–present.

Major Professional Service Activities: Past

Conference Co-Chair, SPIE Wavelets and Sparsity conference series, 2006–2016.
IEEE Transactions on Computational Imaging, Senior Area Editor, 2019–2024.
SIAM Journal on Imaging Sciences, Associate Editor, 2020–2023.
IEEE Open Journal on Signal Processing, Editorial Board, 2019–2022.
Technical Program Co-Chair, 11th International Conference on Sampling Theory and Applications (SampTA 2015).
Scientific Advisory Board of the Banff International Research Station for Mathematical Innovation and Discovery, 2011–2015; Programme Committee Member, 2012, 2013.
IEEE Transactions on Multimedia Steering Committee, 2013.
Computational Imaging Technical Committee (TC) Member, IEEE Signal Processing Society, 2015–2020 (elected position).
Industry Digital Signal Processing (IDSP) TC Member, IEEE Signal Processing Society, 2016–2020 (elected position).
Applied Signal Processing Systems (ASPS) TC Member, IEEE Signal Processing Society, 2021 (elected position).
Image, Video, and Multidimensional Signal Processing (IVMSP) Technical Committee Member, IEEE Signal Processing Society, 2014 (elected position); Vice Chair (elected position) 2014.
Image and Multiple Dimensional Signal Processing (IMDSP) Technical Committee Member, IEEE Signal Processing Society, 2003–2009 (elected position); Associate Member 2012–2013.

Major Boston University Service Activities

Appointment, Promotion & Tenure Committee, College of Engineering, September 2020–August 2023.
Area Coordinator for Information and Data Sciences, September 2016–August 2021.

Professional and Honorary Memberships

Phi Beta Kappa (former chapter Vice-President)
Tau Beta Pi (National Engineering and Physics Honor Society)
Eta Kappa Nu (National Electrical Engineering Honor Society)
Sigma Xi (National Scientific Research Honor Society)
Omicron Delta Kappa (National Leadership Honor Society and Service Organization)
American Association for the Advancement of Science
Institute of Electrical and Electronics Engineers
Optical Society of America
Society for Industrial and Applied Mathematics

PUBLICATIONS

Journal papers

101. Unay Dorken Gallastegi, Wentao Shangguan, Vaibhav Choudhary, Akshay Agarwal, Hoover Rueda-Chacón, Martin J. Stevens, and Vivek K Goyal, "Ozone Cues Mitigate Reflected Downwelling Radiance in LWIR Absorption-Based Ranging," submitted 2 Jun 2025.
100. Vaibhav Choudhary, Akshay Agarwal, and Vivek K Goyal, "Beam Cross Sections Create Mixtures: Improving Feature Localization in Secondary Electron Imaging," submitted 21 May 2025.
99. Alfred Krister Ulvog, Joshua Rapp, and Vivek K Goyal, "FMCW Lidar Beyond Nyquist by Instantaneous Frequency Fitting," submitted 16 May 2025.
98. Wenwen Li, Yijun Zhou, Wei Li, Xin Huang, Chen Dai, Jianwei Zeng, Yutao Chen Xiankang Dou, Vivek K Goyal, Feihu Xu, and Jian-Wei Pan, "Turning rough surfaces into non-line-of-sight cameras," *Optica*, vol. 12, no. 5, pp. 626–634, May 2025.
97. Unay Dorken Gallastegi, Hoover Rueda-Chacón, Martin J. Stevens, and Vivek K Goyal, "Absorption-Based, Passive Range Imaging from Hyperspectral Thermal Measurements," *IEEE Trans. Pattern Analysis & Machine Intelligence*, vol. 47, no. 5, pp. 4044–4060, May 2025.
96. Akshay Agarwal, Leila Kasaei, Xinglin He, Ruangrawee Kitichotkul, Oğuz Kağan Hitit, J. Albert Schultz, Leonard C. Feldman, and Vivek K Goyal, "Ion Count-Aided Microscopy for Quantitative, Shot Noise-Mitigated Secondary Electron Imaging," *Microscopy and Microanalysis*, vol. 30, no. S1, article ozae044.987, July 2024.
95. Akshay Agarwal, Leila Kasaei, Xinglin He, Ruangrawee Kitichotkul, Oğuz Kağan Hitit, Minxu Peng, J. Albert Schultz, Leonard C. Feldman, and Vivek K Goyal, "Shot Noise-Mitigated Secondary Electron Imaging with Ion Count-Aided Microscopy, *Proc. National Academy of Sciences of the USA*, vol. 121, no. 31, article e2401246121, 25 Jul 2024.
94. Unay Dorken Gallastegi, Hoover Rueda-Chacón, Martin J. Stevens, and Vivek K Goyal, "Absorption-Based Hyperspectral Thermal Ranging: Performance Analyses, Optimization, and Simulations," *Optics Express*, vol. 32, no. 1, pp. 151–166, 2024.
93. Ruangrawee Kitichotkul, Joshua Rapp, and Vivek K Goyal, "The Role of Detection Times in Reflectivity Estimation with Single-Photon Lidar," *IEEE J. Sel. Top. Quantum Electronics*, vol. 30, no. 1, art. seq. no. 8800114, January/February 2024.
92. Akshay Agarwal, Leila Kasei, Albert Schultz, Leonard C. Feldman, and Vivek K Goyal, "Progress in Secondary Electron Yield Mapping in Charged Particle Microscopy," *Microscopy and Microanalysis*, vol. 29, no. S1, pp. 741–742, August 2023.
91. Oğuz Kağan Hitit, Akshay Agarwal, and Vivek K Goyal, "Fourier-Ring Correlation Resolution for Time-Resolved Measurement in Charged Particle Microscopy," *Microscopy and Microanalysis*, vol. 29, no. S1, pp. 730–731, August 2023.
90. Sheila Seidel, Hoover Rueda-Chacón, Iris Cusini, Federica Villa, Franco Zappa, Christopher Yu, and Vivek K Goyal, "Non-Line-of-Sight Snapshots and Background Mapping with an Active Corner Camera," *Nature Communications*, vol. 14, article no. 3677, 21 Jun 2023.
89. Minxu Peng, Ruangrawee Kitichotkul, Sheila W. Seidel, Christopher Yu, and Vivek K Goyal, "Denoising Particle Beam Micrographs with Plug-and-Play Methods," *IEEE Trans. Computational Imaging*, vol. 9, pp. 581–593, 13 June 2023.
88. Akshay Agarwal, Minxu Peng, and Vivek K Goyal, "Continuous-Time Modeling and Analysis of Particle Beam Metrology," *IEEE J. Sel. Areas Inform. Theory*, vol. 4, pp. 61–74, 9 June 2023.
87. Charles Saunders and Vivek K Goyal, "MEGS: A Penalty for Mutually Exclusive Group Sparsity," *IEEE Open J. Signal Process.*, vol. 4, pp. 275–283, 26 May 2023.
86. Akshay Agarwal, John Simonaitis, Vivek K Goyal, and Karl K. Berggren, "Secondary Electron Count Imaging in SEM," *Ultramicroscopy*, vol. 245, no. 113662, 2023 (7 December 2022).
85. Sheila W. Seidel, Luisa Watkins, Minxu Peng, Akshay Agarwal, Christopher Yu, and Vivek K Goyal, "Addressing Neon Gas Field Ion Source Instability Through Online Beam Current Estimation," *Microscopy and Microanalysis*, vol. 28, no. S1, pp. 36–39, August 2022.
84. Sheila W. Seidel, Luisa Watkins, Minxu Peng, Akshay Agarwal, Christopher Yu, and Vivek K Goyal, "Online Beam Current Estimation in Particle Beam Microscopy," *IEEE Trans. Computational Imaging*, vol. 8, pp. 521–535, 2022.
83. Luisa Watkins, Sheila W. Seidel, Minxu Peng, Akshay Agarwal, Christopher Yu, and Vivek K Goyal, "Prevention Beats Removal: Avoiding Stripe Artifacts from Current Variation in Particle Beam Microscopy Through Time-Resolved Sensing," *Microscopy and Microanalysis*, vol. 27, no. S1, pp. 422–425, August 2021.
82. Minxu Peng, John Murray-Bruce, and Vivek K Goyal, "Time-Resolved Focused Ion Beam Microscopy: Modeling, Estimation Methods, and Analyses," *IEEE Trans. Computational Imaging*, vol. 7, pp. 547–561, 2021.
81. Shuhui Li, Charles Saunders, Daniel J. Lum, John Murray-Bruce, Vivek K Goyal, Tomáš Čižmár, and David B. Phillips, "Compressively Sampling the Optical Transmission Matrix of a Multimode Fibre," *Light: Science & Applications*, vol. 10, article no. 88, 21 Apr 2021.

80. Cheng Wu, Jianjiang Liu, Xin Huang, Zhengping Li, Chao Yu, Juntian Ye, Jun Zhang, Qiang Zhang, Haiyun Xia, Xiankang Dou, Vivek K Goyal, Feihu Xu, and Jian-Wei Pan, "Non–line-of-sight imaging over 1.43 kilometers," *Proc. National Academy of Sciences of the USA*, vol. 118, no. 10, article e2024468118, 9 Mar 2021.

79. Sheila W. Seidel, John Murray-Bruce, Yanting Ma, Christopher Yu, William T. Freeman, and Vivek K Goyal, "Two-Dimensional Non-Line-of-Sight Scene Estimation from a Single Edge Occluder," *IEEE Trans. Computational Imaging*, vol. 7, pp. 58–72, 2021. Video.

78. Joshua Rapp, Yanting Ma, Robin M. A. Dawson, and Vivek K Goyal, "High-Flux Single-Photon Lidar," *Optica*, vol. 8, no. 1, pp. 30–39, January 2021.

    - Second most downloaded paper, January 2021.

77. Joshua Rapp, Charles Saunders, Julián Tachella, John Murray-Bruce, Yoann Altmann, Jean-Yves Tourneret, Stephen McLaughlin, Robin M. A. Dawson, Franco N. C. Wong, and Vivek K Goyal, "Seeing Around Corners with Edge-Resolved Transient Imaging," *Nature Communications*, vol. 11, article no. 5929, 23 Nov 2020. Video.

76. Joshua Rapp, Robin M. A. Dawson, and Vivek K Goyal, "Dithered Depth Imaging," *Optics Express*, vol. 22, no. 12, pp. 35143–35157, November 2020.

75. Akshay Agarwal, John Simonaitis, Vivek K Goyal, and Karl K. Berggren, "Offline Secondary Electron Counting and Conditional Re-illumination in SEM," *Microscopy and Microanalysis*, vol. 26, no. S2, pp. 1182–1184, August 2020.

74. Joshua Rapp, Julián Tachella, Yoann Altmann, Stephen McLaughlin, and Vivek K Goyal, "Advances in Single-Photon Lidar for Autonomous Vehicles," *IEEE Signal Processing Magazine*, vol. 37, no. 4, pp. 62–71, July 2020.

73. Minxu Peng, John Murray-Bruce, Karl K. Berggren, and Vivek K Goyal, "Source Shot Noise Mitigation in Focused Ion Beam Microscopy by Time-Resolved Measurement," *Ultramicroscopy*, vol. 211, no. 112948, April 2020 (27 January 2020). Video.

72. Safa C. Medin, John Murray-Bruce, David A. Castañón, and Vivek K Goyal, "Beyond Binomial and Negative Binomial: Adaptation in Bernoulli Parameter Estimation," *IEEE Trans. Computational Imaging*, vol. 5, no. 4, pp. 570–584, December 2019.

71. Daewon Seo, Ravi K. Raman, Joong B. Rhim, Vivek K Goyal, and Lav R. Varshney, "Beliefs in Decision-Making Cascades," *IEEE Trans. Signal Process.*, vol. 67, no. 19, pp. 5103–5117, 1 Oct 2019.

70. Akshay Agarwal, Vivek K Goyal, and Karl K. Berggren, "Performance Analysis of Interaction-Free-Measurement-based Electron Microscopy," *Microscopy and Microanalysis*, vol. 25, no. S2, pp. 152–153, August 2019.

69. Joshua Rapp, Yanting Ma, Robin M. A. Dawson, and Vivek K Goyal, "Dead Time Compensation for High-Flux Ranging," *IEEE Trans. Signal Process.*, vol. 67, no. 13, pp. 3471–3486, 1 Jul 2019.

68. Joshua Rapp, Robin M. A. Dawson, and Vivek K Goyal, "Estimation from Quantized Gaussian Measurements: When and How to Use Dither," *IEEE Trans. Signal Process.*, vol. 67, no. 13, pp. 3424–3438, 1 Jul 2019.

67. Akshay Agarwal, Karl K. Berggren, Yuri J. van Staaden, and Vivek K Goyal, "Reduced Damage in Electron Microscopy by Using Interaction-Free Measurement and Conditional Re-illumination," *Physical Review A*, vol. 99, no. 6, art. 063809, 5 Jun 2019.

66. Charles Saunders, John Murray-Bruce, and Vivek K Goyal, "Computational Periscopy with an Ordinary Digital Camera," *Nature*, vol. 565, pp. 472–475, 24 Jan 2019. Video.

    - See also the News and Views item: Martin Laurenzis, "Shadows used to peer around corners," *Nature*, vol. 565, pp. 435–436, 24 Jan 2019.

65. Yoann Altmann, Stephan McLaughlin, Miles J. Padgett, Vivek K Goyal, Alfred O. Hero, and Daniele Faccio, "Quantum-Inspired Computational Imaging," *Science*, vol. 361, no. 6403, pp. 660, 17 Aug 2018 (full article online).

    - See also the editors' commentary: Ian S. Osborne, "More to imaging than meets the eye," *Science*, vol. 361, no. 6403, p. 659-B, 17 Aug 2018.
    - Winner of a Frontiers of Science Award in Computational Optics, 2023.

64. Joshua Rapp and Vivek K Goyal, "A Few Photons Among Many: Unmixing Signal and Noise for Photon-Efficient Active Imaging," *IEEE Trans. Computational Imaging*, vol. 3, no. 3, pp. 445–459, September 2017.

    - Winner of a 2020 IEEE Signal Processing Society Young Author Best Paper Award.

63. Sundeep Rangan, Alyson K. Fletcher, Vivek K Goyal, Evan Byrne, and Philip Schniter, "Hybrid Approximate Message Passing," *IEEE Trans. Signal Process.*, vol. 65, no. 17, pp. 4577–4592, 1 Sep 2017.

62. Lav R. Varshney, Julius Kusuma, and Vivek K Goyal, "On Palimpsests in Neural Memory: An Information Theory Viewpoint," *IEEE Trans. Molecular, Biological, and Multi-Scale Communications*, vol. 2, no. 2, pp. 143–153, December 2016.

61. Lav R. Varshney, Julius Kusuma, and Vivek K Goyal, "Malleable Coding for Updatable Cloud Caching," *IEEE Trans. Communications*, vol. 64, no. 12, pp. 4946–4955, December 2016.

60. Dongeek Shin, Jeffrey H. Shapiro, and Vivek K Goyal, "Performance Analysis of Low-Flux Least-Squares Single-Pixel Imaging," *IEEE Signal Process. Lett.*, vol. 23, no. 12, pp. 1756–1760, December 2016.

59. Dongeek Shin, Feihu Xu, Dheera Venkatraman, Rudi Lussana, Federica Villa, Franco Zappa, Vivek K Goyal, Franco N. C. Wong, and Jeffrey H. Shapiro, "Photon-Efficient Imaging with a Single-Photon Camera," *Nature Communications*, vol. 7, article no. 12046, 24 June 2016.

    - See also Nature Photonics Research Highlights: David Pile, "Photon per pixel," *Nature Photonics*, vol. 10, no. 8, p. 498, August 2016.

58. Dongeek Shin, Feihu Xu, Franco N. C. Wong, Jeffrey H. Shapiro, and Vivek K Goyal, "Computational Multi-Depth Single-Photon Imaging," *Optics Express*, vol. 24, no. 3, pp. 1873–1888, February 2016.

57. Dongeek Shin, Jeffrey H. Shapiro, and Vivek K Goyal, "Single-Photon Depth Imaging Using a Union-of-Subspaces Model," *IEEE Signal Process. Lett.*, vol. 22, no. 12, pp. 2254–2258, December 2015.

56. Dongeek Shin, Ahmed Kirmani, Vivek K Goyal, and Jeffrey H. Shapiro, "Photon-Efficient Computational 3D and Reflectivity Imaging with Single-Photon Detectors," *IEEE Trans. Computational Imaging*, vol. 1, no. 2, pp. 112–125, June 2015.

    - Winner of a 2019 IEEE Signal Processing Society Best Paper Award.

55. Joong B. Rhim and Vivek K Goyal, "Distributed Hypothesis Testing with Social Learning and Symmetric Fusion," *IEEE Trans. Signal Process.*, vol. 62, no. 23, pp. 6298–6308, 1 Dec 2014.

54. Soheil Feizi, Georgios Angelopoulos, Vivek K Goyal, and Muriel Médard, "Backward Adaptation for Power Efficient Sampling," *IEEE Trans. Signal Process.*, vol. 62, no. 16, pp. 4327–4338, 15 Aug 2014.

53. Ahmed Kirmani, Dheera Venkatraman, Dongeek Shin, Andrea Colaço, Franco N. C. Wong, Jeffrey H. Shapiro, and Vivek K Goyal, "First-Photon Imaging," *Science*, vol. 343, no. 6166, pp. 58–61, 3 Jan 2014. Movie M1. Movie M2.

    - See also the editors' commentary: "This Week in Science: Computing an Image," *Science*, vol. 343, no. 6166, p. 5, 3 Jan 2014.

52. Sumeet Kumar, Vivek K Goyal, and Sanjay E. Sarma, "Efficient Parametric Signal Estimation from Samples with Location Errors," *IEEE Trans. Signal Process.*, vol. 61, no. 21, pp. 5285–5297, 1 Nov 2013.

51. John Z. Sun and Vivek K Goyal, "Intersensor Collaboration in Distributed Quantization Networks," *IEEE Trans. Communications*, vol. 61, no. 9, pp. 3931–3942, September 2013.

50. John Z. Sun, Vinith Misra, and Vivek K Goyal, "Distributed Functional Scalar Quantization Simplified," *IEEE Trans. Signal Process.*, vol. 61, no. 14, pp. 3495–3508, 15 Jul 2013.

49. Daniel S. Weller, Jonathan R. Polimeni, Leo Grady, Lawrence L. Wald, Elfar Adalsteinsson, and Vivek K Goyal, "Sparsity-Promoting Calibration for GRAPPA Accelerated Parallel MRI Reconstruction," *IEEE Trans. Medical Imaging*, vol. 32, no. 7, pp. 1325–1335, July 2013.

48. John Z. Sun, Grace I. Wang, Vivek K Goyal, and Lav R. Varshney, "A Framework for Bayesian Optimality of Psychophysical Laws," *J. Mathematical Psychology*, vol. 56, no. 6, pp. 495–501, December 2012.

47. Ulugbek Kamilov, Vivek K Goyal, and Sundeep Rangan, "Message-Passing De-Quantization with Applications to Compressed Sensing," *IEEE Trans. Signal Process.*, vol. 60, no. 12, pp. 6270–6281, December 2012.

    - Winner of a 2017 IEEE Signal Processing Society Best Paper Award.

46. Alyson K. Fletcher, Sundeep Rangan, and Vivek K Goyal, "Ranked Sparse Signal Support Detection," *IEEE Trans. Signal Process.*, vol. 60, no. 11, pp. 5919–5931, November 2012.

45. Daniel S. Weller, Jonathan R. Polimeni, Leo Grady, Lawrence L. Wald, Elfar Adalsteinsson, and Vivek K Goyal, "Denoising Sparse Images from GRAPPA using the Nullspace Method," *Magnetic Resonance in Medicine*, vol. 68, no. 4, pp. 1176–1189, October 2012.

44. Soheil Feizi, Vivek K Goyal, and Muriel Médard, "Time-Stampless Adaptive Nonuniform Sampling for Stochastic Signals," *IEEE Trans. Signal Process.*, vol. 60, no. 10, pp. 5440–5450, October 2012.

43. Lav R. Varshney, Sanjoy K. Mitter, and Vivek K Goyal, "An Information-Theoretic Characterization of Channels That Die," *IEEE Trans. Inform. Theory*, vol. 58, no. 9, pp. 5711–5724, September 2012.

42. Joong B. Rhim, Lav R. Varshney, and Vivek K Goyal, "Quantization of Prior Probabilities for Collaborative Distributed Hypothesis Testing," *IEEE Trans. Signal Process.*, vol. 60, no. 9, pp. 4537–4550, September 2012.

41. Sundeep Rangan, Alyson K. Fletcher, and Vivek K Goyal, "Asymptotic Analysis of MAP Estimation via the Replica Method and Applications to Compressed Sensing," *IEEE Trans. Inform. Theory*, vol. 58, no. 3, pp. 1902–1923, March 2012.

40. Ahmed Kirmani, Haris Jeelani, Vahid Montazerhodjat, and Vivek K Goyal, "Diffuse Imaging: Creating Optical Images with Unfocused Time-Resolved Illumination and Sensing," *IEEE Signal Process. Lett.*, vol. 19, no. 1, pp. 31–34, January 2012.

39. Berkin Bilgic, Vivek K Goyal, and Elfar Adalsteinsson, "Multi-contrast Reconstruction with Bayesian Compressed Sensing," *Magnetic Resonance in Medicine*, vol. 66, no. 6, pp. 1601–1615, December 2011.

38. Ahmed Kirmani, Andrea Colaço, Franco N. C. Wong, and Vivek K Goyal, "Exploiting Sparsity in Time-of-Flight Range Acquisition Using a Single Time-Resolved Sensor," *Optics Express*, vol. 19, no. 22, pp. 21485–21507, October 2011.

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15. Vivek K Goyal, John Stefanski, David Saltzman, Mark Stefanski, David Sloo, Isabel Thornton, "Automated Display Adjustment for Smart-Home Device Based on Viewer Location or Other Sensed Viewer-Related Parameters," U. S. Patent no. 9 353 965 issued May 31, 2016 (filed August 26, 2015).
14. Soheil Feizi-Khankandi, Vivek K Goyal, and Muriel Médard, "Energy-Efficient Time-Stampless Adaptive Nonuniform Sampling," U. S. Patent no. 9 294 113 issued March 22, 2016 (filed July 5, 2012).
13. Vivek K Goyal and G. Ahmed Kirmani, "Method and Apparatus to Determine Depth Information for a Scene of Interest," U. S. Patent no. 8 982 363 issued March 17, 2015 (filed October 5, 2012).
12. Daniel S. Weller, Vivek K Goyal, Jonathan R. Polimeni, and Leo Grady, "System for Accelerated MR Image Reconstruction," U. S. Patent no. 8 823 374 issued September 2, 2014 (filed December 15, 2011).
11. Adam C. Zelinski, Lawrence L. Wald, Elfar Adalsteinsson, and Vivek K Goyal, "Method for Joint Sparsity-Enforced k-Space Trajectory and Radiofrequency Pulse Design," U. S. Patent no. 8 154 289 issued April 10, 2012 (filed April 13, 2009).
10. Adam C. Zelinski, Kawin Setsompop, Elfar Adalsteinsson, and Vivek K Goyal, "Method for Reducing Maximum Local Specific Absorption Rate in Magnetic Resonance Imaging," U.S. Patent no. 8 148 985 issued April 3, 2012 (filed October 15, 2009).
9. Adam C. Zelinski, Lawrence L. Wald, Elfar Adalsteinsson, Vivek K Goyal, and Vijayanand Alagappan, "Coil Array Mode Compression for Parallel Transmission Magnetic Resonance Imaging," U.S. Patent no. 8 085 046 issued December 27, 2011 (filed August 28, 2009).
8. Jens Rasmussen, Amin Shokrollahi, Soren Lassen, Gavin B. Horn, Vivek K Goyal, Barry Dobyns, and Michael Luby, "System and Method for Reliably Communicating the Content of a Live Data Stream," U.S. Patent no. 7 249 291 issued July 24, 2007 (filed February 14, 2003).
7. Vivek K Goyal, "Method and Apparatus for Adaptive Signal Processing Involving a Karhunen-Loève Basis," U.S. Patent no. 6 993 477 issued January 31, 2006 (filed June 8, 2000).
6. Vivek K Goyal, Jelena Kovačević, and Francois Masson, "Method of Multiple Description Coding of Signals for Wireless Transmission," U.S. Patent no. 6 983 243 issued January 3, 2006 (filed October 27, 2000). European Patent filed October 2, 2001.
5. Vivek K Goyal, Jonathan A. Kelner, and Jelena Kovačević, "Method and Apparatus for Lattice-Structured Multiple Description Vector Quantization," U.S. Patent no. 6 594 627 issued July 15, 2003 (filed filed March 23, 2000).
4. Vivek K Goyal and Jelena Kovačević, "Multiple Description Transform Coding Using Optimal Transforms of Arbitrary Dimension," U.S. Patent no. 6 345 125 issued February 5, 2002 (filed February 25, 1998).
3. Vivek K Goyal, Jelena Kovačević, and Martin Vetterli, "Multiple Description Transform Coding of Images Using Optimal Transforms of Arbitrary Dimension," U.S. Patent no. 6 330 370 issued December 11, 2001 (filed September 30, 1998).
2. Ramon Arean, Vivek K Goyal, and Jelena Kovačević, "Multiple Description Transform Coding of Audio Using Optimal Transforms of Arbitrary Dimension," U.S. Patent no. 6 253 185, issued June 26, 2001 (filed November 12, 1998).
1. Vivek K Goyal, "Method and Apparatus for Reduced Complexity Entropy Coding," U.S. Patent no. 6 198 412, issued March 6, 2001 (filed January 20, 1999).

FUNDING

Draper Lab	PI	$12 034	1 Jun 2022–31 May 2023	Occlusion-Aided Non-Line-of-Sight Imaging
DARPA	Co-PI (BU PI)	$7 386 346 ($671 998 mine)	1 Jul 2021–30 Sep 2024	Super Headlights: Superconducting Nanowire Detectors for Passive Infrared Sensing
NSF 2039762	PI	$380 000	1 Jul 2021–30 Jun 2024	CCSS: Signal Processing for Single-Photon Detectors
Draper Lab	PI	$57 322	1 Jun 2021–31 May 2022	Occlusion-Aided Non-Line-of-Sight Imaging
NSF 1955219	Lead PI	$1 199 994 ($599 994 mine)	1 Jul 2020–30 Jun 2024	Collaborative Research: CIF: Medium: Occlusion and Directional Resolution in Computational Imaging
Draper Lab	PI	$57 851	1 Jun 2020–31 May 2021	Occlusion-Aided Non-Line-of-Sight Imaging
Google Research Award	PI	$41 182	1 Jan 2020–31 Dec 2020	Information Processing Foundations for Single-Photon Detectors
Draper Lab	PI	$47 709	1 Jun 2019–31 May 2020	Occlusion-Aided Non-Line-of-Sight Imaging
Draper Lab	PI	$49 533	1 Jun 2019–31 May 2020	Photon-Efficient Active Optical Imaging
NSF 1815896	PI	$490 462	1 Jul 2018–30 Jun 2021	CIF: Small: Sequential and Compound Estimation for Computational Imaging Systems
Draper Lab	PI	$56 994	1 Jun 2018–31 May 2019	Occlusion-Aided Non-Line-of-Sight Imaging
Draper Lab	PI	$61 724	1 Jun 2018–31 May 2019	Photon-Efficient Active Optical Imaging
Draper Lab	PI	$35 929	1 Sep 2017–31 May 2018	Extending Homodyne Time-of-Flight Techniques
Draper Lab	PI	$50 177	1 Jun 2017–31 May 2018	Photon-Efficient Active Optical Imaging
Draper Lab	PI	$47 422	1 Jun 2016–31 May 2017	Photon-Efficient Active Optical Imaging
DARPA	Co-PI (BU PI)	$5 487 727 ($699 896 mine)	26 Jan 2016–25 Jan 2020	REVEAL: Principles, Limits and Methods for Computational Periscopy
Draper Lab	PI	$33 287	1 Sep 2015–31 May 2016	Photon-Efficient Active Optical Imaging
NSF 1422034	PI	$465 189	1 Sep 2014–31 Aug 2017	CIF: Small: Low-Light 3D Imaging: From Fundamental Limits to Practical Systems
NSF 1441917	PI	$156 840	1 Jan 2014–31 Jul 2015	CIF: Small: Quantization for Acquisition and Computation Networks
HP	PI	$75 000	1 Oct 2012–30 Sep 2013	High-Resolution Compressive Depth Acquisition
Qualcomm	PI	$50 000	1 Sep 2012–31 Aug 2013	CoFeCam: Compressive Feature Camera
NSF 1161413	Lead PI	$750 000	1 Apr 2012–31 Mar 2015	CIF: Medium: Space-from-Time Imaging: Fundamental Limits, Algorithms, and Preliminary Demonstrations
Qualcomm	PI	$100 000	1 Sep 2011–31 Aug 2012	Single Pixel Depth Sensing and 3D Camera
Siemens	PI	$97 200	1 Jul 2011–31 May 2012	Accelerated MR Imaging using Multiple Receiver Coils and Sparsity-Based Modeling
NSF 1115159	PI	$368 860	1 Aug 2011–31 May 2014	CIF: Small: Quantization for Acquisition and Computation Networks
NSF 1101147	PI	$328 847	1 Jul 2011–30 Jun 2014	ICES: Small: Decision Making with Bounded Categorization
HP	PI	$25 000	1 May 2011–31 Oct 2011	Novel 3d Depth Sensors
TI	PI	$50 000	15 Apr 2011–31 Dec 2011	Single-Pixel Time-of-flight Camera for Depth Estimation using Compressed Sensing
DARPA	Co-PI	$5 921 676 ($750 000 mine)	1 Sep 2010–31 Jul 2013	Information in a Photon: High Information Capacity Quantum Imaging
Lincoln Lab	PI	$50 000	1 Jan 2008–31 Aug 2008	Compressive Sensor Networking
NSF 0729069	PI	$285 000	15 Sep 2007–31 Aug 2011	Compressing Unordered Data: Theory, Algorithms, and Applications
NSF 0643836	PI	$400 000	15 Feb 2007–31 Jan 2012	CAREER: Acquisition, Approximation, and Compression—An Integrated Study
NEC	PI	$50 000	1 Jun 2006–31 May 2007	Economical Sampling—Slow and Unsteady Can Win the Race
TI		$221 733	1 Jan 2005–30 Jun 2013	Gift funding (many installments)

PRESS COVERAGE AND PUBLICITY

Inferences from Hyperspectral Longwave Infrared Measurements (see J97)

- *ENGineer* (semiannual publication of the Boston University College of Engineering), "Many Hands Make Light Work: Using the Light We Can't See," Jessica Colarossi and Patrick L. Kennedy, Spring 2025.

Non-Line-of-Sight Imaging Using Rough Surfaces (see J98)

- *New Scientist*, Any wall can be turned into a camera to see around corners, James Woodford, May 30, 2025.

Guggenheim Fellowship

- *The Brink*, BU Electrical Engineer Vivek Goyal Named a 2024 Guggenheim Fellow, Alene Bouranov, April 11, 2024.
- *The Boston Globe*, 11 Greater Boston residents win Guggenheim Fellowships this year, Mark Feeney, April 11, 2024.
- *New India Times*, Several Indian-origin winners in 2024 list of Guggenheim Fellows, April 17, 2024.

Election to AAAS Fellow

- *The Brink*, These BU Researchers Were Just Named AAAS Fellows, Alene Bouranov, January 31, 2023.
- *Science*, 2002 AAAS Fellows approved by the AAAS Council, vol. 379, issue 66349, February 24, 2023.

Non-Line-of-Sight Imaging over 1.43 km (see J80)

- *The Economist* (print issue 20 Mar 2021), How to see what is hidden from view, March 18, 2021.
- *BU Engineering*, Professor Goyal's Record-Breaking Long Distance NLOS Imaging Featured in PNAS, Caroline Amato, March 17, 2021.

Election to OSA Fellow

- *Optics & Photonics News*, Meet OSA's 2020 Fellows, Meredith Smith, Kari Apter and Samantha Hornback, February 1, 2020.

High School Mentoring (see C134)

- *KGET (Bakersfield NBC affiliate)*, Stockdale High senior earns prestigious national math and science recognition, Karen Cruz-Orduña, January 9, 2020.

Non-Line-of-Sight Imaging with an Ordinary Digital Camera (see J66 and C128)

- *Nature News*, How an ordinary camera can see around corners, Davide Castelvecchi, January 23, 2019.
- *The Economist* (print issue 24 Jan 2019), A camera that can see round corners, January 24, 2019.
- *Scientific American*, A Simple Camera and an Algorithm Let You See around Corners, Jeff Hecht, January 23, 2019.
- *Cosmos Magazine*, Spying around corners just got easier, Natalie Parletta, January 24, 2019.
- *The Daily Free Press*, BU professor develops camera that can see around corners, Andy Vo and Susannah Sudborough, January 27, 2019.
- *Futurism*, Spooky Algorithm Sees Around Corners by Analyzing Shadows, Dan Robitzski, January 25, 2019.
- *ge.com*, The 5 Coolest Things On Earth This Week, Sam Worley, January 23, 2019.
- *The Guardian*, Program allows ordinary digital camera to see round corners, Ian Sample, January 23, 2019.
- *Inside Science*, How to See Around Corners with a Digital Camera, Marcus Woo, January 23, 2019.
- *El Mundo*, La cámara digital que puede tomar imágenes de objetos escondidos, Amado Herrero, January 23, 2019.
- *N+1*, Este algoritmo permitirá a la cámara de tu smartphone ver detrás de las esquinas, Victor Román, January 24, 2019.
- *New Scientist*, Algorithm that can see around corners could help autonomous cars, Yvaine Ye, January 23, 2019.
- *PhysicsBuzz*, Using Just a Digital Camera, a New Method Lets Scientists See Around Corners, Kendra Redmond, January 23, 2019.
- *Physics World*, Shadowy algorithm allows digital camera to see round corners, Sam Jarman, January 25, 2019.
- *RedShark News*, This incredible new technique allows us to see around corners in photographs!, Adrian Pennington, January 31, 2019.
- *ScienceAlert*, This Not-at-All-Creepy New Computer Program Lets Any Camera See Around Corners, David Nield, January 25, 2019.

- *Science News*, Ordinary cameras can now photograph out-of-sight objects, Maria Temming, January 23, 2019.
- *Smithsonian.com*, Scientists Used an Ordinary Digital Camera to Peer Around a Corner, Jane Recker, January 23, 2019.
- *Springwise*, Algorithm allows cameras to see around corners, February 12, 2019.
- *Tech.Co*, Your Camera Could Soon See Around Corners, Jack Turner, January 25, 2019.
- *The Telegraph*, Soldiers could see round corners using digital cameras with new technology, Sarah Knapton, January 23, 2019.
- *Times of London*, Camera that could help your car see around corners, Tom Whipple, January 24, 2019.
- *The Wilson Leader Bulletin*, Military dream come true – the camera looks around the corner, Teodora Torrendo, January 26, 2019.
- *The Wire*, A Digital Camera That Can Help You See Beyond Walls, Sarah Iqbal, February 15, 2019.
- *Wired*, Scientists Reconstruct an Object by Photographing its Shadow, Sophia Chen, January 23, 2019.
- *BU Engineering*, Seeing around Corners, January 23, 2019.
- *BU Research*, Can Technology Eliminate Blind Spots?, January 23, 2019.
- Interview on *BBC Radio 5 Live*, January 25, 2019.
- Interview on *talkRADIO UK*, January 27, 2019.
- *New Scientist*, Digital camera sees around corners by guessing what's lurking behind, Jon Cartwright, May 17, 2019.
- *New Scientist*, Seeing around corners: How to decipher shadows to see the invisible, Jon Cartwright, November 6, 2019.
- *About Trust*, Peeking Around the Corner, Tanita Hecking, July 2020.
- Additional commentary, repostings, and translations online at many sites including: ABC News, Futurity, R&D Magazine, le Scienze.

Imaging from Very Little Detected Light (see J53 and J59)

- *Nature News*, Stealth camera takes pictures virtually in the dark, Ron Cowen, November 28, 2013.
- *BBC News*, Camera takes 3D photos in the dark, December 2, 2013.
- *CERN Courier*, First-photon imaging, John Swain, February 24, 2014.
- *DefenseTech*, MIT System Captures 3D Images from the Darkness, Bryant Jorday, December 2, 2013.
- *Design News*, 3D Scanners Capture Clear Images in Darkness, Cabe Atwell, January 2, 2014.
- *The Epoch Times*, New Camera Uses Just 1 Photon per Pixel, August 23, 2016.
- *Korean Broadcasting System (KBS)* (in Korean), Clearly photograph 'objects in the dark' with a 3D camera, December 3, 2013.
- *Phys.org*, Researchers generate 3D images using just one photon per pixel, Lisa Zyga, July 13, 2016.
- *BU Engineering*, Imaging Method Promises to Upgrade Remote Sensing and Microscopy, Mark Dwortzan, January 27, 2014.
- *BU Engineering*, A Point of Light, Sara Elizabeth Cody, July 7, 2016.
- *ENGineer* (semiannual publication of the Boston University College of Engineering), "A Point of Light: Vivek Goyal Creates Images from Single Photons," Sara Cody, Fall 2016.
- *MIT News*, 3-D images, with only one photon per pixel: New scheme could enable laser rangefinders to infer depth from a hundredth as much light – and to produce images from only one nine-hundredth the light, Larry Hardesty, November 28, 2013.
- Additional commentary online at many sites including: Gizmodo, Mashable, Nuit Blanche.

Low-Power, Low-Cost 3-D Acquisition Systems and Methods (see J38, C105, and C111)

- *BBC Focus*, Breakthroughs of 2013: Gesture-Controlled Mobile Phones, January 2013, p. 35.
- *The Wall Street Journal Online*, "Gesture Is the New Touch: MIT $100K Entrepreneurship Competition Awards $100,000 Grand Prize to 3dim, Creator of the First 3-D Gesture Sensor for Mobile Devices," May 16, 2013.
- *The Boston Globe*, "Technology to control smartphones by gesture wins MIT $100K Entrepreneurship prize," Chris Reidy, May 16, 2013.
- *The Times of India*, "Goa girl develops touch-free phone technology," Gauree Malkarnekar, May 22, 2013.
- *BostInno*, MIT $100K Awards Their Grand Prize To a Team Bringing 3D Gesturing to the Mobile Market, Lauren Landry, May 16, 2013.
- *BostInno*, The 8 Finalists Making Their Case for Capital at the MIT $100K Finale, Lauren Landry, May 14, 2013.

- *BostInno*, MIT Accelerates Into Their $100K Competition By Awarding $10K to the 'Next Generation of Prosthetics', Lauren Landry, February 20, 2013.
- *MIT News*, 3-D cameras for cellphones: Clever math could enable a high-quality 3-D camera so simple, cheap and power-efficient that it could be incorporated into handheld devices, Larry Hardesty, January 5, 2012.
- *BostInno*, The MIT $100K Kicks Off With Superhero Pitches, Awarding an Early $5,000 To a Mobile 3D Camera, Lauren Landry, October 23, 2012.
- Press release on MIT $100K Entrepreneurship Competition Pitch Contest, October 25, 2012.
- Additional commentary online at many sites including: Wired, Nuit Blanche, Spar Point Group, OutlookSeries, I Programmer, Crazy Engineers, and Next Big Future.

Information Representation in Biological Systems (see J48)

- *Significance*, the bimonthly magazine of the Royal Statistical Society and the American Statistical Association, "Why do we perceive logarithmically?," Lav Varshney and John Sun, 10(1):28–31, February 2013.
- *The American Scholar*, "Brainstorming," Emily Ochoa, in Works in Progress column edited by Allen Freeman, Winter 2013 (print edition); also online.
- *IEEE Spectrum* Techwise Conversations podcast, Does the Brain Work Logarithmically?, November 8, 2012.
- *MIT News*, What number is halfway between 1 and 9? Is it 5 – or 3? A new information-theoretical model of human sensory perception and memory sheds light on some peculiarities of the nervous system, Larry Hardesty, October 5, 2012.
- Additional commentary online at many sites including the following: ScienceDaily, The Huffington Post, EurekaAlert, R&D Magazine, and TVTechnology.

Magnetic Resonance Imaging (see J39)

- *MIT News*, New algorithm could substantially speed up MRI scans: Faster scans could reduce the time patients spend in the machine from 45 to 15 minutes, Helen Knight, November 1, 2011.

Other Technical Commentary

- *New Scientist*, New device can scan your face in 3D from hundreds of metres away, Karmela Padavic-Callaghan, February 6, 2025.

Invited Presentations

Conference/workshop plenary/keynote presentations

18. "Quantitative Secondary Electron Yield Mapping in Ion-beam Microscopy," IS&T Electronic Imaging, Keynote in joint session of Computational Imaging XXII and Materials Science III, Burlingame, CA, January 23, 2024.
17. "Ion Count-Aided Microscopy," 3rd International Computational Imaging Conference, Beijing, December 9, 2023.
16. "Looking Inside the Dwell Time in Particle Beam Microscopy," Gordon Research Conference on Chemical Imaging, Easton, MA, August 3, 2023.
15. "One Click at a Time: Photon- and Electron-Level Modeling in Computational Imaging," 5th International Symposium on Signal Processing Systems, Guangzhou, China, March 25, 2023.
14. "Quantization and Dither in Single-Photon Lidar," Computational Cameras and Display Workshop at 2022 IEEE/CVF Computer Vision and Pattern Recognition Conference, New Orleans, LA, June 20, 2022.
13. "One Click at a Time: Photon- and Electron-Level Modeling in Computational Imaging," Coordinated Science Laboratory Student Conference, University of Illinois at Urbana–Champaign, February 23, 2022.
12. "One Click at a Time: Photon- and Electron-Level Modeling for Improved Imaging," 12th International Conference on Signal Processing Systems, Shanghai, China, November 6, 2020.
11. "One Click at a Time: Photon- and Electron-Level Modeling for Improved Imaging," Sensor Signal Processing for Defence Conference, Edinburgh, UK, September 15, 2020.
10. "Computational Imaging with Few Photons, Electrons, or Ions," SPIE Wavelets and Sparsity XVIII, San Diego, CA, August 15, 2019.
9. "Computational Imaging with a Single-Photon Camera," Gordon Research Conference on Imaging Science, Easton, MA, June 19, 2018.
8. "Photon-Efficient Computational 3-D and Reflectivity Imaging With Single-Photon Detectors," International Conference on Computational Photography, Stanford, CA, May 12, 2017.

7. "First-Photon Imaging and Other Imaging with Few Photons," 1st Workshop on Sparsity and Compressive Sensing in Multimedia at the IEEE International Conference on Multimedia and Expo, Seattle, WA, July 15, 2016.
6. "First-Photon Imaging and Few-Photon Imaging," 6th International Conference on Computing Communications and Networking Technologies (IEEE technically sponsored), Denton, TX, July 13, 2015.
5. "Space-from-Time Imaging: Acquiring Reflectance and Depth With Less Optics," 20th European Signal Processing Conference (EUSIPCO 2012), Bucharest, Romania, August 31, 2012.
4. "The Optimistic Bayesian: Replica Method Analysis of Compressed Sensing," INSPIRE 2010 Conference on Information Representation and Estimation, University College London, London, UK, September 6, 2010.
3. "Compressed Sensing: Revisiting Resolution, Modeling, and Computation," IEEE International Workshop on Multimedia Signal Processing, Rio de Janeiro, Brazil, October 7, 2009.
2. "Sparse Signal Recovery, Compression, and Communication," IEEE Data Compression Conference, Snowbird, UT, March 16, 2009.
1. "Universal Compression of Sparse Sources: Bounds and Improvements," Wavelets and Applications Conference, Bernoulli Center, École Polytechnique Fédérale de Lausanne, July 11, 2006.

IEEE Signal Processing Society Distinguished Lecturer presentations

15. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE Princeton/Central Jersey Section, Princeton, NJ, February 19, 2019.
14. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE Kerala Section and IEEE International Conference on Recent Advances in Intelligent Computational Systems, Thiruvananthapuram, Kerala, India, December 7, 2018.
13. "Teaching Signal Processing with Geometry," IEEE Kerala Section and Trivandrum College of Engineering SPS Student Branch Chapter, Thiruvananthapuram, Kerala, India, December 6, 2018.
12. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Madras Chapter, Vellore Institute of Technology, Chennai, India, December 4, 2018.
11. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Madras Chapter, Indian Institute of Technology–Madras, Chennai, India, December 4, 2018.
10. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Bangalore Chapter, Bengaluru, India, December 3, 2018.
9. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Gujarat Chapter, Surat, India, November 30, 2018.
8. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Kharagpur Chapter and Indian Institute of Technology–Kharagpur SPS Student Branch Chapter, Kharagpur, India, November 28, 2018.
7. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Delhi Chapter, New Delhi, India, November 26, 2018.
6. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Malaysia Chapter, Kuala Lumpur, Malaysia, November 14, 2018.
5. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Singapore Chapter, Nanyang Technological University, Singapore, November 12, 2018.
4. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE Cleveland Section (Joint Society Encompassing Signal Processing; Nuclear and Plasma Sciences; Engineering in Medicine and Biology; Instrumentation and Measurements), Warrensville Heights, OH, October 16, 2018.
3. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Cyprus Chapter, Lefkosia, Cyprus, September 20, 2018.
2. "Computational Imaging with Few Photons, Electrons, or Ions," IEEE SPS Eastern North Carolina Chapter (co-sponsored by North Carolina State University), Raleigh, NC, September 7, 2018.
1. "First-Photon Imaging and Other Imaging with Few Photons," IEEE New Hampshire Section (co-sponsored by IEEE Engineering in Medicine and Biology Section), Nashua, NH, November 2, 2017.

Other presentations (without proceedings papers)

156. MathWorks Research Summit, Natick, MA, June 17, 2025.
155. Boston University CryoEM User Group Meeting, Boston, MA, November 14, 2024.
154. Second Combined FIT4NANO and European FIB Network Workshop, Durrës, Albania, September 19, 2024.

153. Rank Prize Funds Symposium on Seeing Through Obscuration, Lake District National Park, Penrith, UK, August 15, 2024.
152. Institute for Mathematical and Statistical Innovation Workshop on Computational Imaging, Chicago, IL, August 6, 2024.
151. University of Illinois at Urbana–Champaign, Electrical and Computer Engineering Department, Urbana, IL, March 4, 2024.
150. Signal Processing & Friends Workshop, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, August 25, 2023.
149. OSA Computational Optical Sensing and Imaging, Boston, MA, August 17, 2023.
148. First International Congress of Basic Science, Beijing, China, July 17, 2023.
147. Tsinghua University, Beijing, China, July 15, 2023.
146. Nanjing University, Nanjing, China, July 13, 2023.
145. Westlake University, Hangzhou, China, July 12, 2023.
144. Shanghai Institute for Advanced Studies, University of Science and Technology of China, Shanghai, China, July 10, 2023.
143. University Defence Research Collaboration Themed Meeting on Quantum Signal Processing, Heriot-Watt University, Edinburgh, Scotland, May 3, 2023.
142. University of Illinois at Urbana–Champaign, Illinois ECE Distinguished Colloquium Series, Urbana, IL, February 23, 2023.
141. Northwestern University, ECE/CS Distinguished Seminar, Evanston, IL, February 20, 2023.
140. University of Iowa Department of Electrical and Computer Engineering, Iowa City, IA, February 16, 2023.
139. Los Alamos National Laboratory, Los Alamos, NM, July 14, 2022.
138. Oak Ridge National Laboratory, Oak Ridge, TN, June 14, 2022.
137. SIAM Conference on Imaging Science, Berlin, Germany, March 25, 2022.
136. EPFL Advanced Quantum Architecture Lab User Group Meeting, Les Diablerets, Switzerland, March 23, 2022.
135. Electrical and Computer Engineering Department Colloquium, University of California at Riverside, January 25, 2021.
134. Statistics Department Seminar, University of California at Los Angeles, January 21, 2021.
133. Faraway Fourier Talks, Norbert Wiener Center on Harmonic Analysis and Applications at the University of Maryland, co-sponsored by the IEEE SPS Washington Chapter, December 21, 2020.
132. Rank Prize Funds Symposium on Seeing Through Obscuration, Lake District National Park, Cumbria, UK, July 6, 2020.
131. Google Computational Imaging Workop, Mountain View, CA, February 3, 2020.
130. Institute for Mathematics and Its Applications Workshop on Computational Imaging, Minneapolis, MN, October 14, 2019.
129. University of Toronto, Toronto, ON, Canada, October 7, 2019.
128. Advances in Computational and Quantum Imaging Workshop, Purdue Quantum Science and Engineering Institute, West Lafayette, IN, September 11, 2019.
127. North American School of Information Theory, panelist on *Information Theory in Industry*, Boston, MA, July 3, 2019.
126. Hong Kong University of Science and Technology, Hong Kong, June 21, 2019.
125. Chinese University of Hong Kong, Hong Kong, June 20, 2019.
124. University of Virginia Physics Department Colloquium (Optical Society of America Traveling Lecturer Program), Charlottesville, VA, April 12, 2019.
123. The Ohio State University, Columbus, OH, February 26, 2019.
122. Vellore Institute of Technology–Chennai, Chennai, India, December 4, 2018.
121. National University of Singapore, November 13, 2018.
120. Case Western Reserve University, October 15, 2018.
119. École Polytechnique Fédérale de Lausanne, September 25, 2018.
118. Mitsubishi Electric Research Laboratory, Cambridge, MA, January 30, 2018.
117. Imperial College London, January 24, 2018.
116. Theo Murphy International Scientific Meeting on Light Transport and Imaging Through Complex Media, The Royal Society, Buckinghamshire, UK, January 22, 2018.
115. Tufts University, November 3, 2017.
114. Carnegie Mellon University, September 7, 2017.
113. OSA Mathematics in Imaging, San Francisco, CA, June 28, 2017.

112. Stanford Center for Image Systems Engineering Colloquium, Palo Alto, CA, February 22, 2017.
111. IEEE Int. Conf. Image Processing, panel moderator on *Compressive Sensing 10 Years Later: Has it Changed Image Acquisition and Processing?*, Phoenix, AZ, September 26, 2016.
110. Technicolor Los Altos Research Center, Los Altos, CA, June 22, 2016.
109. SIAM Conference on Imaging Science, Albuquerque, NM, May 26, 2016.
108. University of California, Berkeley, joint seminar of Photobears (joint student chapter of the SPIE and OSA) and the Berkeley Laboratory of Information and Systems Sciences, May 18, 2016.
107. IEEE Santa Clara Valley Signal Processing Society Chapter, Sunnyvale, CA, March 3, 2016.
106. OSA Computational Optical Sensing and Imaging, Arlington, VA, June 9, 2015.
105. Stanford Information Theory Forum, Palo Alto, CA, May 1, 2015.
104. Information Theory and Applications Workshop, San Diego, CA, February 2, 2015.
103. Stanford Compression Forum, Palo Alto, CA, January 22, 2015.
102. Boston University Electrical and Computer Engineering Colloquium, October September 22, 2014.
101. École Polytechnique Fédérale de Lausanne, Computer and Communication Sciences Summer Research Institute, June 16, 2014.
100. SIAM Conference on Imaging Science, Hong Kong, May 12, 2014.
99. February Fourier Talks, University of Maryland, February 21, 2014.
98. Boston University Electrical and Computer Engineering Colloquium, June 5, 2013.
97. Google Research, Mountain View, CA, May 30, 2013.
96. Microsoft Research, Redmond, WA, May 16, 2013.
95. Washington University, March 20, 2013.
94. 2013 Information Theory and Applications Workshop, San Diego, CA, February 15, 2013.
93. Carnegie Mellon University, December 5, 2012.
92. Workshop on Next Generation Medical Imaging, Carnegie Mellon University, September 5, 2012.
91. École Polytechnique Fédérale de Lausanne, August 23, 2012.
90. Imperial College London, August 20, 2012.
89. Polytechnic Institute of New York University, June 20, 2012.
88. Schlumberger Doll Research Center, Cambridge, MA, May 16, 2012.
87. Johns Hopkins University, Baltimore, MD, March 16, 2012.
86. University of British Columbia, Vancouver, BC, March 8, 2012.
85. University of British Columbia, Vancouver, BC, March 7, 2012.
84. Lincoln Laboratory Technology Office Seminar Series, Lincoln, MA, March 6, 2012.
83. University of California, San Diego, ITA Seminar, San Diego, CA, February 14, 2012.
82. Qualcomm Corporate Research, San Diego, CA, February 13, 2012.
81. 2012 Information Theory and Applications Workshop, San Diego, CA, February 9, 2012.
80. Air Force Institute of Technology, Dayton, OH, December 5, 2011.
79. MIT Imaging and Computing Seminar, Cambridge, MA, December 1, 2011.
78. MIT Laboratory for Information and Decision Systems Seminar, Cambridge, MA, November 8, 2011.
77. Cornell University Center for Applied Mathematics Colloquium, Ithaca, NY, November 4, 2011.
76. University of Southern California, October 12, 2011.
75. University of California, Berkeley, Networking, Communications, and DSP Seminar, October 10, 2011.
74. University of Wisconsin ECE 600 Departmental Seminar Series, October 3, 2011.
73. University of Texas Wireless Networking and Communications Seminar, Austin, TX, September 23, 2011.
72. Rice University Electrical and Computer Engineering Seminar, September 21, 2011.
71. 2011 International Workshop on Biomedical and Astronomical Signal Processing Frontiers, Villars, Switzerland, September 7, 2011.

70. Texas Instruments' DSP Solutions Research and Development Center, Dallas, TX, July 22, 2011.
69. École Polytechnique Fédérale de Lausanne, Computer and Communication Sciences Summer Research Institute, June 24, 2011.
68. Center for Scientific Computation and Mathematical Modeling–Norbert Wiener Center joint seminar, University of Maryland, College Park, May 4, 2011.
67. Harvard University Electrical Engineering Seminar Series, April 29, 2011.
66. Banff International Research Station Workshop on Sparse and Low Rank Approximation, March 10, 2011.
65. Workshop on Recent Trends in Social Networks: Algorithms, Models and Learning, Tata Institute of Fundamental Research, Mumbai, India, January 5, 2011.
64. Rice University Electrical and Computer Engineering Texas Instruments Leadership Universities Seminar, November 11, 2010.
63. Howard Hughes Medical Institute Janelia Farm Research Campus, Ashburn, VA, November 5, 2010.
62. University of Illinois at Urbana-Champaign Communications Seminar, October 18, 2010.
61. Illinois/Missouri Applied Harmonic Analysis Seminar, University of Illinois at Urbana-Champaign, October 16, 2010.
60. Army Research Office Workshop on Challenges in Information Evaluation and Extraction in Distributed Sensing Systems, Cambridge, MA, October 21, 2009.
59. MGH–MIT–Siemens Workshop on Compressed Sensing, Beverly, MA, July 21, 2009.
58. Digital Media Laboratory, Sungkyunkwan University, Suwon, South Korea, June 25, 2009.
57. École Polytechnique Fédérale de Lausanne, Computer and Communication Sciences Summer Research Institute, June 17, 2009.
56. MIT Stochastics and Applications Seminar, Cambridge, MA, May 1, 2009.
55. Texas Instruments' DSP Solutions Research and Development Center, Dallas, TX, February 27, 2009.
54. North Carolina State University Electrical and Computer Engineering Colloquium, February 20, 2009.
53. 2009 Information Theory and Applications Workshop, University of California, San Diego, February 10, 2009.
52. American Institute of Mathematics Workshop on Frames for the Finite World, Palo Alto, CA, August 19, 2008.
51. Carnegie Mellon University, February 21, 2008.
50. 2008 Information Theory and Applications Workshop, University of California, San Diego, January 29, 2008.
49. Syracuse University EECS/CASE Colloquium, November 14, 2007.
48. Cornell University School of Electrical and Computer Engineering Colloquium, November 13, 2007.
47. Boston University Electrical and Computer Engineering Colloquium, November 7, 2007.
46. Forschungszentrum Telekommunikation Wien (ftw.) Telecommunications Forum, Vienna, Austria, October 10, 2007.
45. Challenges in Theoretical and Applied Signal Processing—Sputnik50@EPFL, École Polytechnique Fédérale de Lausanne, October 5, 2007.
44. 6th Int. Congress on Industrial and Applied Mathematics, Zürich, Switzerland, July 17, 2007.
43. Shell International Exploration and Production, Rijswijk, The Netherlands, June 21, 2007.
42. Technische Universiteit Delft, The Netherlands, June 19, 2007.
41. IBM T. J. Watson Research Center, Friends of Information Theory Seminar, Yorktown Heights, NY, March 16, 2007.
40. Qualcomm Communication Technologies, San Diego, CA, January 30, 2007.
39. Lincoln Laboratory Embedded Digital Systems Group, Lincoln, MA, December 15, 2006.
38. École Polytechnique Fédérale de Lausanne, Computer and Communication Sciences Summer Research Institute, July 6, 2006.
37. SIAM Imaging Science Conference, Minisymposium on Sparse Representations—Theory and Applications in Image Processing, Minneapolis, MN, May 15, 2006.
36. Texas Instruments' DSP Solutions Research and Development Center, Dallas, TX, April 28, 2006.
35. Banff International Research Station Workshop on Coarsely Quantized Redundant Representations of Signals, March 13, 2006.
34. Analog Devices, Inc., Wilmington, MA, January 13, 2006.
33. Woods Hole Oceanographic Institution, August 31, 2005.
32. École Polytechnique Fédérale de Lausanne, Laboratoire de Communications Audiovisuelles 10th Anniversary, July 15, 2005.

31. École Polytechnique Fédérale de Lausanne, Computer and Communication Sciences Summer Research Institute, July 11, 2005.
30. MIT Stochastic Systems Group Seminar, May 4, 2005.
29. École Polytechnique Fédérale de Lausanne, Computer and Communication Sciences Summer Research Institute, July 14, 2004.
28. Texas Instruments' DSP Solutions Research and Development Center, Dallas, TX, May 7, 2004.
27. Carnegie Mellon University, January 29, 2004.
26. Massachusetts Inst. of Technology, April 24, 2003.
25. Univ. Washington, April 15, 2003.
24. Univ. California, Los Angeles, April 9, 2003.
23. Stanford Univ., April 3, 2003.
22. École Polytechnique Fédérale de Lausanne, March 18, 2003.
21. Inst. for Operations Research and Management Sci. (INFORMS) Annual Meeting, San Jose, CA, November 17, 2002.
20. École Polytechnique Fédérale de Lausanne, Computer and Communication Sciences Summer Research Institute, July 11, 2002.
19. California Inst. of Technology, April 10, 2002.
18. Univ. Southern California, April 9, 2002.
17. Stanford Univ. Networking Seminar, January 24, 2002.
16. Univ. of Michigan, March 6, 2001.
15. Univ. of California, Berkeley, March 1, 2001.
14. California Inst. of Technology, February 28, 2001.
13. Univ. Southern California, February 27, 2001.
12. Murray Hill Mathematics Research Colloquium, February 15, 2001.
11. SPIE Wavelet Applications in Signal and Image Processing VIII, San Diego, CA, August 4, 2000.
10. Bell Labs Math Center Research Review, July 21, 2000.
9. 34th Conf. Inform. Sciences & Systems, Princeton Univ., March 15, 2000.
8. Princeton Univ. Time-Frequency Brown Bag Seminar, February 29, 2000.
7. Bell Labs Math Center Research Review, November 12, 1999.
6. Murray Hill Mathematics Research Colloquium, October 14, 1999.
5. Murray Hill Mathematics Research Colloquium, July 15, 1999.
4. Univ. of California, San Diego, June 1, 1998.
3. Purdue Univ., May 4, 1998.
2. Univ. of Illinois at Urbana-Champaign, April 9, 1998.
1. Univ. of Maryland, College Park, March 16, 1998.

TUTORIALS

5. "Teaching Image Processing with Geometry," IEEE Int. Conf. on Image Process., Orlando, FL, Sep. 30, 2012 (with J. Kovačević).
4. "Teaching Signal Processing with Geometry," European Signal Process. Conf., Bucharest, Romania, Aug. 27, 2012 (with M. Vetterli).
3. "Teaching Signal Processing with Geometry," IEEE Int. Conf. on Acoustics, Speech, and Signal Process., Kyoto, Japan, March 26, 2012 (with Martin Vetterli).
2. "WWW: World Wide Wavelets," IEEE Int. Conf. on Image Processing, Vancouver, BC, Canada, Sep. 10, 2000 (with Martin Vetterli and J. Kovačević).
1. "Wavelets and Applications: State of the Art," 45th SPIE Annual Meeting, San Diego, CA, Aug. 3, 2000 (with J. Kovačević).

TEACHING AND EDUCATIONAL CONTRIBUTIONS

Image Reconstruction and Restoration (BU ENG EK 717)

Role: Lecturer Spring 2020 and Fall 2022.

Topics: Principles and methods of reconstructing images and estimating multidimensional fields from indirect and noisy data; general deterministic (variational) and stochastic (Bayesian) techniques of regularizing ill-posed inverse problems; relationship of problem structure (data and models) to computational efficiency; impact of typically large image processing problems on viability of solution methods; problems in imaging and computational vision including tomography and surface reconstruction.

Comments: Starting with a course last offered in 2014, substantially modified with each offering. First added machine learning material in Spring 2020, then incorporated many materials from C. Bouman's *Foundations of Computational Imaging* in Fall 2022.

Probability, Statistics, and Data Science for Engineers (BU ENG EK 381)

Role: Lecturer Spring 2019, Fall 2019, Spring 2021, Fall 2023, and Spring 2024.

Topics: Provides a strong foundation in probability and an introduction to statistics and machine learning. Includes experience with translating engineering problems into probabilistic models, and working with these models analytically and algorithmically. Prepares students for upper-level electives that use probabilistic reasoning.

Comments: Adjusted this course to highlight the utility of probabilistic modeling by discussing decision making and estimation applications throughout, rather than only at the end.

Foundations of Signal Representation and Estimation (BU ENG EC 700)

Role: Lecturer Fall 2020.

Topics: Provide students with tools to exploit the power of sparse representations along with a perspective on how the importance of sparsity arose and why it is a departure from classical techniques in linear algebra and signal processing.

Comments: Developed this new graduate-level course.

Digital Signal Processing (BU ENG EC 516)

Role: Lecturer Spring 2014, Fall 2017, and Spring 2018.

Topics: Hilbert space formulation of continuous-time and discrete-time signals; projection theorem and its applications; orthogonal and biorthogonal signal expansions; Fourier transforms for periodic and aperiodic sequences and functions; sampling; uncertainty principles and the time-frequency plane; basics of quantization and source coding.

Comments: Adjusted this graduate-level course to provide more sophisticated and generalizable tools by following *Foundations of Signal Processing*.

Probability Theory in Electrical and Computer Engineering (BU ENG EC 381)

Role: Lecturer Fall 2016

Topics: Modeling uncertainty in electrical and computer systems; experiments, models, and probabilities; discrete and continuous random variables; reliability models for circuits; probability distributions; moments and expectations; random vectors; functions of random variables; sums of random variables and limit theorems; signal detection and estimation; basic stochastic processes; discrete-time Markov chains; applications to statistical modeling and interpretation of experimental data in computer, communication, and optical systems.

Wavelets, Approximation, and Compression (MIT 6.342)

Role: Lecturer Fall 2005, Spring 2007, Spring 2009, and Spring 2011.

Topics: Hilbert space formulation of continuous-time and discrete-time signals; sampling; orthogonal and biorthogonal signal expansions; uncertainty principles and the time-frequency plane; two-channel filter banks, iterated filter banks, discrete wavelet transforms, multiresolution analysis, wavelet bases, regularity, approximation properties, and nonlinear approximation; basics of quantization and source coding; compression, denoising, and other image processing using wavelets; and advanced topics from the current research literature.

Comments: Developed this new graduate-level course and co-authored textbooks *Foundations of Signal Processing* and *Fourier and Wavelet Signal Processing*.

Probabilistic Systems Analysis (MIT 6.041) and **Applied Probability** (MIT 6.431)

Roles: Lecturer Spring 2010 and Recitation Instructor Spring 2004, Fall 2004, Spring 2006, Spring 2008, Fall 2008, Fall 2010.

Topics: An introduction to probability theory, and the modeling and analysis of probabilistic systems; sample space, probabilistic models, conditional probability; discrete and continuous random variables; transform techniques; Bernoulli and Poisson processes; Markov processes; limit theorems and elements of statistical inference.

Comments: Made contributions acknowledged in the Second Edition of Bertsekas and Tsitsiklis's *Introduction to Probability*.

Discrete-Time Signal Processing (MIT 6.341)

Role: Lecturer Spring 2005, Fall 2006, and Fall 2009.

Topics: Representation, analysis, and design of discrete time signals and systems; discrete-time processing of continuous-time signals; decimation, interpolation, and sampling rate conversion; flowgraph structures for DT systems; time- and frequency-domain design techniques for recursive (IIR) and non-recursive (FIR) filters; parametric signal modeling and linear prediction; discrete Fourier transform, FFT algorithm; short-time Fourier analysis and filter banks; and multirate techniques.

Comments: Jointly responsible for this course with Alan Oppenheim, and made contributions acknowledged in the Third Edition of Oppenheim and Schafer's *Discrete-Time Signal Processing*.

Department-Wide Mentoring Contributions

PhD Seminar 1 and 2 (BU ENG EC 890/891)

Role: Coordinator, leader of most sessions Fall 2021, Spring 2022, Fall 2022, Spring 2023, Fall 2023, and Spring 2024.

Topics: Seminar for first-year PhD students to orient them to the department and to program requirements. Also provides training and advice as a collection of "How to . . . " sessions (read papers, write papers, manage your references, write rebuttals, review papers, give presentations, meet with your advisor, use BU research computing resources, do computational experimentation, do reproducible research, be a good graduate student teacher, manage your time, handle your email, typeset beautifully, do deep work, . . .).

Comments: Substantially expanded when I became Associate Chair.

Teaching Practicum I and II (BU ENG EC 801/802)

Role: Instructor Fall 2021, Spring 2022, Fall 2022, Spring 2023, Fall 2023, and Spring 2024.

Topics: Course for Graduate Student Teachers in electrical and computer engineering on effective and inclusive teaching.

Comments: Combines the Center for the Integration of Research, Teaching and Learning's open online course titled *An Introduction to Evidence-Based Undergraduate STEM Teaching* with essential policies and processes of BU. Introduced when I became Associate Chair.

Thesis Supervision and Research Mentoring

Postdoctoral researchers

4. Akshay Agarwal – BU, 2022–present.
3. Hoover Rueda-Chacón – BU, 2021–2022. Now an Assistant Professor at Universidad Industrial de Santander, Bucaramanga, Colombia.
2. John Murray-Bruce – BU, 2017–2019. Now an Assistant Professor at the University of South Florida.
1. Yanting Ma – BU, 2018–2019. Now a Principal Research Scientist with Mitsubishi Electric Research Laboratories.

PhD (or MS/PhD) advisees

19. Wentao Shangguan – student at BU, 2022–present.
18. Kao Kitichotkul – student at BU, 2022–present.
17. Alfred Krister Seiya Ulvog IV – student at BU, 2021–present.
16. Vaibhav Choudhary – student at BU, 2021–present.
15. Shashwath Bharadwaj – student at BU, 2020–present.
14. Unay Dorken
    PhD May 2025 (BU): Computational Methods for Scene Inference from Thermal Hyperspectral Measurements

13. Sheila P. (Werth) Seidel – Now a Lead Research Scientist with Analog Devices, Inc.
    PhD September 2022 (BU): Edge-Resolved Non-Line-of-Sight Imaging
    ○ 2023 **BU Electrical and Computer Engineering Doctoral Achievement Award**
    ○ 2021 **BU Center for Information & Systems Engineering Best Student Paper Award**
12. Minxu Peng – Now with Amazon.
    PhD August 2022 (BU): Computational Particle Beam Microscopy
11. Charles Saunders – Now a Senior Research Scientist, MathWorks.
    PhD May 2021 (BU): Occluder-Aided Non-Line-of-Sight Imaging
10. Joshua Rapp – Now a Principal Research Scientist with Mitsubishi Electric Research Laboratory.
    PhD January 2020 (BU): Probabilistic Modeling for Single-Photon Lidar
    ○ 2021 **IEEE Signal Processing Society Best PhD Dissertation Award**
    ○ 2020 **BU Outstanding Electrical Engineering Dissertation Award**
9. Dongeek Shin – Now with Google Nest.
    PhD February 2016 (MIT): Computational Imaging with Small Numbers of Photons
    SM June 2014 (MIT): Computational 3D and Reflectivity Imaging with High Photon Efficiency
8. G. Ahmed Kirmani – Co-founder of 3dim (acquired by Google); now with Facebook Reality Labs.
    PhD December 2014 (MIT): Computational Time-Resolved Imaging
    ○ 2015 **Jin-Au Kong Award**, Honorable Mention (best MIT PhD thesis in electrical engineering)
7. Joong B. Rhim – Now with GroupM Data and Analytics R&D Group.
    PhD June 2014 (MIT): Aggregation and Influence in Teams of Imperfect Decision Makers
    SM September 2010 (MIT): Quantization of Prior Probabilities in Bayesian Group Decision-Making
6. Andrea B. Colaço (co-advised with Christopher M. Schmandt) – Co-founder of 3dim (acquired by Google); now Senior Staff Engineering Manager, Google.
    PhD June 2014 (MIT): Compact and Low-Power Computational 3D Sensors for Gestural Input
5. John Z. Sun – Now a Quantitative Researcher with PDT Partners, LLC.
    PhD May 2013 (MIT): Quantization in Acquisition and Computation Networks
    SM September 2009 (MIT): Compressive Sensor Networks: Fundamental Limits and Algorithms
    ○ 2013 **Paul L. Penfield Student Service Award**
4. Daniel S. Weller – Now a Senior Manager of AI/Algorithms Engineering, KLA.
    PhD March 2012 (MIT): Accelerating Magnetic Resonance Imaging by Unifying Sparse Models and Multiple Receivers
    SM May 2008 (MIT): Mitigating Timing Noise in ADCs through Digital Post-Processing
3. Lav R. Varshney – Now an Associate Professor at the University of Illinois at Urbana-Champaign.
    PhD March 2010 (MIT): Unreliable and Resource-Constrained Decoding
    ○ 2011 **Jin-Au Kong Award**, Honorable Mention (best MIT PhD thesis in electrical engineering)
    SM May 2006 (MIT): Optimal Information Storage: Nonsequential Sources and Neural Channels
    ○ 2006 **Ernst A. Guillemin Thesis Prize**, Winner (best MIT SM thesis in electrical engineering)
2. Adam C. Zelinski – Now Managing Director of TrexQuant Management, LLC.
    PhD September 2008 (MIT): Improvements in Magnetic Resonance Imaging Excitation Pulse Design
1. Julius Kusuma – Now a Research Scientist with Facebook Connectivity Lab.
    PhD August 2006 (MIT): Economical Sampling of Parametric Signals

MS or MEng advisees

13. Glenn Martinez.
    MS August 2021 (BU): Towards Saturation of Detection Efficiency in Superconducting Single-Photon Detectors at 4.2 K Using Local Helium Ion Irradiation
12. Jeff Craley – Completed a PhD at Johns Hopkins University.
    MS August 2015 (BU): Low Ion Dose Imaging in the Helium Ion Microscope Under Neyman Type A Statistics
11. Jonathan B. Mei – Completed a PhD at Carnegie Mellon University.
    MEng May 2013 (MIT): Algorithms for 3D Time-of-Flight Imaging
    ○ 2013 **David Adler Memorial Prize**, 2nd Place (best MIT MEng thesis in electrical engineering)
10. Vahid Montazerhodjat – Was an Assistant Professor of the Practice at Boston College.
    SM February 2013 (MIT): Photon-Limited Time of Flight Depth Acquisition: New Parametric Model and Its Analysis
9. Ulugbek Kamilov – Now an Associate Professor at Washington University in Saint Louis.
    MS March 2011 (EPFL): Optimal Quantization for Sparse Reconstruction with Relaxed Belief Propagation

8. Michael T. Snella – Now with Sandia National Laboratory.
   MEng September 2010 (MIT): Drift Correction for Scanning-Electron Microscopy
7. Ha Quy Nguyen – Now a postdoctoral researcher at École Polytechnique Fédérale de Lausanne.
   SM September 2009 (MIT): Generalizations of Permutation Source Codes
6. Vinith Misra – Now a Data Science Manager at Netflix.
   MEng May 2008 (MIT): Functional Quantization
   ○ 2008 **David Adler Memorial Prize**, Winner (best MIT MEng thesis in electrical engineering)
5. Behnam Jafarpour (co-advised with William T. Freeman) – Now a Professor at the University of Southern California.
   SM February 2008 (MIT): Estimation of Channelized Features in Geological Media Using Sparsity Constraints
4. Ricky D. Nguyen
   MEng June 2007 (MIT): Rate Control and Bit Allocation for JPEG Transcoding
3. Ruby Pai – Now Member of Technical Staff, Sandia National Laboratory.
   MEng August 2006 (MIT): Nonadaptive Lossy Encoding of Sparse Signals
2. Demba Ba – Now an Associate Professor at Harvard University.
   SM May 2006 (MIT): Nonlinear Transform Coding using Lossless Polar Coordinates
1. Francois Masson – Bell Labs intern, 2000.
   MS 2000 (EPFL): "Multiple Description Robust Low-Delay Speech Coding"
   ○ **Best Thesis Award**, École Polytechnique Fédérale de Lausanne

Undergraduate mentoring

11. Xiang Jin – BU undergraduate researcher May 2024–present.
10. Tara Gill – BU undergraduate researcher Spring 2024.
9. Xinglin He – BU undergraduate researcher March 2023–May 2024.
8. Ada Yıldırım– undergraduate at Boğaziçi University, researcher March 2023–present.
7. Oğuz Kağan Hitit– undergraduate at Koç University, researcher September 2022–present.
6. Emily Lampat – BU undergraduate researcher Spring 2023.
5. Alexander Zhou – BU undergraduate researcher Spring 2023.
4. Balaji Sathyanarayanan – Machine Learning Concentration advisor (BS computer engineering, spring 2023, magna cum laude).
3. William Krska – BU undergraduate researcher September 2020 to August 2022. Now a PhD student, Carnegie Mellon University.
   ○ 2023 **CRA Outstanding Undergraduate Research Award Honorable Mention**
   ○ 2022/2023 **BU Electrical and Computer Engineering Undergraduate Outstanding Research Award**
2. Luisa Watkins – BU undergraduate researcher January 2020 to December 2021. Now a PhD student, University of California at San Diego.
   BS Honors June 2021 (BU): Mitigating Current Variation in Particle Beam Microscopy
   ○ Named **Clare Booth Luce Scholar** for Summer 2020 project completed under my supervision
   ○ 2021 **Microscopy and Microanalysis Poster Award Winner**
1. Safa Can Medin – undergraduate at Boğaziçi University, intern Summer 2017 and Summer 2018. Now a PhD student, Massachusetts Institute of Technology.

High school mentoring

3. Alexander Mehta – Boston University Research in Science & Engineering (RISE) Program intern from Fremont High School, Sunnyvale, CA, Summer 2023.
2. Teresa Siqi Zhang – Boston University Research in Science & Engineering (RISE) Program intern from Emma Willard School, Troy, NY, Summer 2022. Now an undergraduate at Stanford University.
1. Rishabh Bose – Boston University Research in Science & Engineering (RISE) Program intern from Stockdale High School, Bakersfield, CA, Summer 2019. Now an undergraduate at Caltech.
   ○ 2020 **Regeneron Science Talent Search Top 300 Scholar** for project completed under my supervision

Industrial interns (non-thesis)

5. Simon Skaria – Digital Fountain intern, 2001. Now a Founder of a stealth-mode startup.
4. Pier Luigi Dragotti – Bell Labs intern, 2000. Now a Professor, Imperial College, London.
3. Raman Venkataramani – Bell Labs intern, 2000. Now a Senior Research Engineer, Seagate Technology.
2. Wei Wang – Bell Labs intern, 2000.
1. Jonathan A. Kelner – Bell Labs intern, 1999. Now a Professor, Massachusetts Institute of Technology.

THESIS COMMITTEES

43. Qianwan Yang – PhD, Electrical and Computer Engineering, BU, 2026 (anticipated).
42. Mikhail Petrov – "Advancing Atomic Force Microscopy Imaging with Machine Learning: Applications for Soft Matter," PhD, Mechanical Engineering, Tufts University, 2025 (anticipated).
41. Francesca Madonini – "Single-Photon Avalanche Diode Arrays for Quantum-Enhanced Imaging and Spectroscopy," PhD, Information Technology, Politecnico Milano, 2022.
40. Yunzhe Li – "Robust Deep Learning for Computational Imaging Through Random Optics," PhD, Electrical and Computer Engineering, BU, November 2022.
39. Yujia Xue – "Computational Miniature Mesoscope for Large-Scale 3D Fluorescence Imaging," PhD, Electrical and Computer Engineering, BU, April 2022.
38. Waleed Tahir – "Deep Learning for Large-Scale Holographic 3D Particle Localization and Two-Photon Angiography Segmentation," PhD, Electrical and Computer Engineering, BU, August 2021.
37. Sandamali Devadithya – "Enhanced Reconstruction and Material Recognition in X-Ray CT for Security Applications," PhD, Electrical and Computer Engineering, BU, June 2021.
36. David B. Lindell – "Computational Imaging with Single-Photon Detectors," PhD, Electrical Engineering, Stanford University, January 2021.
35. Jonathan Dong – "A computational tour on random matrices: imaging through complex media and optical computing," PhD, Physics, École Normale Supérieure, Paris, France, December 2020 ("rapporteur anglais").
34. Akshay Agarwal – "Techniques for Enhancing Electron Microscopy," PhD, Electrical Engineering and Computer Science, MIT, September 2020.
33. Jinyuan Zhao – "Active Scene Illumination Methods for Privacy-Preserving Indoor Occupant Localization," PhD, Electrical and Computer Engineering, BU, September 2019.
32. Michael George Sidhom Farag – "Interference Channels: Theoretical and Empirical Potentials," PhD, Electrical and Computer Engineering, BU, December 2016.
31. Zachary Sun – "Reduced and Coded Sensing Methods for X-Ray Based Security," PhD, Electrical and Computer Engineering, BU, August 2016.
30. Jonathan Wu – "Gesture Passwords: Concepts, Methods and Challenges," PhD, Electrical and Computer Engineering, BU, May 2016.
29. Weicong Ding – "Learning Mixed Membership Models with a Separable Latent Structure: Theory, Provably Efficient Algorithms, and Applications," PhD, Electrical and Computer Engineering, BU, June 2015.
28. Dheera Venkatraman – "Quantum-mimetic imaging," PhD, Electrical Engineering and Computer Science, MIT, February 2015.
27. Joseph Wang – "Local Learning by Partitioning," PhD, Electrical and Computer Engineering, BU, January 2015.
26. Nicholas D. Hardy – "Optimal Standoff Imaging using Structured Laser Illumination and Graphical Models," PhD, Electrical Engineering and Computer Science, MIT, September 2014.
25. Ahmet Tuysuzoglu – "Robust Inversion and Detection Techniques for Improved Imaging Performance," PhD, Electrical and Computer Engineering, BU, May 2014.
24. Sumeet Kumar – "Mobile Sensor Systems for Field Estimation and 'Hot Spot' Identification," PhD, Mechanical Engineering, MIT, February 2014.
23. Trina Kok – "Magnetic Resonance Spectroscopic Imaging with 2D Spectroscopy for the Detection of Brain Metabolites," PhD, Electrical Engineering and Computer Science, MIT, September 2012.
22. Hyun Sung Chang – "Informative Sensing: Theory and Applications," PhD, Electrical Engineering and Computer Science, MIT, June 2012.

21. Fred Chen – "Energy-Efficient Algorithms, Circuits and Devices for Power Constrained Systems," PhD, Electrical Engineering and Computer Science, MIT, September 2011.
20. Dennis Wei – "Design of Discrete-Time Filters for Computational Efficiency," PhD, Electrical Engineering and Computer Science, MIT, June 2011.
19. Shay Maymon – "Sampling and Quantization for Optimal Reconstruction," PhD, Electrical Engineering and Computer Science, MIT, June 2011.
18. Szymon Kazimierz Jakubczak – "SoftCast: Exposing a Waveform Interface to the Wireless Channel for Scalable Video Broadcast," PhD, Electrical Engineering and Computer Science, MIT, June 2011.
17. Behtash Babadi – "Fundamental Limits and Constructive Methods for Estimation and Sensing of Sparse Signals," PhD, Harvard University, May 2011.
16. Fatih Kamişli – "Transforms for Prediction Residuals in Video Coding," PhD, Electrical Engineering and Computer Science, MIT, September 2010.
15. Wesley M. Gifford – "Bandwidth Scaling Behavior in Wireless Systems: Theory, Experimentation, and Performance Analysis," PhD, Electrical Engineering and Computer Science, MIT, September 2010.
14. Chung Chan – "Generating Secret in a Network," PhD, Electrical Engineering and Computer Science, MIT, September 2010.
13. Vivienne Sze – "Parallel Algorithms and Architectures for Low Power Video Decoding," PhD, Electrical Engineering and Computer Science, MIT, June 2010.
12. Charles Swannack – "Channel State Quantization in MIMO Broadcast Systems: Architectures and Codes," PhD, Electrical Engineering and Computer Science, MIT, June 2010.
11. Pedro C. Pinto – "Stochastic Wireless Communication Networks in Fading Dispersive Channels," PhD, Electrical Engineering and Computer Science, MIT, June 2010.
10. Rayan Saab – "Compressed Sensing: Decoding and Quantization," PhD, University of British Columbia, Vancouver, BC, Canada, May 2010.
9. Mehmet Akçakaya – "An Information Theoretic Approach to Compressed Sensing and Its Utility in Magnetic Resonance Imaging," PhD, Harvard University, May 2010.
8. Milan Derpich – "Optimal Source Coding with Signal Transfer Function Constraints," PhD, University of Newcastle, Callaghan, New South Wales, Australia, December 2008.
7. Vijay Divi – "Estimation and Calibration Algorithms for Distributed Sampling Systems," PhD, Electrical Engineering and Computer Science, MIT, September 2008.
6. Tony Q. S. Quek – "Efficient Approaches to Robust and Cooperative Wireless Network Design," PhD, Electrical Engineering and Computer Science, MIT, February 2008.
5. Sourav R. Dey – "Randomized Sampling and Multiplier-Less Filtering," PhD, Electrical Engineering and Computer Science, MIT, February 2008.
4. Julie S. Chalfant – "Three-Dimensional Object Registration Using Wavelet Features," PhD, Mechanical Engineering (Ocean Engineering program), MIT, February 2008.
3. Jan Østergaard – "Multiple-Description Lattice Vector Quantization," PhD, Technische Universiteit Delft, Netherlands, June 2007.
2. Petros T. Boufounos – "Quantization and Erasures in Frame Representations," PhD, Electrical Engineering and Computer Science, MIT, January 2006.
1. Brian A. Heng – "Adaptive Multiple Description Mode Selection for Error Resilient Video Communications," PhD, Electrical Engineering and Computer Science, MIT, June 2005.

SERVICE

Co-organized (with Jelena Kovačević) the DIMACS Workshop on Source Coding and Harmonic Analysis, New Brunswick, NJ, May 8–10, 2002.
Lead organizer of Challenges in Theoretical and Applied Signal Processing—Sputnik50@EPFL, 2007.
Program committee for IEEE Data Compression Conf. 2002, 2006–2015.
Program committee for IEEE Int. Conf. Image Processing 2003–present.
Program committee for IEEE Int. Conf. Acoustics, Speech, & Signal Processing 2004–present.
Program committee for IEEE Int. Symp. on Multimedia over Wireless, 2005.
Program committee for IEEE Int. Symp. Information Theory, 2008, 2012.
Program committee for IEEE Information Theory Workshop, 2011, 2013.
Program committee for SPIE Wavelet Applications in Signal & Image Processing VIII, 2000.
Program committee for SPIE Wavelet Applications in Signal & Image Processing IX, 2001.
Program committee for 20th European Signal Processing Conf. (EUSIPCO 2012), 21st European Signal Processing Conf. (EUSIPCO 2013).
Technical committee member for 6th Int. Conf. on Computing Communications and Networking Technologies (ICCCNT 2015).
Program committee for Int. Conf. Computational Photography, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025.
Awards Subcommittee Chair of the Image and Multiple Dimensional Signal Processing (IMDSP) Technical Committee, IEEE Signal Processing Society, 2006–2009.
Student Award Committee for IEEE Int. Conf. Image Processing 2012.
Panelist for National Defense Science & Engineering Graduate Fellowship 2000.
Reviewer for the Israel Science Foundation 2004.
Review panelist for the Austrian Science Fund (FWF) National Research Network (NFN) program 2007, 2014.
Expert Referee for the Research Council of Norway 2007.
Judge for Siemens Competition in Math, Science and Technology (formerly the Siemens Westinghouse Competition), 2008.
Panelist and/or Ad Hoc Reviewer for National Science Foundation 2008, 2009, 2012, 2013, 2014, 2016, 2017, 2019, 2020, 2021, 2022, 2024.
External Reviewer for Research Grants Council of Hong Kong, 2010.
Remote Referee for European Research Council, 2017.
Reviewer for Barry M. Goldwater Scholarship, 2024.
Reviewer for the following journals: ACS Photonics; Advances in Computational Mathematics; Applied & Computational Harmonic Analysis; Applied Optics; Applied Physics Letters; Automatica; Biometrika; Circuits, Systems, and Signal Processing; Communications Physics; EURASIP J. Applied Signal Processing; EURASIP J. Audio, Speech, and Music Processing; Foundations & Trends in Signal Processing; Foundations of Computational Mathematics; Games and Economic Behavior; IEEE Communications Magazine. IEEE J. Selected Topics in Signal Processing; IEEE Signal Processing Letters; IEEE Signal Processing Magazine; IEEE Trans. Audio, Speech, and Language Processing; IEEE Trans. Circuits & Systems for Video Technology; IEEE Trans. Communications; IEEE Trans. Computational Imaging; IEEE Trans. Graphics; IEEE Trans. Image Processing; IEEE Trans. Information Theory; IEEE Trans. Molecular, Biological, and Multi-Scale Communications; IEEE Trans. Signal Processing; IET Science, Measurement & Technology; J. American Statistical Association; J. Fourier Analysis & Applications; J. Lightwave Technology; J. Modern Optics; J. VLSI Signal Processing; Nature; Nature Communications; Nature Photonics; Optica; Optics Express; Optics Letters; Optical Engineering; Photonics Research; Physics Letters A; PLoS ONE; Proc. National Academy of Sciences; Sampling Theory in Signal & Image Processing; Science; Science Advances; Scientific Reports; SIAM J. Matrix Analysis & Applications; Transportation Research Part C: Emerging Technologies; World Scientific J.