

VIJAYAKUMAR BHAGAVATULA

(B.V.K. Vijaya Kumar)

Director, Carnegie Mellon University Africa (<http://africa.cmu.edu>)

U. A. and Helen Whitaker Professor of Electrical and Computer Engineering

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<http://www.ece.cmu.edu/~kumar/>

Google Scholar: <https://scholar.google.com/citations?hl=en&user=3IdSGX8AAAAJ>

Fellow of IEEE, SPIE, OSA, IAPR, AAAS and NAI

Co-founder of Biometricore, Hawxeye, Skynet, VerisafeID and VTL.

Former Interim Dean of the College of Engineering, CMU

EDUCATION

- Ph.D. (Electrical Engineering) from Carnegie Mellon University, February 1980.
- M.Tech. (Electrical Engineering) from Indian Institute of Technology, Kanpur, India, June 1977.
- B.Tech. (Electrical Engineering) from Indian Institute of Technology, Kanpur, India, May 1975.

EMPLOYMENT

- Director, Carnegie Mellon University Africa, Kigali, Rwanda, January 2018 –
- Interim Vice Provost for Research, Carnegie Mellon University, April 2017 – December 2017
- Associate Dean for Graduate and Faculty Affairs, College of Engineering, Carnegie Mellon University, July 2010 – March 2017.
- Professor of ECE, CMU, September 1991 – .
- Interim Dean, College of Engineering, Carnegie Mellon University, August 1, 2012 – December 31, 2012.
- Acting Head of the Department, Electrical and Computer Engineering (ECE) Department, CMU, July 2004-February 2005.
- Associate Department Head of ECE, CMU from July 1994 to June 1996.
- Associate Professor of ECE, CMU from September 1987 to August 1991.
- Assistant Professor of ECE, CMU from September 1982 to August 1987.
- Research Associate in ECE, CMU from March 1980 to August 1982.

TECHNICAL CONSULTING

- Lockheed Missiles and Space Company, Palo Alto, CA.
- General Dynamics, Pomona, CA.
- Unicorn Systems Inc., Pittsburgh, PA.
- Westinghouse Electric Corp., Pittsburgh, PA.
- Two-Six Inc., Saxonburg, PA.
- Carnegie Mellon Research Institute, Pittsburgh, PA.
- Teledyne Brown Engineering, Huntsville, AL.
- Dynetics Inc., Huntsville, AL.

- US Army Missile Command Laboratories, Huntsville, AL.
- Rosemount Analytical, Inc., Pittsburgh, PA.
- Martin Marietta Company, Orlando, FL.
- Hughes Missile Systems Company, Tucson AZ.
- Southwest Intelligent Systems Inc., Tucson, AZ.
- Hughes Research Laboratories, Malibu, CA.
- Mytec Technologies Inc., Toronto, Canada
- Raytheon Systems Company, Tucson, AZ.
- ADC Communications, Pittsburgh, PA.
- Litton TASC Institute, VA.
- Maxoptix Corp., Fremont, CA
- Northrop Grumman, Pittsburgh, PA.
- Lockheed Martin, Orlando, FL.
- Lucent Technologies, NJ.
- Mine Safety Appliances, Pittsburgh, PA.
- Media Balance, East Lansing, Michigan.
- Pukoa Scientific, Hawaii.
- Utopia Compression, CA.

LEGAL CONSULTING

- Morgan, Lewis and Bockius, Washington, DC.
- Baker and McKenzie, San Francisco, CA.
- Finnegan, Henderson, Farabow, Garrett and Dunner, Washington, DC.
- McAndrews, Held & Malloy, Chicago, Illinois.
- Weil, Gotshal & Manges, Redwood Shores, CA.
- Fish and Richardson, Washington, DC.

TEACHING

Carnegie Mellon Courses

- Mathematical Foundations of Electrical Engineering
- Signals and Systems
- Digital Communications
- Applied Stochastic Processes
- Digital Signal Processing
- Advanced Digital Signal Processing
- Pattern Recognition Theory
- Error Control Coding
- Detection and Estimation Theory
- Linear IC Applications
- Special Topics in Signal processing: Biometrics
- Noisy Signal Representation and Processing

Short Courses

- Algorithms for Biometric Recognition (Intl. Conf. on Image Processing, Singapore; SPIE Defense & Security Symposium)
- Statistical Pattern Recognition (SPIE Aerosense Symposium)
- Advanced Correlation Filters (SPIE Aerosense Symposium)

- Partial response Maximum Likelihood (PRML) methods for Optical Data Storage (Optical Data Storage conference)
- MATLAB for Signal Processing (TASC Institute)
- Coding for Data Storage (StorageTek Inc.)
- Low Density Parity Check (LDPC) Codes (Data Storage Institute, Singapore)
- Correlation Filters for Biometric Recognition (Indian National Academy of Engineer's Workshop on Image and Speech Processing, IIT/Madras, Chennai, India)
- Frequency-domain methods for biometric recognition (ICASSP 2007)
- Multiple Uses of Correlation Filters for Biometrics (BTAS 2012, Washington D.C.)
- Theory and Applications of Correlation Filters for Computer Vision (Osmania University, Hyderabad, India, November 2017)

INVITED TALKS

1. "Performance of synthetic discriminant functions for distortion-invariant pattern recognition," **Jet Propulsion Laboratories**, Pasadena, California, March 1987.
2. "Optimal detection of digital information on particulate magnetic recording media," **Hewlett-Packard Laboratories**, Palo Alto, California, March 1987.
3. "Detection of digital signals on particulate media in non-stationary noise," **Control Data**, Minneapolis, Minnesota, May 1987.
4. "Optical correlators for pattern recognition," **IEEE ASSP Society and IEEE Controls Society Chapter meeting**, Pittsburgh, Pennsylvania, October 1987.
5. "Associative Memory from Neural Networks," Joint Seminar, **Department of Electrical Engineering and Division of Imaging Science**, Yale University, New Haven, Connecticut, November 1987.
6. "Input-output characterization of laterally inhibited networks," **Electrical and Computer Engineering**, University of Missouri, Columbia, Missouri, February 1988.
7. "Optical Pattern Recognition," **Defense Research and Development Laboratories**, Hyderabad, India, June 1988.
8. "Image Reconstruction from Partial Fourier Information," **Center for Fluorescence Research**, Carnegie Mellon University, Pittsburgh, Pennsylvania, October 1988.
9. "Noise Modeling in Magnetic Recording," **Magnetics Technology Center**, Carnegie Mellon University, Pittsburgh, Pennsylvania, November 1988.
10. "Input-Output characteristics of a class of Laterally Inhibited Neural Networks," **Jet Propulsion Laboratories**, Pasadena, California, January 1989.
11. "Input-output characterization of a class of laterally inhibited neural networks," **US West Advanced Technologies**, Englewood, Colorado, February 1989.
12. "Phase-only and binary phase-only filters for optical pattern recognition," **NSF Center for Opto-Electric Computing Systems**, University of Colorado, Boulder, Colorado, February 1989.

13. "Optical Data Processing Research at CMU," **ECE Graduate Seminar**, Carnegie Mellon University, Pittsburgh, Pennsylvania, September 1989.
14. "Partial-Information Correlator Systems," **Litton Data Systems**, Van Nuys, California, January 1990.
15. "Design of phase-only and binary phase-only correlation filters," **Rockwell International Sciences Center**, Los Angeles, California, July 1990.
16. "Binary phase-only filter design," **Litton Data Systems**, Van Nuys, California, July 1990.
17. "Partial-information correlation filter design," **Sandia National Laboratories**, Albuquerque, New Mexico, July 1990.
18. "Three-level composite filters for optical pattern recognition," **Litton Data Systems**, Van Nuys, California, March 1991.
19. "Advances in correlation filter design," **U.S. Army Night Vision Laboratories**, April 1991.
20. "Trade-off in the design of correlation filters," **SPIE Critical Reviews**, San Jose, California, November 1991.
21. "Filter design for optical correlators," **Martin-Marietta Company**, Orlando, Florida, April 1992.
22. "Design of Filters for Optical Correlators," **Sandia National Laboratories**, Albuquerque, New Mexico, January 1993.
23. "Application of Differential Learning to Pattern Recognition," **Indian Institute of Technology**, Madras, India, June 1993.
24. "Efficient statistical pattern recognition through differential learning," **Indian Statistical Institute**, Calcutta, India, July 1993.
25. "Applications of Signal Processing in Data Storage Systems," **KODAK**, Rochester, New York, September 1993.
26. "Differential learning approaches," **Hughes Missile Systems Company**, Canoga Park, California, March 1994.
27. "Neural networks for Pattern Recognition," **NASA Johnson Space Center**, Houston, Texas, May 1994.
28. "Correlation filters for Automatic Target Recognition," **Westinghouse Science & Technology Center**, Pittsburgh, PA, September 1994.
29. "Correlation Filters for Pattern Recognition," **Hughes Research Labs**, Malibu, California, October 1994.

30. "Equalization for Holographic Data Storage," **University of Arizona**, Tucson, AZ, January 1996.
31. "Correlation Filters for Automatic Target Recognition," **Northrop Grumman Norden Systems**, Norwalk, CT, July 1996.
32. "Coding for Data Storage," **Storage Technologies Inc.**, Boulder, CO, December 1996.
33. "Coding for High-density Data Storage," Computational Sciences Center, **University of Kentucky**, Lexington, KY, March 1997.
34. "Advanced correlation filters for pattern recognition," **Indian Statistical Institute**, New Delhi, India, May 1997.
35. "Run-length limited Codes for high-density data storage," **Hughes Missile Systems Company**, Tucson, AZ, October 1997.
36. "Partial response methods for high density data storage," **Raytheon Missile Systems Company**, Tucson, AZ, March 1998.
37. "Equalization methods for optical data storage," **Calimetrics Inc.**, Oakland, CA, June 1998.
38. "Equalization methods for optical data storage," **Quantum Electronics**, Shrewesbury, MA, July 24, 1998.
39. "Advanced optical correlation methods," **Raytheon Missile Systems Company**, Tucson, AZ, August 1998.
40. "Coding and Signal processing for high-density data storage systems," **Indiana University of Pennsylvania**, Indiana, PA, September 1998.
41. "Equalization for holographic data storage," **International Workshop for Holographic Data Storage**, Nice, France, March 1999.
42. "Clutter rejection methods for automatic target recognition," **Northrop Grumman Science and Technology Center**, Pittsburgh, PA, October 1999.
43. "Optical data storage research at DSSC," **Optical Data Storage Center, University of Arizona**, Tucson, AZ, October 1999.
44. "Signal Processing for Optical Data Storage," **NSIC Optical Data Storage Road Map Workshop**, Los Gatos, CA, November 1999.
45. "Timing recovery for data storage," **Seagate**, Minneapolis, MN, December 14, 1999.
46. "Turbo codes for data storage," **IEEE Magnetics Society Seminar**, Minneapolis, MN, December 14, 1999.
47. "Characterization and equalization of tape dropouts," **Imation**, Minneapolis, MN, December 15, 1999.

48. "Turbo coding for optical data storage," **Infineon Technologies**, Santa Cruz, CA, May 5, 2000.
49. "Turbo codes for data storage," **Quantum Inc.**, Milpitas, CA, May 5, 2000.
50. "Eigen and non-linear for improved clutter rejection in correlation-based automatic target recognition," **Northrop Grumman Science and Technology Center**, Pittsburgh, PA, September 29, 2000.
51. "Coding and Signal Processing for Data Storage," **Lucent Technologies**, Allentown, PA October 13, 2000.
52. "Correlation Filters: State of the Art," **Raytheon Systems Company**, Tucson, AZ, March 2001.
53. "Low Density Parity Check (LDPC) Codes for Data Storage," **Samsung Information Systems of America**, San Jose, CA, March 2001.
54. "Advanced correlation filters for Automatic Target Recognition," **Lockheed Martin**, Orlando, FL, April 2001.
55. "Coding and Signal Processing for Optical Data Storage," **Philips Laboratories**, Eindhoven, Netherlands, June 2001.
56. "Role of Coding and Signal Processing for Digital Data Preservation," **NIST**, Gaithersburg, MD, August 2001.
57. "Biometric verification algorithms," **Lockheed Martin**, Orlando, Florida, March 2002.
58. "Coding and Signal Processing Research at Data Storage Systems Center," **Data Storage Institute**, Singapore, December 2002.
59. "Advanced timing recovery methods for low-SNR data storage channels," Coding and Signal Processing Group, **Data Storage Institute**, Singapore, December 2002.
60. "Correlation filter methods for face verification," ECE Dept., **Natl. Univ. of Singapore**, Singapore, December 2002.
61. "Biometric verification using correlation filters," Computer Science Department, **IIT/Madras**, Madras, India, December 2002.
62. "Biometric recognition using correlation filters," Cal-IT2 seminar, **University of California at San Diego**, CA, October 2003.
63. "Biometrics for Security," **IEEE Erie Section New Members Dinner Meeting**, Erie, PA, November 2003.
64. "Correlation Pattern Recognition," Dowd Fellowship Seminar, **Carnegie Institute of Technology**, CMU, Pittsburgh, PA, December 2003.

65. "Biometrics for Human Identification," **Indian National Academy of Sciences (INSA) Chennai Chapter**, Chennai, India, January 9, 2004.
66. "Correlation filters for biometric authentication," **Siemens Corporate Research Center**, Princeton, NJ, March 19, 2004.
67. "Biometrics research at Carnegie Mellon's CyLab," **West Virginia University**, Morgantown, WV, September 29, 2004.
68. "Biometrics Research at Carnegie Mellon's Cylab," **IEEE Communications Society Queensland Chapter**, Brisbane, Australia, December 7, 2004.
69. "Biometric Authentication using Correlation Filters," **Michigan State University**, February 8, 2005.
70. "DSSC Coding and Signal Processing Research," **Broadcom**, Longmont, Colorado, July 28, 2005.
71. "Frequency-domain Biometric Authentication," **North Carolina State University**, Raleigh, NC, August 30, 2005.
72. "Correlation Filters for Face Recognition," **Face Recognition Advanced Study Workshop**, Morgantown, WV, November 2005.
73. "DSSC Channels research," **LSI Logic**, Fort Collins, CO, December 2005.
74. "Frequency-domain approach to Image Biometric Authentication," Invited talk, **IAPR International Conference on Biometrics (ICB)**, Hong Kong, January 5, 2006.
75. "Introduction to Correlation Filters for Biometric Recognition," **IIT**, Hyderabad, January 12, 2006.
76. "Iris verification," **IIT/Madras**, Chennai, India, February 27, 2006.
77. "Spatial-frequency domain methods for face recognition and iris recognition," **Booz Allen Hamilton**, McLean, VA, May 2, 2006.
78. "Spatial-frequency domain techniques for face recognition grand challenge (FRGC)," **CyLab**, Carnegie Mellon university, Pittsburgh, June 5, 2006.
79. "FPGA-based evaluation of LDPC codes," **Sabanci University**, Istanbul, Turkey, September 14, 2006.
80. "Correlation filters for ATR & Biometrics," **General Dynamics Robotic Systems**, Pittsburgh, September 25, 2006.
81. "Image biometric verification in spatial frequency domain," **Royal Melbourne Institute of Technology (RMIT) University**, Melbourne, Australia, October 6, 2006.
82. "Coding and signal processing for holographic data storage," **Data Storage Institute (DSI)**, Singapore, June 20, 2007.

83. "Biometric recognition in spatial frequency domain," **University of Gottingen**, Germany, September 8, 2007.
84. "Spatial frequency domain biometric recognition," **Air Force Institute of Technology**, Dayton, Ohio, November 9, 2007.
85. "Image biometric recognition via spatial frequency domain," Keynote speech, **3rd Indian International Conference on Artificial Intelligence**, Pune, India, December 17, 2007.
86. "Iris verification," Invited talk, **Workshop on Image and Signal Processing**, Guwahati, India, December 28, 2007.
87. "Face recognition," Invited talk, **Workshop on Image and Signal Processing**, Guwahati, India, December 29, 2007.
88. "Signal processing approaches for face and iris recognition," **Syracuse University**, Syracuse, NY, February 13, 2008.
89. "Coding and signal processing for bit-patterned media," **LSI**, Milpitas, CA, December 12, 2008.
90. "Super-resolution for face recognition," **CyLab**, Carnegie Mellon University, February 16, 2009.
91. "Error control coding for data storage," **Jet Propulsion Labs**, Pasadena, CA, May 4, 2009.
92. "Super-resolution for face recognition," **IIT**, Hyderabad, June 26, 2010.
93. "Channels research at Data Storage Systems Center," **KMITL**, Bangkok, Thailand, July 30, 2010.
94. "Low density parity check codes for data storage systems," keynote talk at **DST-CON**, Bangkok, Thailand, July 31, 2010.
95. "Super-resolution face recognition," invited seminar at **Penn State University**, State College, PA, March 3, 2011.
96. "Signal processing approaches for biometric recognition," **IEEE Pittsburgh Chapter**, Pittsburgh, PA, April 8, 2011.
97. "Recent advances in correlation filters," **ATR Working Group**, MITRE, McLean, VA, July 11, 2011.
98. "Multiple uses of correlation filters for biometrics," Interdisciplinary Distinguished Seminar Series, **North Carolina State University**, Raleigh, NC, November 4, 2011.
99. "Multiple uses of correlation filters for biometrics," Keynote speech, **International Conference on Hand Biometrics**, Hong Kong, November 17, 2011.

100. “Correlation filters for biometrics,” Department of Electrical and Computer Engineering, **University of Houston**, Houston, TX, December 9, 2011.
101. “Multiple uses of correlation filters for biometrics,” **CyLab**, Carnegie Mellon University, Pittsburgh, March 5, 2012.
102. “Matching challenging ocular images,” invited talk, **SPIE Conference on Biometric Technology for Human Identification IX**, Baltimore, April 23, 2012.
103. “Correlation filters for biometrics,” **Institute for Infocomm Research (I²R)**, Singapore, June 26, 2012.
104. “Computer vision for cars,” keynote speech, **Intl. Conf. on Advanced Vehicle Technologies and Integration (VTI 2012)**, Changchun, China, July 17, 2012.
105. “Combining correlation filters and support vector machines (SVMs),” **International Institute of Information Technology (IIIT)**, Hyderabad, India, August 2, 2013.
106. “Recent advances in correlation filters for biometrics,” Department of Computer Science Colloquium, **Hong Kong Baptist University**, Hong Kong, August 19, 2013.
107. “Multiple uses of correlation filters for biometrics,” keynote talk, **Workshop on Speech and Image Processing**, IIT, Guwahati, India, December 13, 2013.
108. “Generalization vs. Localization: Combining correlation filters and support vector machines,” keynote talk, **Workshop on Speech and Image Processing**, IIT, Guwahati, India, December 14, 2013.
109. “Coding and signal processing for flash memory,” **LSI Corporation**, San Jose, CA, March 10, 2014
110. “College of Engineering at Carnegie Mellon,” **King Saud University**, Riyadh, Saudi Arabia, April 6, 2014.
111. “Personalized ECG analysis for real-time monitoring,” key note talk, **International Conference on Medical Biometrics (ICMB)**, Shenzhen, China, May 30, 2014.
112. “Some basic topics in pattern recognition,” tutorial talk, **International Institute of Information Technology (IIIT)**, Hyderabad, India, January 19, 2015.
113. “New correlation filter designs and applications,” Distinguished Lecture, **Hong Kong Baptist University**, Hong Kong, June 22, 2016.
114. “Innovations in Correlation Filter Design Architectures for Robust Object Recognition,” invited talk, **IEEE Applied Imagery Pattern Recognition (AIPR) Workshop**, Washington, DC, October 19, 2016.
115. “Innovative Correlation Filter Designs and Approaches for Object Recognition and Tracking,” Distinguished Lecture, Computer Science and Engineering, **Michigan State University**, East Lansing, Michigan, December 2, 2016.

116. "Application of Computer Vision and Signal Processing to Intelligent Transportation" **Graduate School at Shenzhen, Tsinghua University**, Shenzhen, China, June 15, 2017.
117. "Application of Computer Vision and Signal Processing to Intelligent Transportation" **Shenzhen Institute of Information Technology**, Shenzhen, China, June 15, 2017.
118. "Road Information Extraction from Crowd-sourced Noisy Vehicle Sensor Data," **CMU-Africa**, Kigali, Rwanda, October 10, 2017.

STUDENT/Post-Doc SUPERVISION

Visiting Faculty

- Prof. Fei Su, Beijing Univ. of Posts & Telecommunications, China (Feb. 2008-Jan. 2009)
- Prof. Vinod Sharma, Indian Institute of Sciences, India (Aug. 2015 – Dec. 2015)

Post-Docs

- Dr. Hyungshin Kim, Ph.D. from KAIST, Korea (May 2003-Feb. 2004)
- Dr. Zongwang Li (January 2004-October 2005)
- Dr. Zheng Li (June 2011 – May 2013)
- Dr. Mohamed Maruf (January 2012-January 2013)
- Dr. Bob Zhang (October 2012 – April 2013)
- Dr. Yao Jun (December 2013 – February 2015)
- Dr. Shayok Chakrabarty (June 2014 – June 2015)
- Dr. Yao Wang (August 2014 – September 2017)

Industry Visitors

- Toshihiro Horigome, Sony, Japan (July 2002-February 2004)

Visiting Students

- Bruno Jesus, University of Porto, Portugal (March 2009 – May 2009)
- Johannes Pallauf, University of Porto, Portugal (July 2011 – September 2011)
- Nitish Sharma, IIT/Kanpur, India (June 2012 – July 2012)
- Varun Sridhar, Netaji Subhas Institute of Technology, Delhi, India (June 2012 – August 2012)
- Xueyan Zou, Hong Kong Baptist University (May – August 2017)
- Xiaofeng Liu, Chinese Academy of Sciences, China (January 2017 -)

Ph.D. Students

1. Christopher Carroll, "Application of Optical Signal Processing to Adaptive Phased Array Radar," May 1987.
2. Bruce Montgomery, "On decoding algorithms for linear binary block codes," July 1987.
3. Zouhir Bahri, "Phase-only and binary phase-only filters in optical correlators," September 1989.
4. Michael Lemmon, "Parameter Estimation using competitively inhibited neural networks," April 1990.

5. Laurence Hassebrook, "Linear phase filters and filter banks for distortion-invariant optical pattern recognition," July 1990.
6. James Connelly, "Two-dimensional correlation using one-dimensional acousto-optic devices," October 1990.
7. Ashraf Ali Kassim, "A neural network architecture for generating potential fields," March 1993.
8. Charles Hendrix, "Two-level and three-level filter design for distortion-invariant pattern recognition," August 1993.
9. John Hampshire, "A differential theory of learning for efficient statistical pattern recognition," September 1993.
10. Inci Ozgunes, "Modeling Magneto-Optic Read Channels," December 1995.
11. Khaled Al-Ghoneim, "Learning ranks for pattern recognition," April 1996.
12. Srinivasan Gopalaswamy, "Multi-channel signal processing for high track density optical recording systems," May 1996.
13. Daniel Carlson, "Optimal tradeoff composite filters," August 1996.
14. Greg Silvus, "Detection of ultra-high-density magnetic tape signals in the presence of nonlinearities," September 1996.
15. Usha Pillai, "Readback signal simulation and development of data detection techniques for a scanner-based multi-channel optical tape system," January 1999.
16. Venkatesh Vadde, "2-Dimensional equalization, detection and coding for volume holographic data storage," August 1999.
17. Mohamed Alkanhal, "Eigen and nonlinear correlation filters for automatic target recognition," September 2000.
18. Yifei Yuan, "Timing recovery for data storage," December 2000.
19. Mehmet Keskinoz, "Two-dimensional equalization and detection for quadratic storage channels," July 2001.
20. Fatih Sarigoz, "Characterization and mitigation of dropouts in magnetic tape recording: A read channel perspective," September 2001. (co-advisor: Dr. James Bain)
21. Hongwei Song, "Iterative soft detection/decoding for data storage channels," December 2002.
22. Jingfeng Liu, "Timing recovery for low-SNR data storage channels," April 2003.
23. Marios Savvides, "Reduced-Complexity Face Recognition using Advanced Correlation Filters and Fourier subspace Methods for Biometric Applications," April 2004 (co-advisor: Prof. Pradeep Khosla).

24. Xiaoming Liu, "Pose-robust video-based face recognition," October 2004 (co-advisor: Prof. Tsuhan Chen).
25. Lingyan Sun, "Implementation and evaluation of iterative soft detection/decoding using field programmable gate array," August 2005 (Recipient of the Milnes Award for the best Ph.D. thesis in ECE Department, CMU, 2005-2006).
26. Jin Xie, "Timing recovery for data storage using Kalman filters," July 2006.
27. Chunyan Xie, "Class-dependence feature analysis for large population face recognition," August 2006.
28. Krithika Venkataramani, "Optimal classifier ensembles for improved biometric verification," January 2007.
29. Jason Thornton, "Iris pattern matching: a probabilistic model based on discriminative cues," April 2007, Recipient of the Milnes Award for the best Ph.D. thesis in ECE Department, CMU, 2006-2007 (co-advisor: Dr. Marios Savvides).
30. Ryan Kerekes, "Combining correlation outputs for enhanced distortion-tolerant target recognition," May 2007.
31. Lakshmi Ramamoorthy, "Advanced coding and signal processing for holographic data storage," February 2008.
32. Xinde Hu, "Low density parity check (LDPC) codes for magnetic recording systems," March 2008.
33. Pablo Hennings, "Simultaneous Super-resolution and recognition," October 2008.
34. Sheida Nabavi, "Signal processing for bit-patterned media channels with inter-track interference," December 2008.
35. Soowoong Lee, "Soft-Decision decoding of Reed-Solomon codes using pattern information over partial response channels," September 2009.
36. Seungjune Jeon, "Low density parity check codes for data storage and memory systems," December 2010.
37. Euseok Hwang, "Storage Channels with Incomplete Writing: Two-Dimensional Magnetic Recording (TDMR) and Memory in a Space Radiation Environment," July 2011 (co-advisor: Prof. Rohit Negi, ECE, CMU)
38. Yibin Ng, "Signal Processing for Bit-Patterned Media and Heat-Assisted Magnetic Recording Systems with Media Noise," July 2012 (co-advisor: Dr. Cai Kui, DSI, Singapore)
39. Andres Rodriguez, "Maximum margin generalized correlation filters," August 2012.
40. Qi Wu, "Vision-based clear path detection through the use of in-vehicle camera," October 2012.

41. Vishnu Naresh Boddeti, "Advances in Correlation Filters: Vector Features, Structured Prediction and Shape Alignment," December 2012.
42. Can Ye, "Online personalized vital signal analysis for real-time health monitoring," November 2013 (co-advisor: Prof. Miguel Coimbra, Univ. of Porto, Portugal)
43. Joseph Fernandez, "Accounting for aliasing in correlation filters: Zero-Aliasing and Partial-Aliasing correlation filters," April 2014.
44. Hyunggi Cho, "Holistic approach to moving object detection and tracking for autonomous urban driving," May 2014 (co-advisor: Dr. Paul Rybski, Robotics Institute, CMU).
45. Kathy Brigham, "Robust state fusers over long-haul sensor networks," March 2015.
46. Jonathon Smereka, "Probabilistic deformation models for biometric image matching in harsh environments," January 2016.
47. Andrew Fox, "Information extraction from undersampled and asynchronous vehicle sensor data," April 2016.
48. Yongjune Kim, "Writing on dirty memory," June 2016.
49. Stephen Siena, "Improving the design and use of correlation filters in visual tracking," September 2017.
50. Zhiding Yu, "Learning discriminative and structural information for traffic scene understanding," December 2017.
51. Eric He
52. Rick Chang (co-advisor: Prof. Aswin Sankaranarayanan)
53. Yang Zou
54. Ibrahim Alkanhal

Master's Students

1. Christopher Carroll, October 1983.
2. Craig Rahenkamp, July 1985.
3. Keith DeVos, October 1985.
4. Zouhir Bahri, October 1986.
5. Venugopal Veeravalli, October 1986.
6. Michael Lemmon, December 1987.
7. James Connelly, February 1988.
8. Dean Hering, December 1989 (joint advisor: Prof. P. Khosla)
9. Phillip Wong, May 1990.

10. Wei Shi, August 1990.
11. Charles Hendrix, December 1990.
12. Greg Silvus, November 1991.
13. Daniel Carlson, May 1992.
14. Chu-Lung Chen, August 1993.
15. Hooman Yaghoobi, May 1994.
16. Aida Ibrahim, September 1995.
17. Fatih Sarigoz, May 1996.
18. Magdalena Wong, August 1996.
19. Glen Clark, May 1997.
20. Mehmet Keskinöz, December 1997.
21. Reese Bovard, December 1999.
22. Siriluck Tipmongkonsilp, May 2000.
23. Rajan Singh, May 2002.
24. Krithika Venkataramani, December 2002.
25. Shilpi Sahu, December 2002.
26. Jason Thornton, December 2003.
27. Mike Beattie, December 2004.
28. Sheida Nabavi, May 2005.
29. Ryan Kerekes, May 2005.
30. Euseok Hwang, May 2008.
31. Vishnu Naresh Boddeti, May 2009.
32. Seh-Hwan Jung, May 2009.
33. Joseph Fernandez, May 2010 (co-advisor: Prof. Dan Stancil, NC State Univ.)

BOOKS

1. B.V.K. Vijaya Kumar, A. Mahalanobis and Richard Juday, **Correlation Pattern Recognition**, Cambridge University Press, United Kingdom, November 2005.
2. B.V.K. Vijaya Kumar and H. Kobori, editors, **Proc. of Optical Data Storage 2004**, SPIE, October 2004.
3. V. Bhagavatula, V. Govindaraju, editors, **Proc. of the Fourth IEEE Workshop on Automatic Identification Advanced Technologies**, Buffalo, NY, October 17-18, 2005.
4. B.V.K. Vijaya Kumar, S. Prabhakar and A. Ross, editors, **Proc. of Biometric Technology for Human Identification V**, vol. 6944, SPIE, March 2008.
5. C.S. Halvorson, S.O. Sothorn, B.V.K. Vijaya Kumar, Salil Prabhakar and Arun Ross, editors, **Proc. of Optics and Photonics in Global Homeland Security V and Biometric Technology for Human Identification VI**, vol. 7306, SPIE, April 2009.

6. B.V.K. Vijaya Kumar, S. Prabhakar and A. Ross, editors, **Proc. of Biometric Technology for Human Identification VII**, vol. 7667, SPIE, April 2010.
7. B.V.K. Vijaya Kumar, S. Prabhakar and A. Ross, editors, **Proc. of Biometric Technology for Human Identification VIII**, vol. 8029B, SPIE, April 2011.
8. B.V.K. Vijaya Kumar, S. Prabhakar and A. Ross, editors, **Proc. of Biometric Technology for Human Identification IX**, vol. 8371B, SPIE, April 2012.

BOOK CHAPTERS

1. D. Casasent and B.V.K. Vijaya Kumar, "Optical linear algebra processors," Chapter 6.1, *Optical Signal Processing* (edited by J.L. Horner), Academic Press, 389-407, 1987.
2. M. Lemmon and B.V.K. Vijaya Kumar, "Competitively Inhibited Neural Networks: Analysis and Applications," Chapter 3 in *Neural Networks: Concepts, Applications and Implementations, Vol. III*, 48-83, Prentice-Hall, 1991.
3. B.V.K. Vijaya Kumar and P. Wong, "Optical Associative Memories," Chapter in *Artificial Neural Networks and Statistical Pattern Recognition: Old and New Connections*, 219-241, North-Holland, 1991.
4. B.V.K. Vijaya Kumar, "Optical Pattern Recognition," Chapter in *Optical Signal Processing*, 39-88, Academic Press, 1994.
5. A. Kassim and B.V.K. Vijaya Kumar, "Artificial potential fields and neural networks," Chapter in *The Handbook of Brain Theory and Neural Networks*, edited by Michael Arbib, 749-753, Bradford Books, 1995.
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14. M. Savvides, K. Harun, V. Bhagavatula, S.W. Park and Y. Li, "Computationally efficient feature extraction and matching iris recognition," US Patent # 9454697

15. Yongjune Kim and Vijayakumar Bhagavatula, “Reducing errors caused by inter-cell interference in a memory device,” Patent application filed, September 2015.

HONORS AND AWARDS

- Recipient, Government of India Merit Scholarship (1970-75).
- Fellow, Optical Society of America (1993).
- Fellow, SPIE, the International Society of Optical Engineering (1991).
- Fellow, IAPR, the International Association of Pattern Recognition (2006)
- Fellow, IEEE (2010)
- Fellow, AAAS, American Association for Advancement of Science (2016).
- Fellow, NAI, National Academy of Inventors (2017)
- Adjunct Professor, Department of Computing, Hong Kong Polytechnic University, Hong Kong (2013 -2019)
- Distinguished Visiting Professor, Shenzhen Institute of Information Technology (2017)
- Departmental Academic Advisor, Department of Computing, Hong Kong Polytechnic University (2010 – 2017)
- Listed in *Who's Who Among Asian Americans*.
- Listed in Marquis *Who's Who in Optical Sciences and Engineering*.
- Listed in *American Men and Women of Science*.
- Listed in Marquis *Who's Who in Sciences and Engineering*.
- Listed in Marquis *Who's Who in Education*.
- Listed in Marquis *Who's Who in Finance and Business*
- Listed in Marquis *Who's Who in America*
- Listed in Marquis *Who's Who in the World*.
- Recipient of Carnegie Institute of Technology’s Philip Dowd Fellowship (2003)
- Recipient of Eta Kappa Nu award for Outstanding Faculty in the Electrical and Computer Engineering (ECE) Department at CMU, May 2003.
- Co-author of the 2008 Best Student Paper in Data Storage area, Data Storage Technical Committee of IEEE Communications Society.
- Co-recipient of 2008 Carnegie Institute of Technology (Engineering College at CMU) Outstanding Faculty Research Award.
- Co-author of the 2010 Best Student Paper award at the SPIE conference on Automatic Target Recognition, Orlando, FL.
- Co-author, 2010 Best Innovative Paper award at the Biometrics: Theory, Applications and Systems (BTAS) conference.
- Co-author, Best student paper award at the 8th *International Symposium on Image and Signal Processing and Analysis* (ISPA 2013), Trieste, Italy, September 2013
- Co-author, Best paper award at the IEEE Biometrics: Theory, Applications and Systems (BTAS) conference, Washington DC, October 2013
- Adjunct Professor appointment, Department of Computing, Hong Kong Polytechnic University, Hong Kong, October 2013 – September 2016
- U.A. & Helen Whitaker Professorship in Electrical and Computer Engineering, Carnegie Mellon University, March 2014.
- Best Paper Award, *IEEE International Conference on Identity, Security and Behavior Analysis* (ISBA), Sendai, Japan, March 2016.
- Best Paper Award, *IEEE International Conference on Communications* (ICC), Kuala Lumpur, Malaysia, May 2016.
- Elected as a Fellow of National Academy of Inventors, December 2017.

PROFESSIONAL SOCIETY ACTIVITIES

- Fellow, IEEE
- Fellow, Optical Society of America (OSA)
- Fellow, Society of Photo-optical Instrumentation Engineers (SPIE)
- Fellow, Intl. Assoc. of Pattern Recognition (IAPR)
- Fellow, American Association for Advancement of Science (AAAS)
- Fellow, National Academy of Inventors (NAI).
- Member, American Society for Engineering Education (ASEE)
- President, Pittsburgh section of OSA (1982)
- Chairman, 1988 Max Born award committee for OSA
- Vice President, Pittsburgh Chapter of Sigma Xi (1992-93)
- Vice Chair, IEEE Signal Processing for Storage Technical Committee, IEEE Communications Society (1998-2000)
- Chair, IEEE Signal Processing for Storage Technical Committee, IEEE Communications Society (2000-2002)
- Member, IEEE Biometrics Council (2008-)
- Member, IEEE Technical Committee on Information Forensics and Security (IFS) (2008-2011)
- Chair, IEEE Biometrics Council Fellow Evaluation Committee (2010 - 2012)
- IEEE Biometrics Council Fellow Evaluation Committee (2016)

PROFESSIONAL CONFERENCE ACTIVITIES

- Program Committee for the SPIE Conference on Optical Information Processing, San Diego (1990 - 1994).
- Program Committee for the 1990 IEEE International Conference on Systems Engineering, Pittsburgh.
- Program Committee for the 1991 SPIE Conference on Emerging Optoelectronic Technologies in Bangalore, India.
- Poster Chairman, The Magnetic Recording Conference (TMRC), Hidden Valley, Pennsylvania, June 1991.
- Program Committees of the SPIE Conference on Optical Pattern Recognition in Orlando, Florida (1992-2016).
- Program Committee, Florida Artificial Intelligence Research Symposium (FLAIRS), Orlando, (1997-2000).
- International Program Committee, IASTED International Conference on Neural Networks (NN'2000), Pittsburgh, PA, May 2000.
- Co-organizer (with Dr. Mike Melas of IBM Almaden Research Center), Workshop on Data Storage in the Third Millennium, International Communications Conference, New Orleans, LA, June 2000.
- Program Committee, Optical Data Storage conference (2001-2011)
- Member, Technical Program Committee, International Symposium on Optical memories (ISOM) (2001-2005).
- Co-chair, Technical Program Committee, Optical Data Storage (ODS) conference, Vancouver, BC, Canada, May 2003.
- Program Committee, Globecom (2004-2007).
- General co-chair, Optical Data Storage (ODS) Conference, Monterey, CA, April 2004.
- Program Committee, Biometric Authentication Workshop, Prague, May 2004.
- Program Committee, International Communications Conference (ICC), (2005, 2006).

- Co-General chair, Advisory Committee, Optical Data Storage (ODS) conference, Hawaii, July 2005.
- Program Committee, Audio, Video-based Person Authentication (AVBPA) conference, New York, July 2005.
- Program Committee, SPIE Conference on Biometric Technology for Human Identification (2005-2014)
- Co-General chair, 4th IEEE workshop on Automatic Identification Advanced Technologies, Buffalo, October 2005.
- Program Committee, International Association of Pattern Recognition International Conference on Biometrics (IAPR ICB), Hong Kong, January 2006.
- Program committee, International Conference on Pattern Recognition (ICPR), Hong Kong, August 2006.
- Program Committee, CVPR Biometrics Workshop, New York City, June 2006.
- Chair, *Biometrics* special session, Intl. Workshop on Multimedia Content Representation, Classification and Security (MRCS 2006), Istanbul, Turkey, September 2006.
- Program Committee, 5th IEEE workshop on Automatic Identification Advanced Technologies, Italy, June 2007.
- Program Committee, Intl. Conf. on Image Analysis and Recognition (ICIAR), 2005-2007.
- Program Committee, Biometrics Consortium Conference, 2006-08.
- Program Committee, Intl. Conf. on Computer Vision (ICCV), 2007.
- Co-chair, SPIE Conference on Biometric Technology for Human Identification, 2008-2012.
- Program Committee, Face & Gesture conference, 2008.
- Program Committee, IEEE Biometrics: Theory, Applications and Systems (BTAS), 2008-2010, 2016.
- Advisory Committee, Intl. Conference on Biometrics, Italy (2009).
- Program Committee, IEEE Workshop on Information Forensics and Security, 2009-2012
- Program Committee, IEEE CVPR Biometrics Workshop, 2007-2016.
- Co-chair, Biometrics track, International Conference on Pattern Recognition (ICPR), Istanbul, 2010.
- Program Committee, International Joint Biometrics Conference (IJCB), Washington DC, October 2011.
- Co-chair, Program Committee, Biometrics: Theory, Applications and Systems (BTAS), Washington DC, September 2012.
- Co-General Chair, International Conference on Medical Biometrics (ICMB), Hong Kong, May 2014.
- Co-Chair, Technical Program Committee, IEEE International Conference on Smart Computing (SMARTCOMP 2014), Hong Kong, November 2014.
- Co-Chair, Technical Program Committee of International Conference on Biometrics (ICB), Phuket, Thailand, May 2015.
- Steering Committee member, 2nd IEEE International Conference on Smart Computing (SMARTCOMP 2016), St. Louis, Missouri, May 2016.
- Steering Committee member, 3rd IEEE International Conference on Smart Computing (SMARTCOMP 2017), Hong Kong, May 2017.

PROFESSIONAL JOURNAL ACTIVITIES

- Reviewer for many journals
- Topical Editor for Pattern Recognition, *Applied Optics* (1990-1996)
- Member, Editorial panel of *Asia-Pacific Engineering Journal* (1991-93)
- Guest Editor, Sept. 1990 Special Issue of *Optical Engineering* on Optical Pattern Recognition

- Co-Guest Editor, April 2001 special issue of the *IEEE Journal of Special Areas of Communications (JSAC)* on *Signal Processing for High-Density Storage Channels*.
- Editorial Board member, *IEEE Surveys and Tutorials in communications* (2001-2007)
- Co-Guest Editor, *IEEE Signal Processing Magazine* special issue on soft algorithms for communications, January 2004.
- Associate Editor, *IEEE Transactions on Information Forensics and Security* (2005-2009)
- Co-Guest Editor, special issue of *IEEE Trans. Information Forensics and Security* devoted to *Human Detection and Recognition* (September 2007)
- Co-Guest Editor, special issue of *Security and Communication Networks* devoted to *Biometric Security for Mobile Computing*, May 2011
- Co-Guest Editor, special issue of *IEEE Transactions on Multimedia* devoted to *Multimedia-based Healthcare*, 2016

OTHER COMMITTEE ACTIVITIES

- Member, Wipe the Slate Clean Committee, ECE Department, CMU: This committee developed the current ECE undergraduate curriculum at CMU.
- Chairman, ECE Head Search Committee (1992)
- Member, ECE Head Search Committee (1998)
- Member, Tri-Service Automatic Target Recognition Technology Assessment Plan (ATR-TAP) for Conventional Weapon Committee (1995)
- Member, Enrollment Process Reengineering Committee, CMU (1995)
- Member, Continuing Education Committee, CIT, CMU (1994-95)
- Member of the committee that developed the CIT Faculty Awards process
- Faculty Senate, Carnegie Mellon University (2000-2002)
- Chairman, Graduate Studies Committee, ECE Dept., CMU (2003-2004)
- Member, Undergraduate Studies Committee, ECE Dept., CMU (2005-2006)
- Member, Undergraduate Advising Committee, ECE Dept., CMU (2008-2009)
- Member, NSF Electrical Engineering Panel for Graduate Research Fellowship Program (2008, 2009)
- Panel member, Jack Kent Cooke Foundation Fellowship Program (2008)
- Member, NDSEG Fellowship Review Panel (2010, 2011)
- Member, CMU Civil and Environmental Engineering (CEE) Department Head Search Committee (Spring 2013)
- Member, Steering Committee of Brain Hub, Carnegie Mellon University (2014 -)
- Member, CMU Biomedical Engineering (BME) Department Head Search Committee (Fall 2016, Spring 2017)

VOLUNTEER ACTIVITIES

- Member of the Executive Committee, S.V. Temple, Pittsburgh, PA (1990-92)
- President, Executive Committee, S.V. Temple, Pittsburgh, PA (1991-92)
- Member of the Board of Directors, S.V. Temple, Pittsburgh, PA (1992-94)
- Secretary, Board of Directors, S.V. Temple, Pittsburgh, PA (1993-94).
- Executive Committee, Pittsburgh Area Telugu Association (1999-2002).
- Judge, Intel Science & Engineering Fair (ISEF), Pittsburgh (2015)
- Chair, Salary and Benefits Review Committee (SBRC), S.V. Temple, Pittsburgh, PA, 2017-18.

Vijayakumar Bhagavath