

# Margrit Betke

Curriculum Vitae, February 2023  
<http://www.cs.bu.edu/faculty/betke>

Margrit Betke is a Professor of Computer Science at Boston University. She co-leads the BU Artificial Intelligence (AI) Research Initiative and the Image and Video Computing and AI-Emerging Media (AIEM) Research Groups. Her focus is integrative research in AI, computer vision, and human computer interaction that benefits other fields, including social, health, and natural sciences, and the arts.

## PROFESSIONAL PREPARATION

### Massachusetts Institute of Technology, Cambridge, MA

Ph.D. in Electrical Engineering and Computer Science, June 1995  
S.M. in Electrical Engineering and Computer Science, February 1992  
Theses Advisor: Professor Ronald L. Rivest, Turing Award Winner

### Bonn University, Germany

Vordiplom in Computer Science and Operations Research, September 1988

## ACADEMIC APPOINTMENTS

### Boston University

Professor, Department of Computer Science	<i>2011–present</i>
Professor, Faculty of Computing & Data Sciences,	<i>2020–present</i>
Affiliated Professor, Department of Biomedical Engineering	<i>2016–present</i>
Affiliated Professor, Department of Electrical and Computer Engineering	<i>2015–present</i>
Director of MS in AI Program, Department of Computer Science	<i>2019–2021</i>
Director of Graduate Studies, Department of Computer Science	<i>2014–2020</i>
Associate Chair, Department of Computer Science	<i>2009–2012</i>
Director of Undergraduate Studies, Department of Computer Science	<i>2004–2006, 2007–2008</i>
Associate Professor, Department of Computer Science	<i>2004–2011</i>
Assistant Professor, Department of Computer Science	<i>2000–2004</i>

### Harvard Medical School and Massachusetts General Hospital

Research Scientist	<i>1999–2007</i>
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### Boston College

Assistant Professor, Computer Science Department	<i>1997–2000</i>
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### University of Maryland

Postdoctoral Research Associate, Institute for Advanced Computer Studies	<i>1995–1997</i>
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## HONORS AND AWARDS

**Data Science Fellow**, Award by Boston University Provost, 2019–2022.

**2022 Top Method Paper Award** for “Community Detection of the Framing Element Network: Proposing and Assessing a New Computational Framing Analysis Approach” at the 105th Conference of the Association for Education in Journalism and Mass Communication (AEJMC), 2022.

**2021 Best Paper Award** for “HGaze Typing: Head-Gesture Assisted Gaze Typing” at ETRA ’21 Full Papers: ACM Symposium on Eye Tracking Research and Applications. May 2021.

**Women Leaders in Higher Education (HERS), Leadership Institute Award**, Wellesley Class of 2018.

**2018 ASAR Competition Award**, presented by The 2nd IEEE International Workshop on Arabic and derived Script Analysis & Recognition (ASAR), held at The Alan Turing Institute, United Kingdom, March 12-14, 2018, to Saad, Elanwar, Abel Kader, Mashali, and Betke for winning the “Layout Analysis of Arabic Historical Manuscripts – Segmentation Challenge.”

**2016 Best Paper Runner-up Award** for “CrowdTrack: Interactive Tracking of Cells in Microscopy Image Sequences with Crowdsourcing Support” at the GroupSight Workshop at The Fourth AAAI Conference on Human Computation and Crowdsourcing (HCOMP 2016), Austin, Texas, 2016.

**2014 Best Paper Award for Innovative Idea** for “How to use level set methods to accurately find boundaries of cells in biomedical images? Evaluation of six methods paired with automated and crowdsourced initial contours” at the MICCAI Workshop on Interactive Medical Image Computation (IMIC), 2014.

**Outstanding Reviewer** for the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2014.

**Best Paper Award** for “SAGE: An approach and implementation empowering quick and reliable quantitative analysis of segmentation quality” at the IEEE Workshop on Applications in Computer Vision (WACV), 2013.

**ACM Senior Member** since October 2012

**IEEE Senior Member** since September 2012

**Top 10 Women to Watch in New England Award**, one of two academic honorees, selected from more than 100 contenders in science and technology, Mass High Tech, February 2005

**NSF CAREER Award** (National Science Foundation Faculty Early Career Development) for “Video-Based Computer Interfaces for People with Severe Disabilities,” 2001–2006

Elected Member of the Sigma Xi Honor Society since 1995

Germanistic Society of America Scholarship, 1994–1995

**Friedrich-Ebert-Stiftung Scholarship**, 1987–1992

## GRANTS

### Principal Investigator:

**Total funding as PI:** ~ \$6.5 million.

DARPA: SBIR/STTR \$80,000

Principal Investigator of the subcontract to BU, D18C-006-0078, 1/1/19–10/31/19  
“Visual Algorithms for Navigation and Guidance of UAVs with Autonomous  
Relational Decisions (VANGUARD)”

National Science Foundation: BIGDATA \$1,000,000

Principal Investigator, 09/15/18 – 08/31/23  
“BIGDATA: IA: Multiplatform, Multilingual, and Multimodal Tools for  
Analyzing Public Communication in over 100 Language”

Google Research: Principal Investigator, AY 18/19 “Providing Real-time Content with Balanced Political Views”	\$88,301
National Science Foundation: Integration Principal Investigator, 09/01/16 – 08/30/22 “INT: Collaborative Research: Detecting, Predicting and Remediating Student Affect and Grit using Computer Vision.”	\$614,990
National Science Foundation: Robust Intelligence Principal Investigator, 08/01/14 – 07/31/18 “RI: Small: Using Humans in the Loop to Collect High-quality Annotations from Images and Time-lapse Videos of Cells.”	\$370,151
The Rafik B. Hariri Institute for Computing and Computational Science & Engineering, Boston University Principal Investigator, 6/12/2017–12/31/2018 “ExerciseCheck: Remote Monitoring and Evaluation Platform for Home Based Physical Therapy”	\$50,000
Adobe Research, Cambridge, MA Principal Investigator, AY 2016/2017 “Deep Learning of Motion Representations for Animation Movies”	\$8,100
National Science Foundation: Human-Centered Computing Principal Investigator, 10/01/13 – 09/30/16 “MRI Collaborative: Development of iRehab, an Intelligent Closed-Loop Instrument for Adaptive Rehabilitation.”	\$287,713 (\$200,109 plus \$85,604 cost share)
National Science Foundation: Human-Centered Computing Principal Investigator, 09/01/09 – 08/31/15 “HCC: Large: Intelligent Tracking Systems that Reason about Group Behavior.”	\$2,858,292
Naval Undersea Warfare Center, Division Newport Principal Investigator, 08/27/09 – 12/31/09 “Research in support of in-house laboratory independent research (ILIR) proposal for the investigation of image analysis methods for automating identification of objects for real-time large-area surveillance performed in naval environments by unmanned vehicles.”	\$10,000
National Science Foundation: Human-Centered Computing Principal Investigator, 09/15/07 – 09/14/10 “HCC: Intelligent Interfaces to Empower People with Disabilities to Participate in the Information Society.”	\$385,840
National Science Foundation Faculty Early Career Development Award Principal Investigator, 08/01/01 – 07/31/06 “CAREER: Video-Based Computer Interfaces for People with Severe Disabilities.”	\$412,734
MIT Lincoln Laboratory under US Air Force Prime Contract Principal Investigator, 09/01/05 – 12/31/05 “Detecting and Tracking People in Video Sequences.”	\$23,602

The Whitaker Foundation: Biomedical Engineering Research Grant Principal Investigator, 05/01/01 – 04/30/04 “Automated Detection of Pulmonary Nodules on Computed Tomography and Assessment of Change over Time.”	\$205,912
National Science Foundation: Major Research Instrumentation Program Principal Investigator, 09/15/1998 – 08/31/1999, “CISE Major Research Instrumentation: Research Laboratory for Computer Science.”	\$150,000

**Co-Principal Investigator or Co-Investigator:**

**Total funding as Co-PI/I:** ~ \$ 21.5 million.

Office of Naval Research: Defense University Research Instrumentation Program (DURIP) Co-Principal Investigator, 01/02/2021 – 07/31/2022 “Experiments with Brain Models for Mobile Robot Navigation”	\$497,047
The Rafik B. Hariri Institute for Computing and Computational Science & Engineering, Boston University Co-Principal Investigator, 9/23/2021–9/22/2023 “Therapy Calculator for Rehabilitation Outcomes after Acquired Brain Injury.”	\$24,935
Office of Naval Research: Multidisciplinary University Research Initiative (MURI) Co-Principal Investigator, 08/01/2019 – 07/31/2023 “ Neuro-Autonomy: Neuroscience-Inspired Perception, Navigation, and Spatial Awareness for Autonomous Robots.”	\$7,500,000
National Institutes of Health Co-Investigator, 7/27/2019–7/26/2021 “Mobile bedside ultrasound (mBSUS) for the diagnosis of pediatric pneumonia in resource limited settings.”	\$199,220
The Rafik B. Hariri Institute for Computing and Computational Science & Engineering, Boston University Co-Principal Investigator, 6/1/2019–6/11/2020 “Brain and Behavior Biomarkers of Recovery.”	\$35,000
National Institutes of Health Co-Investigator, 1/9/2018–8/31/2020 “Project SEARCH (Scanning EARs for Child Health).”	\$275,000
The Rafik B. Hariri Institute for Computing and Computational Science & Engineering, Boston University Co-Principal Investigator, 6/12/2017–6/11/2018 “IKEA: Product, Pricing, and Exchange Rate Pass-through.”	\$25,000
Office of Naval Research: Multidisciplinary University Research Initiative Co-Principal Investigator on Boston University subcontract to University of Washington 10/1/10 – 1/30/16. Subcontract award to BU: \$3,127,730 “AIRFOILS: Animal Inspired Robust Flight with Outer and Inner Loop Strategies.”	\$7,500,000

National Science Foundation: Division of Computer and Network Systems Co-Principal Investigator, 09/01/09 – 8/31/12 “II-EN: Infrastructure for Gesture Interface Research Outside the Lab.”	\$591,445
Air Force Office of Scientific Research Co-Principal Investigator, 04/15/09 – 04/14/10 “Acquisition of an Advanced Thermal Infrared Imaging System for Tracking Multiple Targets in Three Dimensions.”	\$523,050
Bat Conservation International Co-Principal Investigator, 05/01/09 – 04/30/10 “A novel BatCam for censusing maternity colonies of bats in regions affected by white-nose syndrome.”	\$5,000
US Fish and Wildlife: Illinois Natural History Survey Co-Principal Investigator, 09/01/07 – 12/31/08 “Effects of Topography and Weather in Vermont and Use of Appropriate Technology to Support Such Investigations.”	\$114,960
National Science Foundation: Information Technology Research Program Co-Principal Investigator, 10/01/03 – 09/30/08 “ITR: Advanced Imaging and Information Technology for Assessing the Ecological and Economic Impact of Brazilian Free-tailed Bats on Agroecosystems.”	\$2,400,000
National Science Foundation: Human Computer Interaction Program Co-Principal Investigator, 09/01/03 – 08/31/06 “Pattern Discovery in Signed Languages and Gestural Communications.”	\$774,096
National Science Foundation: Information and Data Management Program Co-Principal Investigator, 09/15/03 – 09/14/06 “Mining and Indexing Spatio-Temporal Patterns in Video Databases of Human Motion.”	\$494,580
National Science Foundation: Research Infrastructure Co-Principal Investigator, 09/01/02 – 08/31/07 “CISE Research Infrastructure: SENSORIUM: Research Infrastructure for Managing Spatio-Temporal Objects in Video Sensor Networks.”	\$1,247,395
Office of Naval Research: Defense University Research Instrumentation Program Co-Principal Investigator, 04/01/01 – 03/31/02 “DURIP: Lab Upgrade for Machine Vision Research and Research-Related Education.”	\$246,242

## PUBLICATIONS

### Peer-reviewed Book

[B1] M. Betke and Z. Wu. Data Association for Multi-Object Visual Tracking. Morgan & Claypool Lecture Series on Computer Vision. 2016. 120 pages. pdf

## Articles in Journals

- [J1] M. Betke, R. L. Rivest, and M. Singh. Piecemeal learning of an unknown environment. *Machine Learning*, 18(2/3):231–254, February/March 1995. pdf.
- [J2] M. Betke and L. Gurvits. Mobile robot localization using landmarks. *IEEE Transactions on Robotics and Automation*, 13(2):251–263, April 1997. pdf.
- [J3] B. Awerbuch, M. Betke, R. L. Rivest, and M. Singh. Piecemeal graph exploration by a mobile robot. *Information and Computation*, 152(2):155–172, August 1999. pdf.
- [J4] M. Betke, E. Haritaoglu, and L. S. Davis. Real-time multiple vehicle detection and tracking from a moving vehicle. *Machine Vision and Applications*, 12(2):69–83, September 2000. pdf.
- [J5] J. P. Ko and M. Betke. Chest CT: Automated nodule detection and assessment of change over time – preliminary experience. *Radiology*, 218(1):267–273, January 2001. pdf.
- [J6] M. Betke and N. C. Makris. Recognition, resolution and complexity of objects subject to affine transformation. *International Journal of Computer Vision*, 44(1):5–40, August 2001. pdf.
- [J7] M. Betke, J. Gips, and P. Fleming. The Camera Mouse: Visual tracking of body features to provide computer access for people with severe disabilities. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 10(1):1–10, March 2002. pdf.
- [J8] M. Betke, H. Hong, D. Thomas, C. Prince, and J. P. Ko. Landmark detection in the chest and registration of lung surfaces with an application to nodule registration. *Medical Image Analysis*, 7(3):265–281, September 2003. pdf.
- [J9] J. P. Ko, H. Rusinek, E. Jacobs, J. S. Babb, M. Betke, G. McGuinness, and D. P. Naidich. Volume measurement of small pulmonary nodules on chest CT: A phantom study. *Radiology*, 228(3):864–870, September 2003. pdf.
- [J10] K. Grauman, M. Betke, J. Lombardi, J. Gips, and G. R. Bradski. Communication via eye blinks and eyebrow raises: Video-based human-computer interfaces. *International Journal Universal Access in the Information Society*, 2(4):359–373, November 2003. pdf.
- [J11] D. P. Gierga, G. T. Y. Chen, J. H. Kung, M. Betke, J. Lombardi, and C. G. Willett. Quantification of respiration-induced abdominal tumor motion and the impact on IMRT dose distributions. *International Journal on Radiation Oncology - Biology - Physics*, 58(5):1584–1595, April 2004. pdf.
- [J12] W. Mullally, M. Betke, J. Wang, and J. Ko. Segmentation of nodules on chest computed tomography for growth assessment. *Medical Physics*, 31(4):839–848, April 2004. pdf.
- [J13] D. P. Gierga, J. Brewer, G. C. Sharp, M. Betke, C. G. Willett, and G. T. Y. Chen. The correlation between internal and external markers for abdominal tumors: Implications for respiratory gating. *International Journal on Radiation Oncology - Biology - Physics*, 61(5):1551–1558, April 2005. pdf.
- [J14] M. Betke, O. Gussyatin, and M. Urinson. SymbolDesign: A user-centered method to design pen-based interfaces and extend the functionality of pointer input devices. *Universal Access in the Information Society*, 4(3):223–236, March 2006. pdf.

- [J15] C. J. Cleveland, M. Betke, P. Federico, J. D. Frank, T. G. Hallam, J. Horn, J. D. López Jr., G. F. McCracken, R. A. Medellín, A. Moreno-Valdez, C. G. Sansone, J. K. Westbrook, and T. H. Kunz. Economic value of the pest control service provided by Brazilian free-tailed bats in south-central Texas. *Frontiers in Ecology and the Environment*, 4(5):238–248, June 2006. pdf.
- [J16] J. Wang, M. Betke, and J. P. Ko. Pulmonary fissure segmentation on CT. *Medical Image Analysis*, 10(4):530–547, August 2006. pdf.
- [J17] M. Gorman, A. Lahav, E. Saltzman, and M. Betke. A camera-based music making tool for physical rehabilitation. *Computer Music Journal*, 31(2):39–53, Summer 2007. pdf.
- [J18] P. J. McNerney, J. Konrad, and M. Betke. Block-based MAP disparity estimation under alpha channel constraints. *IEEE Transactions on Circuits and Systems for Video Technology*, 17(16):785–789, June 2007. pdf.
- [J19] M. Betke, D. E. Hirsh, N. C. Makris, G. F. McCracken, M. Procopio, N. I. Hristov, S. Tang, A. Bagchi, J. D. Reichard, J. W. Horn, S. Crampton, C. J. Cleveland, and T. H. Kunz. Thermal imaging reveals significantly smaller Brazilian free-tailed bat colonies than previously estimated. *Journal of Mammalogy*, 89(1):18–24, February 2008. pdf. Also discussed in *Nature*, 452, Research Highlights, p. 507, pdf.
- [J20] J. Wang, V. Athitsos, S. Sclaroff, and M. Betke. Detecting objects of variable shape structure with hidden state shape models. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 30(3):477–492, March 2008. pdf, videos.
- [J21] P. Federico, T. G. Hallam, G. F. McCracken, S. Purucker, W. Grant, A. N. Sandoval, J. Westbrook, R. Medellín, C. Cleveland, C. G. Sansone, J. D. López Jr., M. Betke, A. Moreno-Valdez, and T. H. Kunz. Brazilian free-tailed bats (*tadarida brasiliensis*) as insect pest regulators in transgenic and conventional cotton crops. *Ecological Applications*, 18(4):826–837, June 2008. pdf.
- [J22] N. I. Hristov, M. Betke, and T. H. Kunz. Applications of thermal infrared imaging for research in aeroecology. *Integrative and Comparative Biology*, 48(1):50–59, July 2008. pdf.
- [J23] J. J. Magee, M. Betke, J. Gips, M. R. Scott, and B. N. Waber. A human-computer interface using symmetry between eyes to detect gaze direction. *IEEE Transactions on Systems Man & Cybernetics Part A: Systems and Humans*, 38(6):1–14, November 2008. pdf, video.
- [J24] W. Mullally, M. Betke, M. Albert, and K. Lutchen. Explaining clustered ventilation defects via a minimal number of airway closure locations. *Annals of Biomedical Engineering*, 37(2):286–300, February 2009. pdf.
- [J25] N. I. Hristov, M. Betke, D. Hirsh, A. Bagchi, and T. H. Kunz. Seasonal variation in colony size of Brazilian free-tailed bats at Carlsbad Caverns using thermal imaging. *Journal of Mammalogy*, 91(1):183–192, February 2010. pdf.
- [J26] T. G. Hallam, A. Raghavan, H. Kolli, D. Dimitrov, P. Federico, H. Qi, G. F. McCracken, M. Betke, J. K. Westbrook, K. Kennard, and T. H. Kunz. Dense and sparse aggregations in complex motion: Video coupled with simulation modeling. *Ecological Complexity*, 7(1):69–75, March 2010. pdf, videos.

- [J27] D. H. Theriault, M. Walker, J. Y. Wong, and M. Betke. Cell morphology classification and clutter mitigation in phase-contrast microscopy images using machine learning. *Machine Vision and Applications*, 23(4):659–673, July 2012. Online Article.
- [J28] S. Epstein, E. Missimer, and M. Betke. Using kernels for a video-based mouse-replacement interface. *Personal and Ubiquitous Computing*, 18:47–60, January 2014. Open Access Online.
- [J29] S. Epstein and M. Betke. The kernel semi-least squares method for sparse distance approximation. *Neural Computation*, 25(3):532–548, February 2013.
- [J30] X. Yang, C. Schaaf, A. Strahler, T. Kunz, N. Fuller, M. Betke, Zu, Z. Wang, D. Theriault, D. Culvenor, D. Jupp, G. Newnham, and J. Lovell. Study of bat flight behavior by combining thermal image analysis with a LiDAR forest reconstruction. *Canadian Journal of Remote Sensing*, 39(S1):S112–S125, 2013. Online Article.
- [J31] D. H. Theriault, N. W. Fuller, B. E. Jackson, E. Bluhm, D. Evangelista, Z. Wu, M. Betke, and T. L. Hedrick. A protocol and calibration method for accurate multi-camera field videography. *The Journal of Experimental Biology*, 217:1843–1848, February 2014. Open access online, pdf.
- [J32] C. W. Kwan, I. Paquette, J. J. Magee, and M. Betke. Adaptive sliding menubars make existing software more accessible to people with severe motion impairments. *Universal Access in the Information Society*, 13(1):5–22, March 2014. Online Article.
- [J33] Z. Wu and M. Betke. Global optimization for coupled detection and data association in multiple object tracking. *Computer Vision and Image Understanding*, 143:25–37, 2016. Online Article.
- [J34] Z. Kong, N. Fuller, S. Wang, K. Özcimder, E. Gillam, D. Theriault, M. Betke, and J. Baillieul. Perceptual modalities guiding bat flight in a native habitat. *Scientific Reports*, June 2016. 10 pages, Open access.
- [J35] A. Joshi, C. Monnier, M. Betke, and S. Sclaroff. Comparing random forest approaches to segmenting and classifying gestures. *Image and Video Computing*, 58:86–95, February 2017. Online Article.
- [J36] J. Zhang, S. Ma, M. Sameki, S. Sclaroff, M. Betke, Z. Lin, X. Shen, B. Price, and R. Mech. Salient object subitizing. *International Journal of Computer Vision*, 124(2):169–186, September 2017. 10 pages, pdf.
- [J37] N. L. Brace, T. L. Hedrick, D. H. Theriault, N. W. Fuller, Z. Wu, M. Betke, J. K. Parrish, D. Grünbaum, K. A. Morgansen, and W. E. Boeing. Using collision cones to assess biological deconfliction methods. *Journal of the Royal Society Interface*, 13, September 2016. Open Access Online, pdf.
- [J38] D. Gurari, K. He, B. Xiong, J. Zhang., M. Sameki, S. D. Jain, S. Sclaroff, M. Betke, and K. Grauman. Predicting foreground object ambiguity and efficiently crowdsourcing the segmentation(s). *International Journal of Computer Vision*, 126:714–730, 2018. pdf.
- [J39] R. I. Elanwar, W. Qin, and M. Betke. Making scanned Arabic documents machine accessible using an ensemble of SVM classifiers. *International Journal on Document Analysis and Recognition*, 21:59–79, June 2018. pdf.



- [J40] W. Feng, M. Sameki, and M. Betke. Exploration of assistive technologies used by people with quadriplegia caused by degenerative neurological diseases. *International Journal of Human Computer Interaction*, 34(9):834–844, 2018. pdf.
- [J41] D. Gurari, Y. Zhao, S. Jain, M. Betke, and K. Grauman. Predicting how to distribute work between algorithms and humans to segment an image batch. *International Journal of Computer Vision*, 127(9):1198–1216, September 2019. pdf. and local pdf.
- [J42] L. Guo, K. Mays, S. Lai, M. Jalal, P. Ishwar, and M. Betke. Accurate, fast, but not always cheap: Evaluating ”crowdcoding” as an alternative approach to analyze social media data. *Journalism & Mass Communication Quarterly*, 97(3):811–834, 2020. pdf.
- [J43] W. Qin, R. Elanwar, and M. Betke. Text and metadata extraction from scanned Arabic documents using support vector machines. *Journal of Information Science*, pages 1–12, July 2020. <https://doi.org/10.1177/0165551520961256>.
- [J44] Elham Saraee, Mona Jalal, and Margrit Betke. Visual complexity analysis using deep intermediate-layer features. *Computer Vision and Image Understanding*, 195:1–17, June 2020. <https://doi.org/10.1016/j.cviu.2020.102949>.
- [J45] L. Etter, A. Simukanga, W. Qin, R. Pieciak, L. Mwananyanda, M. Betke, J. Phiri, C. Carbo, A. Hamapa, and C. Gill. Project SEARCH (Scanning EARs for Child Health): Validating an ear biometric tool for patient identification in Zambia. *Gates Open Research*, 4(168):1–14, November 2020. <https://gatesopenresearch.org/articles/4-168>.
- [J46] Lei Guo, Kate Mays, Yiyang Zhang, and Margrit Betke. What makes gun violence a (less) prominent issue? A computational analysis of compelling arguments and selective agenda setting. *Mass Communication & Society*, 24(5):651–675, April 2021. <https://doi.org/10.1080/15205436.2021.1898644>.
- [J47] Yi Zheng, Clarissa A. Cassol, Saemi Jung, Divya Veerapaneni, Vipul C. Chitalia, Kevin Ren, Shubha S. Bellur, Peter Boor, Laura M. Barisoni, Sushrut S. Waikar, Margrit Betke, and Vijaya B. Kolachalama. Deep learning-driven quantification of interstitial fibrosis in digitized kidney biopsies. *The American Journal of Pathology*, May 2021. <https://doi.org/10.1101/2021.01.03.21249179>.
- [J48] Randa Elanwar, Wenda Qin, Margrit Betke, and Derry T. Wijaya. Extracting text from scanned Arabic books: a large-scale benchmark dataset and a fine-tuned Faster-R-CNN model. *International Journal on Document Analysis and Recognition (IJDAR)*, 24:349–362, June 2021. <https://doi.org/10.1007/s10032-021-00382-4>.
- [J49] Alinani Simukanga, Misaki Kobayashi, Lauren Etter, Wenda Qin, Rachel Pieciak, Duarte Albuquerque, Yu-Jen Chen, Margrit Betke, William MacLeod, Jackson Phiri, Lawrence Mwananyanda, and Christopher J. Gill. The impact of ear growth on identification rates using an ear biometric system in young infants. *Gates Open Research*, 5(179):1–15, December 2021. <https://gatesopenresearch.org/articles/5-179>.
- [J50] Anne Billot, Sha Lai, Maria Varkanitsa, Emily J. Braun, Brenda Rapp, Todd B. Parrish, James Higgins, Ajay S. Kurani, David Caplan, Cynthia K. Thompson, Prakash Ishwar, Margrit Betke, and Swathi Kiran. Multimodal neural and behavioral data predict response to rehabilitation in

chronic post-stroke aphasia. *Stroke*, pages 1–9, January 2022.  
<https://DOI.org/10.1161/STROKEAHA.121.036749>.

- [J51] Lei Guo, Chao Su, Sejin Paik, Vibhu Bhatia, Vidya Prasad Akavoor, Ge Gao, Margrit Betke, and Derry Wijaya. Proposing an open-sourced tool for computational framing analysis of multilingual data. *Digital Journalism*, February 2022. pdf, Open Framing Code.
- [J52] Nataniel Ruiz\*, Hao Yu\*, Danielle Alessio, Mona Jalal, Ajjen Joshi, Tom Murray, John J. Magee, Kevin Manuel Delgado, Vitaly Ablavsky, Stan Sclaroff, Ivon Arroyo, Beverly Woolf, Sarah Adel Bargal, and Margrit Betke. ATL-BP: A student engagement dataset and model for affect transfer learning for behavior prediction. *IEEE Transactions on Biometrics, Behavior, and Identity Science*, pages 1–14, September 2022. DOI 10.1109/tbiom.2022.3210479, \*Equal contribution.
- [J53] Yi Zheng, Rushin H. Gindra, Emily J. Green, Eric J. Burks, Margrit Betke, Jennifer E. Bean, and Vijaya B. Kolachalama. A graph transformer for whole slide image classification. *IEEE Trans Med Imaging*, 41(11):3003–3015, November 2022.  
<https://doi.org/10.1109/TMI.2022.3176598>.

## Articles in Peer Reviewed Conference and Workshop Proceedings

- [C1] M. Betke, R. L. Rivest, and M. Singh. Piecemeal learning of an unknown environment. In *Proceedings of the 1993 Conference on Computational Learning Theory (COLT)*, pages 277–286, Santa Cruz, California, July 1993. ACM Press. pdf.
- [C2] M. Betke and L. Gurvits. Mobile robot localization using landmarks. In *Proceedings of the IEEE/RSJ/GI International Conference on Intelligent Robots and Systems*, pages 135–142, Munich, Germany, September 1994. pdf.
- [C3] M. Betke and N. C. Makris. Fast object recognition in noisy images using simulated annealing. In *Proceedings of the Fifth International Conference on Computer Vision (ICCV)*, pages 523–530, Cambridge, MA, June 1995. IEEE Computer Society. pdf.
- [C4] B. Awerbuch, M. Betke, R. L. Rivest, and M. Singh. Piecemeal graph exploration by a mobile robot. In *Proceedings of the 1995 Conference on Computational Learning Theory (COLT)*, pages 321–328, Santa Cruz, California, July 1995. ACM Press. pdf.
- [C5] M. Betke, E. Haritaoglu, and L. S. Davis. Multiple vehicle detection and tracking in hard real time. In *Proceedings of the 1996 IEEE Intelligent Vehicles Symposium*, pages 351–356, Seikei University, Tokyo, Japan, September 1996. IEEE Industrial Electronics Society. pdf.
- [C6] M. Betke, E. Haritaoglu, and L. S. Davis. Multiple vehicle detection and tracking. In D. Schaefer and E. F. Williams, editors, *25th Applied Imagery Pattern Recognition (AIPR) Workshop: Emerging Applications of Computer Vision*, pages 104–110. SPIE–The International Society for Optical Engineering, Bellingham, WA, October 1996. pdf.
- [C7] M. Betke, E. Haritaoglu, and L. S. Davis. Highway scene analysis in hard real time. In *Proceedings of the IEEE Conference on Intelligent Transportation Systems*, pages 812–817, Boston, MA, November 1997. pdf.

- [C8] M. Betke and N. C. Makris. Information-conserving object recognition. In *Proceedings of the Sixth International Conference on Computer Vision (ICCV)*, pages 145–152, Mumbai, India, January 1998. IEEE Computer Society. pdf.
- [C9] M. Betke and H. Nguyen. Highway scene analysis from a moving vehicle under reduced visibility conditions. In *Proceedings of the International Conference on Intelligent Vehicles*, pages 131–136, Stuttgart, Germany, October 1998. IEEE Industrial Electronics Society. pdf.
- [C10] M. Betke and J. P. Ko. Detection of pulmonary nodules on CT and volumetric assessment of change over time. In C. Taylor and A. Colchester, editors, *Medical Image Computing and Computer-Assisted Intervention – MICCAI’99*, pages 245–252, Cambridge, UK, September 1999. Springer-Verlag, Berlin. pdf.
- [C11] M. Betke and J. Kawai. Gaze detection via self-organizing gray-scale units. In *Proceedings of the International Workshop on Recognition, Analysis, and Tracking of Faces and Gestures in Real-Time Systems*, pages 70–76, Kerkyra, Greece, September 1999. IEEE. pdf.
- [C12] M. Betke, W. J. Mullally, and J. Magee. Active detection of eye scleras in real time. In *Proceedings of the IEEE CVPR Workshop on Human Modeling, Analysis and Synthesis (HMAS 2000)*, Hilton Head Island, SC, June 2000. 8 pp., pdf.
- [C13] J. Gips, M. Betke, and P. Fleming. The Camera Mouse: Preliminary investigation of automated visual tracking for computer access. In *Proceedings of the Rehabilitation Engineering and Assistive Technology Society of North America 2000 Annual Conference (RESNA 2000)*, pages 98–100, Orlando, FL, July 2000. pdf.
- [C14] M. Betke and W. Mullally. Preliminary investigation of real-time monitoring of a driver in city traffic. In *Proceedings of the International Symposium on Intelligent Vehicles*, pages 563–568, Dearborn, MI, October 2000. IEEE Industrial Electronics Society. pdf.
- [C15] G. Kollios, S. Sclaroff, and M. Betke. Motion mining: Discovering spatio-temporal patterns in databases of human motion. In *Proceedings of the 2001 ACM SIGMOD Workshop on Research Issues in Data Mining and Knowledge Discovery (DMKD 2001)*, pages 25–32, Santa Barbara, CA, May 2001. pdf.
- [C16] J. Gips, M. Betke, and P. A. DiMattia. Early experiences using visual tracking for computer access by people with profound physical disabilities. In C. Stephanidis, editor, *Universal Access In HCI: Towards an Information Society for All, Volume 3, Proceedings of the 1st International Conference on Universal Access in Human-Computer Interaction (UA-HCI)*, pages 914–918. Lawrence Erlbaum Associates, Mahwah, NJ, 2001. pdf.
- [C17] M. Betke, H. Hong, and J. P. Ko. Automatic 3D registration of lung surfaces in computed tomography scans. In W. J. Niessen and M. A. Viergever, editors, *Medical Image Computing and Computer-Assisted Intervention – MICCAI 2001: 4th International Conference*, pages 725–733, Utrecht, The Netherlands, October 2001. Springer-Verlag, Berlin. pdf.
- [C18] M. Betke, E. Naftali, and N. C. Makris. Necessary conditions to attain performance bounds on structure and motion estimates of rigid objects. In *Proceedings of the IEEE Computer Vision and Pattern Recognition Conference (CVPR)*, volume 1, pages 448–455, Kauai, Hawaii, December 2001. pdf.

- [C19] K. Grauman, M. Betke, J. Gips, and G. R. Bradski. Communication via eye blinks - detection and duration analysis in real time. In *Proceedings of the IEEE Computer Vision and Pattern Recognition Conference (CVPR)*, volume 2, pages 1010–1017, Kauai, Hawaii, December 2001. pdf.
- [C20] H. Hong, M. Betke, S. Teng, D. Thomas, and J. P. Ko. Multilevel 3D registration of lung surfaces in computed tomography scans – preliminary experience. In *Proceedings of the International Conference on Diagnostic Imaging and Analysis (ICDIA)*, pages 90–95, Shanghai, China, August 2002. pdf.
- [C21] W. Mullally, M. Betke, H. Hong, K. Mann, and J. P. Ko. Multi-criterion 3D segmentation and registration of pulmonary nodules on CT: A preliminary investigation. In *Proceedings of the International Conference on Diagnostic Imaging and Analysis (ICDIA)*, pages 176–181, Shanghai, China, August 2002. pdf.
- [C22] J. Wang, M. Betke, and J. P. Ko. Segmentation of pulmonary fissures on diagnostic CT – preliminary experience. In *Proceedings of the International Conference on Diagnostic Imaging and Analysis (ICDIA)*, pages 107–112, Shanghai, China, August 2002. pdf.
- [C23] J. Gips, P. DiMattia, and M. Betke. Collaborative development of new access technology and communication software. In *Proceedings of the 10th Biennial Conference of the International Society for Augmentative and Alternative Communication (ISAAC 2002)*, Odense, Denmark, August 2002. pdf.
- [C24] S. Crampton and M. Betke. Finger counter: A human-computer interface. In *Proceedings of the 7th ERCIM Workshop on User Interfaces for All*, pages 195–196, Paris, France, October 2002. pdf.
- [C25] J. Lombardi and M. Betke. A camera-based eyebrow tracker for hands-free computer control via a binary switch. In *7th ERCIM Workshop on User Interfaces for All*, pages 199–200, Paris, France, October 2002. pdf.
- [C26] R. L. Cloud, M. Betke, and J. Gips. Experiments with a camera-based human-computer interface system. In *7th ERCIM Workshop on User Interfaces for All*, pages 103–110, Paris, France, October 2002. pdf.
- [C27] C. Fagiani, M. Betke, and J. Gips. Evaluation of tracking methods for human-computer interaction. In *IEEE Workshop on Applications in Computer Vision*, pages 121–126, Orlando, Florida, December 2002. pdf.
- [C28] S. Crampton and M. Betke. Counting fingers in real time: A webcam-based human-computer interface with game applications. In *Proceedings of the Conference on Universal Access in Human-Computer Interaction (UA-HCI)*, pages 1357–1361, Crete, Greece, June 2003. pdf.
- [C29] O. Gussyatin, M. Urinson, and M. Betke. A method to extend functionality of pointer input devices. In C. Stary and C. Stephanidis, editors, *Proceedings of the 8th International ERCIM Workshop on User Interfaces for All, Revised Selected Papers, Lecture Notes in Computer Science 3196*, pages 426–439. Springer-Verlag, Vienna, Austria, June 2004. pdf.

- [C30] J. J. Magee, M. R. Scott, B. N. Waber, and M. Betke. Eyekeys: A real-time vision interface based on gaze detection from a low-grade video camera. In *IEEE Workshop on Real-Time Vision for Human-Computer Interaction (RTV4HCI)*, Washington, D.C., July 2004. IEEE Computer Society. 8 pp. A revised version appeared under the title “A Real-Time Vision Interface Based on Gaze Detection – EyeKeys.” In B. Kisacanin, V. Pavlovic, and T. S. Huang, editors, *Real-Time Vision for Human-Computer Interaction*, 2005, pages 141–157, Springer-Verlag, pdf.
- [C31] J. Brewer, M. Betke, D. P. Gierga, and G. T. Y. Chen. Real-time 4D tumor tracking and modeling from internal and external fiducials in fluoroscopy. In C. Barillot and D. R. Haynor, editors, *Medical Image Computing and Computer-Assisted Intervention – MICCAI 2004: 7th International Conference, Proceedings, Part II, LNCS 3217*, pages 594–601, Saint-Malo, France, September 2004. pdf.
- [C32] J. Wang, M. Betke, and J. P. Ko. Shape-based curve growing model and adaptive regularization for pulmonary fissure segmentation in CT. In C. Barillot and D. R. Haynor, editors, *Medical Image Computing and Computer-Assisted Intervention – MICCAI 2004: 7th International Conference, Proceedings, Part I, LNCS 3217*, pages 541–548, Saint-Malo, France, September 2004. pdf.
- [C33] J. Wang, E. Gu, and M. Betke. MosaicShape: Stochastic region grouping with shape prior. In *Proceedings of the IEEE Computer Society International Computer Vision and Pattern Recognition Conference (CVPR)*, pages 902–908, San Diego, CA, June 2005. pdf.
- [C34] W. Mullally, M. Betke, C. Bellardine, and K. Lutchen. Locally switching between cost functions in iterative non-rigid registration. In Y. Liu, T. Jiang, and C. Zhang, editors, *Proceedings of the First International Workshop on Computer Vision for Biomedical Image Applications (CVBIA 2005), Beijing, China, October 21, 2005, Lecture Notes in Computer Science 3765*, pages 367–377. Springer-Verlag Berlin Heidelberg, 2005. pdf.
- [C35] B. N. Waber, J. J. Magee, and M. Betke. Fast head tilt detection for human-computer interaction. In *Proceedings of the ICCV Workshop on Human Computer Interaction, Lecture Notes in Computer Science*, Beijing, China, October 2005. Springer Verlag. 10 pp., pdf.
- [C36] V. Athitsos, J. Wang, S. Sclaroff, and M. Betke. Detecting instances of shape classes that exhibit variable structure. In *Computer Vision – ECCV 2006, 9th European Conference on Computer Vision, Graz, Austria, May 7-13, 2006, Proceedings, Part 1, Lecture Notes in Computer Science, Vol. 3951*, pages 121–134. Springer Verlag, 2006. pdf.
- [C37] T. Castelli, M. Betke, and C. Neidle. Facial feature tracking and occlusion recovery in American Sign Language. In A. Fred and A. Lourenço, editors, *Pattern Recognition in Information Systems: Proceedings of the 6th International Workshop on Pattern Recognition in Information Systems – PRIS 2006*, pages 81–90, Paphos, Cyprus, May 2006. INSTICC Press. pdf.
- [C38] M. Betke, J. Ruel, G. C. Sharp, S. B. Jiang, D. P. Gierga, and G. T. Y. Chen. Tracking and prediction of tumor movement in the abdomen. In A. Fred and A. Lourenço, editors, *Pattern Recognition in Information Systems: Proceedings of the 6th International Workshop on Pattern Recognition in Information Systems – PRIS 2006*, pages 27–37, Paphos, Cyprus, May 2006. INSTICC Press. pdf.

- [C39] M. Shugrina, M. Betke, and J. Collomosse. Empathic painting: Interactive stylization through observed emotional state. In *Proceedings of the 4th International Symposium on Non-Photorealistic Animation and Rendering (NPAR 2006)*, Annecy, France, June 2006. 8 pp., pdf, video.
- [C40] B. Waber, J. J. Magee, and M. Betke. Web mediators for accessible browsing. In C. Stephanidis and M. Pieper, editors, *Universal Access in Ambient Intelligence Environments – 9th International ERCIM Workshop “User Interfaces For All” UI4ALL 2006, Königswinter, Germany, September 2006, Revised Papers. LNCS 4397*, pages 447–466. Springer-Verlag, 2006. pdf.
- [C41] W. Akram, L. Tiberii, and M. Betke. A customizable camera-based human computer interaction system allowing people with disabilities autonomous hands free navigation of multiple computing tasks. In C. Stephanidis and M. Pieper, editors, *Universal Access in Ambient Intelligence Environments – 9th International ERCIM Workshop “User Interfaces For All” UI4ALL 2006, Königswinter, Germany, September 2006, Revised Papers. LNCS 4397*, pages 28–42. Springer-Verlag, 2006. pdf.
- [C42] W. Mullally, A. Milutinovic, M. Betke, M. Albert, and K. Lutchen. Personalized airway trees from a generative model, lung atlas, and Hyperpolarized Helium MRI. In *MICCAI 2006 Workshop “From Statistical Atlases to Personalized Models: Understanding Complex Diseases in Populations and Individuals”*, Copenhagen, Denmark, October 2006. 4 pp., pdf.
- [C43] M. Betke, D. E. Hirsh, A. Bagchi, N. I. Hristov, N. C. Makris, and T. H. Kunz. Tracking large variable numbers of objects in clutter. In *Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*, Minneapolis, MN, June 2007. 8 pp., pdf.
- [C44] M. Betke. Camera-based interfaces and assistive software for people with severe motion impairments. In J. C. Augusto, D. Shapiro, and H. Aghajan, editors, *Proceedings of the 3rd Workshop on “Artificial Intelligence Techniques for Ambient Intelligence” (AITAmI’08), Patras, Greece, 21st-22nd of July 2008. Co-located event of ECAI 2008.*, pages 409–432, 2008. 5 pp., pdf.
- [C45] Z. Wu, M. Betke, J. Wang, V. Athitsos, and S. Sclaroff. Tracking with dynamic hidden-state shape models. In D. A. Forsyth, P. H. S. Torr, and A. Zisserman, editors, *Computer Vision - ECCV 2008, 10th European Conference on Computer Vision, Marseille, France, October 12-18, 2008, Proceedings, Part I, LNCS 5302*, pages 643–656. Springer-Verlag, 2008. pdf.
- [C46] S. Deshpande and M. Betke. RefLink: An interface that enables people with motion impairments to analyze web content and dynamically link to references. In A. Fred, editor, *The 9th International Workshop on Pattern Recognition in Information Systems – PRIS 2009. In conjunction with ICEIS 2009, Milan, Italy – May 2009*, pages 28–36. INSTICC Press, 2009. pdf.
- [C47] D. House, M. L. Walker, Z. Wu, J. Y. Wong, and M. Betke. Tracking of cell populations to understand their spatio-temporal behavior in response to physical stimuli. In *MMBIA 2009: IEEE Computer Society Workshop on Mathematical Methods in Biomedical Image Analysis*, Miami, FL, June 2009. 8 pp., pdf.
- [C48] C. Connor, E. Yu, J. Magee, E. Cansizoglu, S. Epstein, and M. Betke. Movement and recovery analysis of a mouse-replacement interface for users with severe disabilities. In *Proceedings of the*

*13th International Conference on Human-Computer Interaction (HCI International 2009), San Diego, CA, July 2009.* 10 pp., pdf.

- [C49] Z. Wu, N. I. Hristov, T. L. Hedrick, T. H. Kunz, and M. Betke. Tracking a large number of objects from multiple views. In *Proceedings of the International Conference on Computer Vision (ICCV)*, Kyoto, Japan, September/October 2009. 8 pp., pdf.
- [C50] Z. Wu, N. I. Hristov, T. H. Kunz, and M. Betke. Tracking-Reconstruction or Reconstruction-Tracking? Comparison of two multiple hypothesis tracking approaches to interpret 3D object motion from several camera views. In *Proceedings of the IEEE Workshop on Motion and Video Computing (WMVC)*, Snowbird, Utah, December 2009. 8 pp., pdf.
- [C51] J. Magee, Z. Wu, H. Chennamaneni, S. Epstein, D. H. Theriault, and M. Betke. Towards a multi-camera mouse-replacement interface. In A. Fred, editor, *The 10th International Workshop on Pattern Recognition in Information Systems – PRIS 2010. In conjunction with ICEIS 2010, Madeira, Portugal – June 2010*, pages 33–42. INSTICC Press, 2010. pdf.
- [C52] E. Missimer and M. Betke. Blink and wink detection for mouse pointer control. In *The 3rd ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA 2010), Pythagorion, Samos, Greece, June 2010*. 8 pp., pdf.
- [C53] J. Magee and M. Betke. HAIL: hierarchical adaptive interface layout. In K. Miesenberger et al., editor, *12<sup>th</sup> International Conference on Computers Helping People with Special Needs (ICCHP 2010), Vienna University of Technology, Austria, Part 1, LNCS 6179*, pages 139–146. Springer-Verlag Berlin Heidelberg, July 2010. pdf. Abstract.
- [C54] E. Ataer-Cansizoglu and M. Betke. An information fusion approach for multiview feature tracking. In *20th International Conference on Pattern Recognition, August 23-26, 2010, Istanbul, Turkey*. IAPR Press, August 2010. 4 pp., pdf.
- [C55] D. H. Theriault, Z. Wu, N. I. Hristov, S. M. Swartz, K. S. Breuer, T. H. Kunz, and M. Betke. Reconstruction and analysis of 3D trajectories of Brazilian free-tailed bats in flight. In *Workshop on Visual Observation and Analysis of Animal and Insect Behavior, held in conjunction with the 20th International Conference on Pattern Recognition, August, 2010, Istanbul, Turkey, August 2010*. 4 pp., pdf.
- [C56] E. Missimer, S. Epstein, J. J. Magee, and M. Betke. Customizable keyboard. In *The 12th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS 2010), Orlando, Florida, USA, October 2010*. 3 pp., pdf.
- [C57] J. J. Magee, S. Epstein, E. Missimer, and M. Betke. Adaptive mappings for mouse-replacement interfaces. In *The 12th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS 2010), Orlando, Florida, USA, October 2010*. 3 pp., pdf.
- [C58] Z. Wu, T. H. Kunz, and M. Betke. Efficient track linking methods for track graphs using network-flow and set-cover techniques. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 1185–1192, Colorado Springs, June 2011. pdf.
- [C59] J. J. Magee, S. Epstein, E. S. Missimer, C. Kwan, and M. Betke. Adaptive mouse-replacement interface control functions for users with disabilities. In *Proceedings of the 6th International Conference on Universal Access in Human-Computer Interaction: Users Diversity - Volume*

*Part II (UAHCI'11), Orlando, Florida*, pages 332–341. Springer-Verlag, Berlin, Heidelberg, July 2011.

- [C60] S. Epstein, E. S. Missimer, and M. Betke. An information theoretic mouse trajectory measure. In *Proceedings of the 6th International Conference on Universal Access in Human-Computer Interaction: Users Diversity - Volume Part II (UAHCI'11), Orlando, Florida*, pages 301–309. Springer-Verlag, Berlin, Heidelberg, July 2011.
- [C61] C. Kwan and M. Betke. Camera canvas: Image editing software for people with disabilities. In *Proceedings of the 6th International Conference on Universal Access in Human-Computer Interaction: Users Diversity - Volume Part II (UAHCI'11), Orlando, Florida*, pages 146–154. Springer-Verlag, Berlin, Heidelberg, July 2011.
- [C62] I. Paquette, C. Kwan, and M. Betke. Menu Controller: Making existing software more accessible for people with motor impairments. In *The 4th ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA 2011), Heraklion, Crete, Greece*, pages 2:1–2:8. ACM, May 2011.
- [C63] B. Kim, D. Gurari, H. O'Donnell, and M. Betke. Interactive art system for multiple users based on tracking hand movements. In *IADIS International Conference Interfaces and Human Computer Interaction (IHCI), Rome, Italy*, July 2011.
- [C64] S. Epstein and M. Betke. An information theoretic representation of agent dynamics as set intersections. In *The Fourth Conference on Artificial General Intelligence (AGI), Mountain View, CA*, August 2011.
- [C65] C. Kwan, I. Paquette, J. J. Magee, P. Y. Lee, and M. Betke. Click control: Improving mouse interaction for people with motor impairments. In *Proceedings of The 13th International ACM SIGACCESS Conference on Computers and Accessibility, ASSETS'11, Dundee, Scotland*, October 2011.
- [C66] J. J. Magee, C. Kwan, M. Betke, and F. Hietpas. Enhancing social connections through automatically-generated online social network messages. In *Proceedings of The 13th International ACM SIGACCESS Conference on Computers and Accessibility, ASSETS'11, Dundee, Scotland*, October 2011.
- [C67] Z. Wu, A. Thangali, S. Sclaroff, and M. Betke. Coupling detection and data association for multiple object tracking. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Providence, RI*, June 2012. 8 pp., pdf.
- [C68] Z. Wu, D. Gurari, J. Y. Wong, and M. Betke. Hierarchical partial matching and segmentation of interacting cells. In *Proceedings of the 15th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), Nice, France*, October 2012. 8 pp., pdf.
- [C69] M. Breslav, N. W. Fuller, and M. Betke. Vision system for wingbeat analysis of bats in the wild. In *Proceedings of the Workshop on Visual Observation and Analysis of Animal and Insect Behavior (VAIB 2012), held in conjunction with the 21st International Conference on Pattern Recognition (ICPR 2012) Tsukuba, Japan*, November 2012. 4 pp., pdf.



- [C70] G. Towne, D. H. Theriault, Z. Wu, N. W. Fuller, T. H. Kunz, and M. Betke. Error analysis and design considerations for stereo vision systems used to analyze animal behavior. In *Proceedings of the Workshop on Visual Observation and Analysis of Animal and Insect Behavior (VAIB 2012), held in conjunction with the 21st International Conference on Pattern Recognition (ICPR 2012) Tsukuba, Japan*, November 2012. 4 pp., pdf.
- [C71] D. Gurari, S. Kim, E. Yang, B. Isenberg, T. Pham, A. Purwada, P. Solski, M. Walker, J. Y. Wong, and M. Betke. SAGE: An approach and implementation empowering quick and reliable quantitative analysis of segmentation quality. In *Proceedings of the IEEE Workshop on Applications in Computer Vision (WACV)*, January 2013. 7 pp., pdf. Best Paper Award. One of two awards selected among 161 submitted and 75 accepted papers.
- [C72] W. Feng, M. Chen, and M. Betke. Preliminary investigation of the impact of visual feedback on camera-based mouse-replacement interaction system. In *The 6th International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), Rhodes, Greece*, May 2013. 4 pages, pdf.
- [C73] B. L. Boardman, T. L. Hedrick, D. H. Theriault, N. W. Fuller, M. Betke, and K. A. Morgansen. Collision avoidance in biological systems using collision cones. In *Proceedings of The 2013 American Control Conference*, June 2013. 8 pp.
- [C74] J. Magee and M. Betke. Automatically generating online social network messages to combat social isolation of people with disabilities. In C. Stephanidis and M. Antona, editors, *Universal Access in Human-Computer Interaction. User and Context Diversity. 7th International Conference, UAHCI 2013, Held as Part of HCI International 2013, Las Vegas, NV, USA, July 21-26, 2013, Proceedings, Part II, LNCS 8010*, pages 684–693. Springer-Verlag Berlin Heidelberg, 2013. pdf.
- [C75] Z. Wu, J. Zhang, and M. Betke. Online motion agreement tracking. In *British Machine Vision Conference (BMVC), Bristol, U.K.*, September 2013. 8 pp., pdf.
- [C76] M. Betke. EMPOWER, an infrastructure for remote assessment of interfaces for individuals with severe motion impairments. In *Proceedings of the AAATE 2013, the 12th European AAATE Conference by the Association for the Advancement of Assistive Technology in Europe, Vilamoura, Portugal*, September 2013. 4 pp.
- [C77] Z. Kong, K. Özcimder, N. Fuller, A. Greco, D. Theriault, Z. Wu, T. Kunz, M. Betke, and J. Baillieul. Optical flow sensing and the inverse perception problem for flying bats. In *The 2013 IEEE Conference on Decision and Control (CDC), Florence, Italy*, December 2013. 8 pp., pdf.
- [C78] Q. Bai, Z. Wu, S. Sclaroff, M. Betke, and C. Monnier. Randomized ensemble tracking. In *International Conference on Computer Vision (ICCV), Sydney, Australia*, page 8 pp., December 2013. pdf.
- [C79] S. K. Kim, D. Gurari, C. Yang, C. D. Hartman, M. Jacobsen, J. Y. Wong, and M. Betke. *I'mCell*: A touch pad tool for annotating cell images. In *Proceedings of the 1st Biomedical Signal Analysis Conference, Florianopolis, Brazil*, March 2014. pdf.
- [C80] M. Breslav, N. Fuller, S. Sclaroff, and M. Betke. 3d pose estimation of bats in the wild. In *Proceedings of the IEEE Winter Conference on Applications of Computer Vision, Steamboat Springs, CO*, March 2014. 8 pages, pdf.

- [C81] W. Feng, M. Chen, and M. Betke. Target reverse crossing – a selection method for camera-based mouse-replacement systems. In *The 7th International Conference on Pervasive Technologies Related to Assistive Environments (PETRA)*, Rhodes, Greece, May 2014. 4 pages, pdf.
- [C82] Z. Wu, N. Fuller, D. Theriault, and M. Betke. A thermal infrared video benchmark for visual analysis. In *Proceedings of the 10th IEEE Workshop on Perception Beyond the Visible Spectrum (PBVS)*, Columbus, Ohio, June 2014. 8 pages. pdf.
- [C83] Z. Kong, K. Özcimder, N. Fuller, D. Theriault, M. Betke, and J. Baillieul. Perception and steering control in paired bat flight. In *The 19th World Congress of the International Federation of Automatic Control (IFAC)*, South Africa, August 2014. 7 pages.
- [C84] D. Gurari, D. Theriault, and M. Betke. Informed segmentation: A framework for using context to select an algorithm and a case study using humans in the loop. In *Interactive Medical Image Computation Workshop (IMIC)*, held in conjunction with MICCAI 2014, Boston, MA, September 2014. 9 pages, pdf.
- [C85] D. Gurari, D. Theriault, M. Sameki, and M. Betke. How to use level set methods to accurately find boundaries of cells in biomedical images? evaluation of six methods paired with automated and crowdsourced initial contours. In *Interactive Medical Image Computation Workshop (IMIC)*, held in conjunction with MICCAI 2014, Boston, MA, September 2014. 9 pages. Best Paper Award for Innovative Idea, Code and data,, pdf.
- [C86] D. Gurari, D. Theriault, M. Sameki, B. Isenberg, T. A. Pham, A. Purwada, P. Solski, M. Walker, C. Zhang, J. Y. Wong, and M. Betke. How to collect segmentations for biomedical images? A benchmark evaluating the performance of experts, crowdsourced non-experts, and algorithms. In *IEEE Winter Conference on Applications of Computer Vision (WACV)*, 2015. 8 pages, pdf.
- [C87] A. Joshi, C. Monnier, M. Betke, and S. Sclaroff. A random forest approach to segmenting and classifying gestures. In *11th IEEE International Conference on Face and Gesture Recognition (FG)*, May 4–8 2015. 7 pages, pdf.
- [C88] M. Sameki, D. Gurari, and M. Betke. Characterizing image segmentation behavior of the crowd. In *2015 Conference on Collective Intelligence*, May 31 – June 2 2015. 4 pages. pdf.
- [C89] J. Zhang, S. Ma, M. Sameki, S. Sclaroff, M. Betke, Z. Lin, X. Shen, B. Price, and R. Mech. Salient object subitizing. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 4045–4054, June 7–12 2015. 10 pages, pdf.
- [C90] A. Kurauchi, W. Feng, C. Morimoto, and M. Betke. HMAGIC: Head movement and gaze input cascaded pointing. In *8th International Conference on Pervasive Technologies Related to Assistive Environments, (PETRA)*, July 1–3 2015. 5 pages, pdf.
- [C91] M. Sameki, D. Gurari, and M. Betke. Predicting the quality of crowdsourced image drawings from crowd behavior. In *Third AAAI Conference on Human Computation and Crowdsourcing (HCOMP-2015)*, November 2015. 2 pages.

- [C92] M. Breslav, M. Betke, S. Sclaroff, and T. Hedrick. Discovering useful parts for pose estimation in sparsely annotated datasets. In *Proceedings of the IEEE Winter Conference on Applications of Computer Vision, Lake Placid, NY*, March 2016. 9 pages, pdf.
- [C93] H. Le, A. Joshi, and M. Betke. b3.js: A library for interactive web data visualizations in virtual reality. In *23rd IEEE Conference on Virtual Reality 2016, Greenville, South Carolina, March 19–23*, 2016. 2 pages, pdf.
- [C94] A. Kurauchi, W. Feng, A. Joshi, C. Morimoto, and M. Betke. EyeSwipe: Dwell-free text entry using gaze paths. In *CHI 2016, the Annual ACM Conference of the Special Interest Group on Computer-Human Interaction (SIGCHI)*, May 7–12 2016. 4 pages, pdf.
- [C95] A. Joshi and M. Betke. Predicting active facial expressivity in people with Parkinson’s disease. In *9th Annual International Conference on Pervasive Technologies Related to Assistive Environments (PETRA’16), Corfu, Greece*, June 2016. 4 pages, pdf.
- [C96] R. S. M. Saad, R. I. Elanwar, N. S. Abdel Kader, S. Mashali, and M. Betke. BCE-Arabic-v1 dataset: A step towards interpreting Arabic document images for people with visual impairments. In *9th Annual International Conference on Pervasive Technologies Related to Assistive Environments (PETRA’16), Corfu, Greece*, June 2016. 8 pages, pdf.
- [C97] E. Saraee and M. Betke. Dynamic adjustment of physical exercises based on performance using the Proficio robotic arm. In *9th Annual International Conference on Pervasive Technologies Related to Assistive Environments (PETRA’16), Corfu, Greece*, June 2016. 8 pages, pdf.
- [C98] E. Saraee, K. Ramrakhyani, A. Sanan, S. Singh, and M. Betke. Kinect versus Proficio: Measuring hand position during exercise monitoring. In *9th Annual International Conference on Pervasive Technologies Related to Assistive Environments (PETRA’16), Corfu, Greece*, June 2016. 2 pages, pdf.
- [C99] D. Gurari, S. D. Jain, M. Betke, and K. Grauman. Pull the Plug? Predicting if computers or humans should segment images. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Las Vegas*, pages 382–391, June 2016. pdf.
- [C100] M. Sameki, D. Gurari, and M. Betke. ICORD: Intelligent Collection of Redundant Data – A dynamic system for crowdsourcing cell segmentations accurately and efficiently. In *Workshop on Computer Vision for Microscopy Image Analysis (CVMI), affiliated with the IEEE International Conference on Computer Vision and Pattern Recognition (CVPR), July 1, 2016*, 2016. 10 pages, pdf.
- [C101] M. Gentil, M. Sameki, D. Gurari, E. Saraee, E. Hasenberg, J. Y. Wong, and M. Betke. Interactive tracking of cells in microscopy image sequences. In *The 3rd Interactive Medical Image Computation Workshop (IMIC), held in conjunction with MICCAI 2016 in Athens, Greece*, October 2016. 10 pages, pdf.
- [C102] D. Gurari, M. Sameki, Z. Wu, and M. Betke. Mixing crowd and algorithm efforts to segment objects in biomedical images. In *The 3rd Interactive Medical Image Computation Workshop (IMIC) held in conjunction with MICCAI 2016 in Athens, Greece*, October 2016. 8 pages, pdf.

- [C103] D. Gurari, M. Sameki, and M. Betke. Investigating the influence of data familiarity to improve the design of a crowdsourcing image annotation system. In *The Fourth AAI Conference on Human Computation and Crowdsourcing (HCOMP 2016)*, Austin, Texas, October 30 – November 3 2016. 10 pages, pdf.
- [C104] M. Sameki, M. Gentil, K. K. Mays, L. Guo, and M. Betke. Dynamic allocation of crowd contributions for sentiment analysis during the 2016 U.S. presidential election. In *Work-in-progress. The Fourth AAI Conference on Human Computation and Crowdsourcing (HCOMP 2016)*, Austin, Texas, October 30 – November 3 2016. 10 pages, pdf.
- [C105] L. Guo, K. Mays, M. Sameki, and M. Betke. From crowdsourcing to crowdcoding: An alternative approach to annotate big data in communication research. In *International Communication Association (ICA) 67th Annual Conference*, San Diego, May 2017.
- [C106] A. Joshi, S. Ghosh, M. Betke, S. Sclaroff, and H. Pfister. Personalizing gesture recognition using hierarchical Bayesian neural networks. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, Waikiki Beach, Hawaii, July 2017. 10 pages. pdf.
- [C107] M. Sameki, T. Zhang, L. Ding, M. Betke, and D. Gurari. Crowd-O-Meter: Predicting the vulnerability of crowd workers to false news. In *The Fifth AAI Conference on Human Computation and Crowdsourcing (HCOMP 2017)*, Quebec City, Canada, October 24–26 2017. 10 pages, pdf.
- [C108] R. S. M. Saad, R. Elanwar, N.S. Abdel Kader, S. Mashali, and M. Betke. Analyzing scanned Arabic documents using random forests. In *2nd IEEE International Workshop on Arabic and derived Script Analysis and Recognition (ASAR 2018)*, March 2018. Winner of the ASAR Segmentation Challenge. pdf.
- [C109] R. Elanwar and M. Betke. The ASAR 2018 Competition on Physical Layout Analysis of Scanned Arabic Books. In *2nd IEEE International Workshop on Arabic and derived Script Analysis and Recognition (ASAR 2018)*, pages 177–182, March 2018. pdf.
- [C110] W. Qin, R. Elanwar, and M. Betke. LABA: Logical layout analysis of book page images in Arabic using multiple support vector machines. In *2nd IEEE International Workshop on Arabic and derived Script Analysis and Recognition (ASAR 2018)*, pages 35–40, March 2018. pdf.
- [C111] A. Joshi, S. Ghosh, S. Gunnery, L. Tickle-Degnen, S. Sclaroff, and M. Betke. Context-sensitive prediction of facial expressivity using multimodal hierarchical Bayesian neural networks. In *The 13th IEEE Conference on Automatic Face and Gesture Recognition, Xi’an, China*, May 2018. 8 pp., pdf.
- [C112] R. Agrawal, A. Joshi, and M. Betke. Enabling early gesture recognition by motion augmentation. In *11th Annual ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA 2018)*, Corfu, Greece, pages 98–101, June 2018. pdf.
- [C113] M. Jalal, K. Mays, L. Guo, and M. Betke. Comparing the performance of crowdworkers and NLP tools on named-entity recognition and entity-level sentiment analysis of political Tweets. In *17th Annual Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, WiNLP Workshop, New Orleans, Louisiana, USA. Work-in-progress presentation*, 2018.

- [C114] A. Joshi, D. Alessio, R. Lisle, J. Magee, I. Arroyo, S. Sclaroff, B. Woolf, and M. Betke. Affect-driven learning outcomes prediction in intelligent tutoring systems. In *The 14th IEEE Conference on Automatic Face and Gesture Recognition, Lille, France*, May 2019. 5 pages.
- [C115] M. Jalal, J. Spjut, B. Boudaoud, and M. Betke. SIDOD: A synthetic image dataset for 3D object pose recognition with distractors. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops*, June 2019. 3 pages.
- [C116] S. Pandit, S. Tran, Y. Gu, E. Saraee, F. Jansen, S. Singh, S. Cao, A. Sadeghi, E. Shandelman, T. Ellis, and M. Betke. ExerciseCheck: A scalable platform for remote physical therapy deployed as a hybrid desktop and web application. In *12th Annual ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA 2019), Rhodos, Greece*, June 2019. 8 pages.
- [C117] E. Saraee, Y. Gu, S. Pandit, S. Tran, E. Shandelman, S. Singh, T. Nordahl, , T. Ellis, and M. Betke. Exercisecheck: Data analytics for a remote monitoring and evaluation platform for home-based physical therapy. In *12th Annual ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA 2019), Rhodos, Greece*, June 2019. 9 pages.
- [C118] L. Guo, K. Mays, Y. Zhang, M. Betke, and D. Wijaya. What makes gun violence a prominent issue? A computational analysis of compelling arguments and partisanship. In *The Association for Education in Journalism and Mass Communication (AEJMC) 2019 Conference, Toronto, Canada, August 7–10, 2019*.
- [C119] M. Jalal, K. Wang, S. Jefferson, Y. Zheng, E. O. Nsoesie, and M. Betke. Scraping social media photos posted in kenya and elsewhere to detect and analyze food types. In *MADiMA 2019, the 5th International Workshop on Multimedia Assisted Dietary Management. In conjunction with the 27th ACM International Conference on Multimedia (ACMMM 2019) Nice, France, October 21, 2019*. 10 pages, also arXiv:1909.00134 pdf.
- [C120] Y. Gu, S. Pandit, E. Saraee, T. Nordahl, T. Ellis, and Margrit Betke. Home-based physical therapy with an interactive computer vision system. In *Proceedings of the IEEE International Conference on Computer Vision Workshops*, October 2019. 10 pages.
- [C121] S. Liu, L. Guo, K. Mays, M. Betke, and D. Wijaya. Detecting frames in news headlines and its application to analyzing news framing trends surrounding U.S. gun violence. In *Proceedings of the Conference on Computational Natural Language Learning (CoNLL), Hong Kong*, November 2019. 11 pp.
- [C122] Q. Wang, Y. Zheng, and M. Betke. A method for detecting text of arbitrary shapes in natural scenes that improves text spotting. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2020 Workshops*, pages 1–10, June 2020.
- [C123] Chenhongyi Yang, Vitaly Ablavsky, Kaihong Wang, Qi Feng, and Margrit Betke. Learning to separate: Detecting heavily-occluded objects in urban scenes. In *16th European Conference on Computer Vision: ECCV'20 Online*, August 2020.
- [C124] Afra Feyza Akyürek, Lei Guo, Randa Elanwar, Margrit Betke, Prakash Ishwar, and Derry T. Wijaya. Multi-label and multilingual news framing analysis. In *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, pages 8614–8624, July 2020.

- [C125] Y. Zheng, W. Qin, D. Wijaya, and M. Betke. LAL: Linguistically aware learning for scene text recognition. In *MM'20: Proceedings of the 28th ACM International Conference on Multimedia*, pages 4051–4059, October 2020. <https://doi.org/10.1145/3394171.3413913>.
- [C126] A. Kurauchi, W. Feng, A. Joshi, C.H. Morimoto, and M. Betke. Swipe&Switch: Text entry using gaze paths and context switching. In *Adjunct Publication of the 33rd Annual ACM Symposium on User Interface Software and Technology (UIST '20), October 2023, 2020, Virtual Event, USA*, pages 84–86, 2020. <https://dl.acm.org/doi/pdf/10.1145/3379350.3416193>.
- [C127] D. Henneman, Y. Li, J. Ochsendorf, M. Betke, and E. Whiting. Augmented reality for sculpture stability analysis and conservation. In *Eurographics Workshop on Graphics and Cultural Heritage. Virtual: The Eurographics Association.*, pages 85–88. The Eurographics Association, 2020. <https://doi.org/10.2312/gch.20201298>.
- [C128] Kaihong Wang, Chenhongyi Yang, and Margrit Betke. Consistency regularization with high-dimensional non-adversarial source-guided perturbation for unsupervised domain adaptation in segmentation. In *The Thirty-Fifth AAAI Conference on Artificial Intelligence (AAAI-21)*, pages 1–9, February 2021. <http://ojs.aaai.org/index.php/AAAI/article/view/17216>.
- [C129] Wenxin Feng, Jiangnan Zou, Andrew Kurauchi, Carlos H. Morimoto, and Margrit Betke. HGaze Typing: Head-gesture assisted gaze typing. In *ETRA '21 Full Papers: ACM Symposium on Eye Tracking Research and Applications*, pages 1–11, May 2021. <https://doi.org/10.1145/3448017.3457379>. Best Paper Award.
- [C130] Sha Lai, Anne Billot, Maria Varkanitsa, Emily Braun, Brenda Rapp, Todd Parrish, Ajay Kurani, James Higgins, David Caplan, Cynthia Thompson, Swathi Kiran, Margrit Betke, and Prakash Ishwar. An exploration of machine learning methods for predicting post-stroke aphasia recovery. In *PETRA 2021: The 14th Pervasive Technologies Related to Assistive Environments Conference*, pages 556–564, June 2021. <https://dl.acm.org/doi/abs/10.1145/3453892.3461319>.
- [C131] H. Yu, A. Gupta, W. Lee, I. Arroyo, M. Betke, D. Allesio, T. Murray, J. Magee, and B. P. Woolf. Measuring and integrating facial expressions and head pose as indicators of engagement and affect in tutoring systems. In *In Adaptive Instructional Systems. Adaptation Strategies and Methods, Third International Conference, AIS 2021, Held as Part of the 23rd HCI International Conference, HCII 2021, Virtual Event, July 24/29, 2021, Proceedings, Part II*, pages 219–233, 2021. DOI: 10.1007/978-3-030-77873-6\_16.
- [C132] Y. Zheng, Q. Wang, and M. Betke. Semantic-based sentence recognition in images using bimodal deep learning. In *2021 IEEE International Conference on Image Processing (ICIP), Anchorage, AK*, pages 2753–2757, September 2021. DOI: 10.1109/ICIP42928.2021.9506688.
- [C133] Kevin Delgado, Juan Manuel Origgi, Tania Hasanpoor, Hao Yu, Danielle Allesio, Ivon Arroyo, William Lee, Margrit Betke, Beverly Woolf, and Sarah Adel Bargal. Student engagement dataset. In *ICCV 2021: 2nd Workshop and Competition on Affective Behavior Analysis in-the-wild (ABAW)*, pages 1–9, October 2021. DOI 10.1109/ICCVW54120.2021.00405.
- [C134] Vibhu Bhatia, Vidya Prasad Akavoor, Sejin Paik, Lei Guo, Mona Jalal, Alyssa Smith, David Assefa Tofu, Edward Edberg Halim, Yimeng Sun, Margrit Betke, Prakash Ishwar, and

Derry Tanti Wijaya. OpenFraming: Open-sourced tool for computational framing analysis of multilingual data. In *2021 Conference on Empirical Methods in Natural Language Processing*, October 2021. DOI 10.18653/v1/2021.emnlp-demo.28.

- [C135] Isidora Tourni, Lei Guo, Taufiq Husad Daryanto, Fabian Zhafransyah, Edward Edberg Halim, Mona Jalal, Boqi Chen, Sha Lai, Hengchang Hu, Margrit Betke, Prakash Ishwar, and Derry Tanti Wijaya. Detecting frames in news headlines and lead images in U.S. gun violence coverage. In *Findings of the Association for Computational Linguistics: 2021 Conference on Empirical Methods in Natural Language Processing, Punta Cana, Dominican Republic*, pages 4037–4050, November 2021. DOI 10.18653/v1/2021.findings-emnlp.339.
- [C136] Nataniel Ruiz, Hao Yu, Danielle Alessio, Mona Jalal, Ajjen Joshi, Thomas Murray, John Magee, Jacob Whitehill, Vitaly Ablavsky, Ivon Arroyo, Beverly Woolf, Stan Sclaroff, and Margrit Betke. Leveraging affect transfer learning for behavior prediction in an intelligent tutoring system. In *IEEE International Conference on Automatic Face and Gesture Recognition*, pages 1–8, December 2021. DOI 10.1109/FG52635.2021.9667001. Best Poster Award.
- [C137] Will Lee, Danielle Alessio, William Rebelsky, Sai Satish Gattupalli, Hao Yu, Ivon Arroyo, Margrit Betke, Sarah Bargal, Tom Murray, Frank Sylvia, and Beverly P. Woolf. Measurements and interventions to improve student engagement through facial expression recognition. In Robert A. Sottilare and Jessica Schwarz, editors, *Adaptive Instructional Systems - 4th International Conference, AIS 2022, Held as Part of the 24th HCI International Conference, HCII 2022, Virtual Event, June 26 - July 1, 2022, Proceedings. Lecture Notes in Computer Science 13332*, pages 286–301. Springer 2022, ISBN 978-3-031-05886-8, 2022.
- [C138] Sha Lai, Yanru Jiang, Lei Guo, Margrit Betke, Prakash Ishwar, and Derry Tanti Wijaya. An unsupervised approach to discover media frames. In *Proceedings of The LREC 2022 Workshop on Natural Language Processing for Political Science, Marseille, France*, pages 22–31, June 2022. pdf.
- [C139] Carley Reardon, Sejin Paik, Ge Gao, Meet Parekh, Yanling Zhao, Lei Guo, Margrit Betke, and Derry Wijaya. NEMO: An affective dataset of gun violence news. In *Proceedings of the 13th Conference on Language Resources and Evaluation (LREC 2022), Palais du Pharo, Marseille, France*, pages 2507–2516, 2022. pdf.
- [C140] Donghyun Kim, Kaihong Wang, Kate Saenko, Margrit Betke, and Stan Sclaroff. A unified framework for domain adaptive pose estimation. In *European Conference on Computer Vision (ECCV), Tel Aviv*, pages 1–18, October 2022.
- [C141] Ge Gao, Sejin Paik, Carley Reardon, Yanling Zhao, Lei Guo, Prakash Ishwar, Margrit Betke, and Derry Wijaya. Prediction of people’s emotional response towards multi-modal news. In *The 2nd Conference of the Asia-Pacific Chapter of the Association for Computational Linguistics and the 12th International Joint Conference on Natural Language Processing (ACL-IJCNLP)*, pages 1–10, November 2022.

## Invited Papers, Book Chapters, and Editorials

- [I1] S. Sclaroff, G. Kollios, and M. Betke. Motion mining. In *Proceedings of the Second International Workshop on Multimedia Databases and Image Communication (MDIC 2001)*, pages 16–30, Amalfi, Italy, September 2001. Springer-Verlag. pdf. Abstract.

- [I2] S. Sclaroff, M. Betke, G. Kollios, J. Alon, V. Athitsos, R. Li, J. Magee, and T. Tian. Tracking, analysis, recognition of human gestures in video. In *Proceedings of the 8th International Conference on Document Analysis and Recognition (ICDAR)*, pages 806–810, Seoul, Korea, August 2005. pdf.
- [I3] T. H. Kunz, M. Betke, N. I. Hristov, and M. Vonhof. Methods for assessing colony size, population size, and relative abundance of bats. In T. H. Kunz and S. Parsons, editors, *Ecological and Behavioral Methods for the Study of Bats. 2nd Edition*, pages 133–157. Johns Hopkins University Press, Baltimore, Maryland, 2009. pdf.
- [I4] M. Betke. Intelligent interfaces to empower people with disabilities. In H. Nakashima, J. C. Augusto, and H. Aghajan, editors, *Handbook of Ambient Intelligence and Smart Environments*, pages 409–432. Springer Verlag, June 2009. pdf.
- [I5] I. Maglogiannis, F. Makedon, G. Pantziou, and M. Betke. Editorial: Pervasive technologies and assistive environments: Cognitive systems for assistive environments: Special issue of PETRA 2010 and 2011 conferences. *Universal Access in the Information Society*: 13(1):1–4, March 2014
- [I6] I. Maglogiannis, M. Betke, G. Pantziou, and F. Makedon. Editorial: Assistive environments for the disabled and senior citizens: Theme issue of the PETRA 2010 and 2011 conferences. *Personal and Ubiquitous Computing*, 18(1):1–3, January 2014.
- [I7] C. Spampinato, G. M. Farinella, B. Boom, V. Mezaris, M. Betke, and R. B. Fisher. Editorial: Special issue on animal and insect behaviour understanding in image sequences. *The EURASIP Journal on Image and Video Processing*, 2015:1, January 30, 2015.
- [I8] M. Betke, T. Hedrick, and D. Theriault. Multi-Camera Videography Methods for Aeroecology In P. B. Chilson and W. F. Frick and J. F. Kelly and F. Liechti, editors, *Aeroecology*, pages 239–257, Springer International Publishing AG. pdf.

## Peer-reviewed Abstracts

- [A1] J. P. Ko, H. Rusinek, E. Jacobs, R. Chandra, G. McGuinness, M. Betke, and D. P. Naidich. Volume quantitation of small pulmonary nodules on low dose chest CT: a phantom study. In *The Radiological Society of North America 87th Scientific Assembly and Annual Meeting (RSNA)*, Chicago, IL, November 2001. Abstract.
- [A2] D. P. Gierga, G. T. Y. Chen, J. Kung, M. Betke, J. Lombardi, and C. Willett. Quantitative fluoroscopy of respiration-induced abdominal tumor motion and the impact of motion on IMRT dose distributions. In *Proceedings of the 45th American Association of Physicists in Medicine Annual Meeting (AAPM)*, San Diego, California, August 2003. Abstract.
- [A3] D. P. Gierga, G. Sharp, J. Brewer, M. Betke, C. Willett, and G. T. Y. Chen. Correlation between external and internal markers for abdominal tumors: Implications for respiratory gating. In *The 45th Annual Meeting of the American Society for Therapeutic Radiology and Oncology (ASTRO)*, Salt Lake City, Utah, October 2003. Oral presentation. Abstract.
- [A4] D. E. Hirsh, M. Betke, S. Crampton, J. Horn, and T. H. Kunz. Censusing Brazilian free-tailed bats using infrared thermal imaging and computer vision methods. In *33rd Annual North*



*American Symposium on Bat Research (NASBR)*, Lincoln, Nebraska, October 2003. D. Hirsh won the Lube Award for an outstanding presentation. Abstract.

- [A5] W. Mullally, E. Rietzel, G. T. Y. Chen, N. Choi, and M. Betke. Fast segmentation of pulmonary tumors by contour propagation in 4DCT. In *Proceedings of the 46th Annual Meeting of the American Association of Physicists in Medicine (AAPM)*, Pittsburgh, PA, July 2004. Abstract.
- [A6] M. Betke, T. H. Kunz, S. Tang, and D. E. Hirsh. Censusing Brazilian free-tailed bats with infrared thermal imaging - challenges, lessons learned, and initial results. In *Proceedings of the 34th Annual North American Symposium on Bat Research (NASBR)*, page 26, Salt Lake City, UT, October 2004. pdf.
- [A7] C. J. Cleveland, M. Betke, P. Federico, J. D. Frank, T. G. Hallam, J. Horn, T. H. Kunz, J. D. López, G. F. McCracken, R. A. Medellín, A. Moreno-Valdez, C. G. Sansone, and J. K. Westbrook. Economic value of pest control services by Brazilian free-tailed bats in Texas cotton production. In *Proceedings of the 34th Annual North American Symposium on Bat Research (NASBR)*, page 34, Salt Lake City, UT, October 2004. pdf.
- [A8] D. E. Hirsh, M. Betke, and T. H. Kunz. Computer vision for tracking bats in infrared thermal video: A tool for understanding the behavior of bats in flight. In *Proceedings of the 34th Annual North American Symposium on Bat Research (NASBR)*, page 50, Salt Lake City, UT, October 2004. pdf.
- [A9] T. H. Kunz, M. Betke, D. Hirsh, N. Hristov, E. Lee, L. Allen, J. Reichard, M. Bamberger, and J. D. Bamberger. Build it and they will come: Establishment of a founder colony of Brazilian free-tailed bats (*tadarida brasiliensis*) in a man-made cave. In *Proceedings of the 34th Annual North American Symposium on Bat Research (NASBR)*, pages 58–59, Salt Lake City, UT, October 2004. pdf.
- [A10] E. Y. Lee, M. Betke, and T. H. Kunz. Bats in motion: Stereo object recognition and trajectory analysis of flying bats. In *Proceedings of the 34th Annual North American Symposium on Bat Research (NASBR)*, page 61, Salt Lake City, UT, October 2004. pdf.
- [A11] N. I. Hristov, M. Betke, and T. H. Kunz. Seasonal monitoring of Brazilian free-tailed bats at Carlsbad Caverns National Park using advanced infrared thermal imaging. In *Proceedings of the 35th Annual North American Symposium on Bat Research (NASBR)*, Sacramento, CA, October 2005.
- [A12] N. I. Hristov, M. Betke, and T. H. Kunz. Assessment of Brazilian free-tailed bat (*tadarida brasiliensis*) populations using advanced infrared thermal imaging. *Symposia and Oral Abstracts. Integrative and Comparative Biology*, 45(6):1015, 2005. Oral presentation at The Society for Integrative and Comparative Biology Annual Meeting, Orlando, FL, January 2006, Abstract.
- [A13] L. B. Premerlani, M. Betke, N. Hristov, J. J. Magee, J. Reichard, S. Sclaroff, and T. H. Kunz. Stereoscopic reconstruction of flight paths of foraging bats using multiple thermal infrared cameras. In *Proceedings of the 36th Annual North American Symposium on Bat Research (NASBR)*, Wilmington, NC, October 2006. pdf.
- [A14] N. I. Hristov, M. Betke, and T. H. Kunz. Lessons in history: Colony size and population decline of Brazilian free-tailed bats at Carlsbad Caverns. In *Proceedings of the 36th Annual North American Symposium on Bat Research (NASBR)*, Wilmington, NC, October 2006.

- [A15] N. I. Hristov, M. Betke, and T. H. Kunz. Lessons in history: Colony size and population decline of Brazilian free-tailed bats at Carlsbad Caverns. In *Society for Integrative and Comparative Biology (SICB), 2007 Annual Meeting*, Phoenix, AZ, January 2007. Abstract.
- [A16] N. I. Hristov, M. Betke, L. Premerlani, M. Procopio, and T. H. Kunz. Thermal imaging reveals highly variable nightly and seasonal activity patterns of Brazilian free-tailed bats at Carlsbad Caverns. In *Proceedings of the XIV International Bat Research Conference (IBRC) and the 37th Annual North American Symposium on Bat Research (NASBR)*, Mérida, Mexico, August 2007.
- [A17] T. H. Kunz, N. Hristov, and M. Betke. Seasonal emergence behavior of Brazilian free-tailed bats at Carlsbad Caverns. In *Proceedings of the International Conference on Complex Systems (ICCS 2007)*, Boston, MA, October 2007. Abstract.
- [A18] L. B. Premerlani, M. Betke, S. Sclaroff, and T. H. Kunz. Stereoscopic reconstruction and analysis of infrared videos of bats. In *Proceedings of the International Conference on Complex Systems (ICCS 2007)*, Boston, MA, October 2007. Abstract.
- [A19] N. I. Hristov, M. Betke, and T. H. Kunz. Applications of thermal infrared imaging in field biology. *Symposia and Oral Abstracts. Integrative and Comparative Biology*, 47(Supplement 1):e1–e152, December 2007. Oral presentation at The Society for Integrative and Comparative Biology Annual Meeting, San Antonio, TX, January 2008, Abstract.
- [A20] T. H. Kunz, J. C. Chau, Z. Wu, L. Hong, J. D. Reichard, M. Betke, and T. D. C. Little. A novel, remote-controlled BatCam for censusing small colonies of bats. In *Proceedings of the 38th Annual North American Symposium on Bat Research (NASBR)*, Scranton, PA, October 2008. Poster.
- [A21] N. I. Hristov, L. C. Allen, E. Gillam, M. Betke, Z. Wu, and T. H. Kunz. Mechanisms of self-organization in flying brazilian free-tailed bats (*tadarida brasiliensis*). In *45th Annual Meeting of the Animal Behavior Society (ABS)*, Snowbird, UT, August 2008.
- [A22] N. I. Hristov, L. C. Allen, E. Gillam, M. Betke, Z. Wu, and T. H. Kunz. Mechanisms of self-organization in flying brazilian free-tailed bats (*tadarida brasiliensis*). In *Proceedings of the 38th Annual North American Symposium on Bat Research (NASBR)*, Scranton, PA, October 2008.
- [A23] M. L. Walker, D. M. House, M. Betke, and J. Y. Wong. Using automated cell tracking tools to quantify durokinesis and durotaxis in real time. In *Proceedings of the Biophysical Society 53rd Annual Meeting*, Boston, MA, USA, February 2009. Abstract.
- [A24] N. Hristov, M. Betke, and T. H. Kunz. Conservation and management of the Brazilian free-tailed bat: colony size and activity patterns using thermal imaging. In *Symposium on the "Protection and Management of Rare and Endangered Subterranean Fauna," co-located with the 15th International Congress of Speleology, Kerrville, Texas USA*, July 2009.
- [A25] K. M. Gillman, G. Towne, A. J. Harwick, A. Gatnick, T. D. Little, M. Betke, Z. Wu, J. D. Reichard, D. S. Reynolds, and T. H. Kunz. *Myotis lucifugus* at maternity colonies in Massachusetts: Assessing impacts of white-nose syndrome. In *Proceedings of the 41st Annual North American Symposium on Bat Research (NASBR 2011)*, Toronto, Canada, October 2011. Abstack.

- [A26] N. Fuller, D. Theriault, A. Greco, Z. Wu, T. Kunz, J. Baillieul, and M. Betke. Describing the *myotis* superhighway: Characteristics of aggregated 3D trajectories through a cluttered environment. In *Proceedings of the XLII North American Symposium on Bat Research (NASBR)*, San Juan, Puerto Rico, October 2012. Abstract.
- [A27] A. Greco, N. Fuller, D. Theriault, Z. Wu, T. Kunz, J. Baillieul, and M. Betke. Understanding obstacle avoidance in *myotis velifer* through analysis of reconstructed 3D flight trajectories. In *Proceedings of the XLII North American Symposium on Bat Research (NASBR)*, San Juan, Puerto Rico, October 2012. Abstract.
- [A28] D. H. Theriault, N. Fuller, and M. Betke. Understanding collective behavior in *tadarida brasiliensis* using computer vision and multi-target tracking. In *Proceedings of the 16th International Bat Research Conference*, San José, Costa Rica, August 2013.
- [A29] M. Betke, D. Theriault, Z. Wu, N. Fuller, M. Breslav, and B. Borucki. Seeing in the dark – an analysis of bat flight through stereographic infrared videography. In *Proceedings of the 16th International Bat Research Conference*, San José, Costa Rica, August 2013. Abstract.
- [A30] Russell Thompson, Jason Li, Kaihong Wang, Lauren Etter, Ingrid Camelo, Ilse Castro, Bindu Setty, Hailey Chang, Margrit Betke, Rachel Pieciak, and Christopher Gill. Using artificial intelligence to interpret pneumonia CXR (chest X ray) findings in children with a phone application platform. In *The Society of Pediatric Radiology (SPR) 2022 Annual Meeting, April 27–May 1, Denver, Colorado, 2022*. Poster.
- [A31] Ingrid Camelo, Rachel Pieciak, Ilse Castro-Aragon, Bindu Setty, Margrit Betke, Lauren Etter, Jason Li, Russell Thompson, and Christopher Gill. Concordance between chest X ray (CXR) and point of care ultrasound (POCUS) findings in children diagnosed with RSV infection by nasopharyngeal RT-PCR: The Zambia experience. In *The 7th Conference RSVVW’23 – A Global Conference on Novel RSV Preventative and Therapeutic Interventions. Respiratory Syncytial Virus Foundation (ReSViNET)*, February 2023. Poster.
- [A32] Saurav Chennuri, Anne Billot, Sha Lai, Prakash Ishwar, Margrit Betke, and Swathi Kiran. Feature analysis and extraction for post aphasia recovery prediction. In *26th UK Conference on Medical Image Understanding and Analysis, 27–29 July, 2022, Centre for Mathematical Sciences, University of Cambridge, 2022*. Poster.
- [A33] Mahir Patel, Yiwen Gu, Lucas Carstensen, Micheal E. Hasselmo, and Margrit Betke. 3D multimodal dataset and token-based pose optimization. In *CV4Animals Workshop Computer Vision for Animal Behavior Tracking and Modeling. In conjunction with Computer Vision and Pattern Recognition (CVPR), June 19-24, 2022, New Orleans, Louisiana, 2022*. Poster.

## SELECTED TECHNICAL REPORTS

- [T1] M. Breslav, T. L. Hedrick, S. Sclaroff, and M. Betke. Automating image analysis by annotating landmarks with deep neural networks, 30 pages. arXiv preprint. <https://arxiv.org/abs/1702.00583>. February 2017.
- [T2] E. Saraee, M. Jalal, M. Betke. SAVOIAS: A Diverse, Multi-Category Visual Complexity Dataset, 10 pages. arXiv preprint. <https://arxiv.org/abs/1810.01771>, September 2018.

- [T3] M. Sameki, S. Lai, K. K. Mays, L. Guo, P. Ishwar, and M. Betke. BUOCA: Budget-Optimized Crowd Worker Allocation, 27 pages. arXiv preprint. <https://arxiv.org/abs/1901.06237>. January 2019.
- [T4] Y. Zheng, Q. Wang and M. Betke. Deep Neural Network for Semantic-based Text Recognition in Images, 10 pages. arXiv preprint. <https://arxiv.org/abs/1908.01403>. August 2019.
- [T5] Q. Wang, Y. Zheng, and M. Betke. SA-Text: Simple but Accurate Detector for Text of Arbitrary Shapes, 10 pages. arXiv preprint. <https://arxiv.org/abs/1911.07046>. November 2019.
- [T6] C. Yang, V. Ablavsky, K. Wang, Q. Feng, and M. Betke. Learning to Separate: Detecting Heavily-Occluded Objects in Urban Scenes, 13 pages. arXiv preprint. <https://arxiv.org/abs/1912.01674>. November 2019.
- [T7] Kaihong Wang, Chenhongyi Yang, and Margrit Betke. Consistency Regularization with High-dimensional Non-adversarial Source-guided Perturbation for Unsupervised Domain Adaptation in Segmentation, 11 pages. arXiv preprint. <https://arxiv.org/abs/2009.08610>. September 2020.
- [T8] Donghyun Kim, Kaihong Wang, Kate Saenko, Margrit Betke, and Stan Sclaroff. A Unified Framework for Domain Adaptive Pose Estimation. 24 pages. arXiv preprint. <https://arxiv.org/abs/2204.00172>. April 2022.
- [T9] Yi Zheng, Rushin H. Gindra, Emily J. Green, Eric J. Burks, Margrit Betke, Jennifer E. Beane, and Vijaya B. Kolachalama. A graph-transformer for whole slide image classification. 16 pages. arXiv preprint. <https://arxiv.org/abs/2205.09671>. May 2022.
- [T10] Kaihong Wang, Donghyun Kim, Rogerio Feris, Kate Saenko, and Margrit Betke. Exploring Consistency in Cross-Domain Transformer for Domain Adaptive Semantic Segmentation. 10 pages. arXiv preprint. <https://arxiv.org/abs/2211.14703>, November 2022.

## DATASETS

- [D1] *BU-TIV: Thermal Infrared Video Benchmark*. Wu, Z., Fuller, N., Theriault, D., Betke, M. (2014). Available at <http://csr.bu.edu/BU-TIV/BUTIV.html>
- [D2] *BCE-Arabic Dataset for Image Analysis of Arabic Documents*. Elanwar, R.I. and Betke, M. (2016). Available at <http://cs.bu.edu/faculty/betke/BCE>
- [D3] *Video-based Student Engagement Measurement Datasets*. Ruiz, N., Yu, H., Alessio, D., Jalal, M., Joshi, A., Murray, T., Magee, J., Whitehill, J., Ablavsky, V., Arroyo, I., Woolf, B., Sclaroff, S., Bargal, S. A., Betke, M. (2021). Available at <https://cs-people.bu.edu/sbargal/studentdatasets>
- [D4] *IDD: Interior Design Dataset*. Zheng, Y., Wang, Q., Betke, M. (2021). Available at <https://github.com/ivc-yz/SSR>
- [D5] *TPID: Text-containing Protest Image Dataset*. Zheng, Y., Wang, Q., Betke, M. (2021). Available at <https://github.com/ivc-yz/SSR>
- [D6] *Rodent3D*

## SOFTWARE ARTIFACTS, PATENTS, AND TECHNOLOGY DISCLOSURES

1. *OpenFraming AI. A tool for analyzing multilingual media frames using AI technologies.* BU AIEM Team, 2020–present. <http://openframing.org>
2. *ExerciseCheck: Home-based Physical Therapy Interface.* Inventors M. Betke and BU Team, June 2019–present.
3. *Camera Mouse: Automated Visual Tracking for Computer Access.* Inventors M. Betke and J. Gips. Patent submitted June 2001 but denied 2006. The technology was commercialized by CM Solutions, Inc., Austin, TX, <http://www.cameramouse.com>. In April 2007, a new version was made available for free at <http://www.cameramouse.org>. It has emerged as a popular mouse-replacement tool for children and adults of all ages. The Camera Mouse software has been downloaded over 3,000,000 times and is used world wide as an alternative communication interface by people with severe motion impairments.
4. *Method and System for the Detection, Comparison and Volumetric Quantification of Pulmonary Nodules on Medical Computed Tomography Scans.* Inventors Margrit Betke and Jane P. Ko. U.S. Patent 7,206,462, issued on April 17, 2007.
5. *BU Microsight: An Automated Cell Tracking Protocol.* Inventors Margrit Betke, David House, Matthew Walker, and Joyce Y. Wong. Technology disclosure, February 27, 2009.
6. *Method for Detection of Shapes of Variable Structure in Images.* Inventors V. Athitsos, J. Wang, S. Sclaroff, M. Betke. Technology disclosure, June 13, 2005.
7. *Registration of Pulmonary Nodules.* Inventors M. Betke and J. P. Ko. Technology disclosure, April 8, 2002.

## INVITED LECTURES, SEMINARS, AND CONFERENCE TALKS

1. Research on Tap – Artificial Intelligence for Biomedicine and Healthcare, Boston University Office of Research. *AI for Pediatric US Diagnosis, AI for Physical Therapy, AI for Post-Stroke Prognosis*, November 9, 2022.
2. 4th NOAA Workshop on Leveraging Artificial Intelligence in Environmental Sciences – AI for Ocean Conservation. *Computer Vision for Conservation – Rats, Bats, Birds, and Fish – Four Case Studies & Lessons Learned*, September 7, 2022.
3. Neuro-Autonomy ONR MURI Annual Review. *Multimodal Pose Estimation*, online presentation, April 11, 2022.
4. AI and Education Initiative Research Exchange Seminar Series. Rafik B. Hariri Institute of Computing and Computational Science & Engineering, Boston University. *Leveraging Computer Vision and Machine Learning for Intelligent Tutor Systems*. February 11, 2021.
5. Medical Image Computing and Computer Assisted Interventions (MICCAI) Workshop on Data Augmentation Labeling & Imperfections. *GLPathNet: Exploiting data size and resolution of histopathologic images with a Global-Local Pathology Network*, online presentation, October 1, 2021. <https://dalimiccai.github.io>

6. Worcester Polytechnic Institute, Seminar, Department of Electrical & Computer Engineering, *Election Week Talk on AI for Multimodal Analysis of Political News*, November 5, 2020.
7. CRA Virtual Conference 2020, *Communicating COVID-19*, online presentation, Computing Research Association, July 20, 2020.
8. Multi University Research Initiative, Kickoff Meeting, *Computer Vision for Motion Analysis of Animals*, Boston, November 13, 2019.
9. Kickoff Meeting of the Boston University Center for Autonomous and Robotics Systems, *3D Tracking with Computer Vision*, Boston, October 31, 2019.
10. MIT CSAIL and Schlumberger-Doll Research Workshop, *3D Visual Tracking and Domain Adaptation*, Cambridge, MA, October 8, 2019.
11. Tufts University, Colloquium, Computer Science Department, *Personalized Face and Gesture Analysis of Innovations in Education and Rehabilitation*, Medford, MA, September 26, 2019.
12. Symposium on Individual Freedom Versus The Hidden Persuaders – Preserving individual freedom in an age of socio-technical control via algorithmic rewards and punishments, *C/overt AI-powered Technologies and the Responsibility of Users*, Boston, September 11, 2019.
13. The 14th IEEE Conference on Automatic Face and Gesture Recognition, *Affect-driven Learning Outcomes Prediction in Intelligent Tutoring Systems*, Lille, France, May 16, 2019.
14. International Workshop on Human Community and PERpetrual Contract in an Era of Artificial Intelligence. *Welcoming Remarks: AI at Boston University*, Boston, April 11, 2019.
15. Digital Health Initiative Award Roundtable, *ExerciseCheck: Remote Physical Therapy with Ease*, Boston, MA, April 3, 2019.
16. MIT, Brain and Cognitive Science Department, *Challenging Tasks for Computer Vision*, Cambridge, MA, February 28, 2019.
17. AI World, *Use Cases in AI and High-Performance Computing*, Boston, MA, December 4, 2018.
18. Invited Plenary Lecture at the ACM 11th Annual International Conference on Pervasive Technologies Related to Assistive Environments (PETRA'18), *Towards Fast and Comfortable Text Entry Using Gaze Paths*, Corfu, Greece, June 27, 2018.
19. ACM 11th Annual International Conference on Pervasive Technologies Related to Assistive Environments (PETRA'18), *Enabling Early Gesture Recognition by Motion Augmentatio*, Corfu, Greece, June 28, 2018.
20. ICA Preconference: Crowdsourcing as a Content Analysis Tool. *Crowdsourcing as a Data Analysis Tool in Computer Science* Prague, Czech Republic, May 24, 2018.
21. In Face-Off: Facial Recognition Technologies and Humanity in an Era of Big Data. *How Does Face Recognition Technology Work?* Boston, MA, April 18, 2018.
22. CVPR 2018 Area Chair Workshop, *Looking at People: Personalized Face and Gesture Analysis using Hierarchical Bayesian Neural Networks*, Toronto, CA, February 19, 2018.

23. University of São Paulo, Computer Science Department, *Looking at People: Gesture Segmentation and Classification*, São Paulo, Brazil, January, 31, 2018.
24. IEEE International Conference on Computer Vision and Pattern Recognition (CVPR) Computer Vision and Microscopy Image Analysis (CVMI) Workshop. *Human Computation Approaches to Microscopy Analysis*, Honolulu, Hawaii, July 21, 2017.
25. University of São Paulo, Computer Science Department, *Vision-based Human-Computer Interfaces, Personalization, and Crowdsourcing*. São Paulo, Brazil, March 7, 2017.
26. CVPR 2017 Area Chair Workshop, *Personalizing Gesture Recognition Using Hierarchical Bayesian Neural Networks*, University of Maryland, College Park, February 27, 2017.
27. Boston University, Department of Biomedical Engineering Seminar, *Microscopic and Macroscopic Image Analysis: Crowdsourcing, Machine Learning, and 4D Modeling to Aid BME Research*, September 23, 2016.
28. ACM 9th Annual International Conference on Pervasive Technologies Related to Assistive Environments (PETRA'16), *BCE-Arabic-v1 dataset: A step towards interpreting Arabic document images for people with visual impairments*, Corfu, Greece, June 30, 2016.
29. Keynote Lecture at Science-Engineering-Technology in the City, *SET in the City: Making a Difference with Computer Vision*, Merck Research Laboratories, Boston, MA, April 2, 2016.
30. BU Data Science Day, *Image and Video Computing for Data Science*, Boston, MA, January 22, 2016.
31. IEEE International Conference on Computer Vision and Pattern Recognition (CVPR) Workshop on Perception Beyond the Visible Spectrum, *Analyzing the Flight Behavior of Bats in Thermal Infrared Video*, Keynote Address, Boston, MA, June 2015.
32. IEEE International Conference on Robotics and Automation, Workshop on Recent Advances in Sensing and Navigation for Bioinspired Agile Flight, *3D Flight Analysis: Individual and Group Motion*, Seattle, May 2015.
33. University of Maryland Institute for Advanced Computer Studies, *Pedestrians of the Sidewalk and the Sky: Visual Tracking of Humans and Bats*, College Park, January 29, 2015.
34. Office of Naval Research Investigator Meeting, *3D Sensing of Bat and Bird Flight*, University of Maryland, College Park, September 22, 2014.
35. National Academies of Science, Engineering, and Medicine, Workshop on *Robust Methods for the Analysis of Images and Videos for Fisheries Stock Assessment Multi-Object Multi-View Tracking*, Washington DC, May 16, 2014.
36. Massachusetts Institute of Technology, Computer Vision Group Seminar *Pedestrian of the Sidewalk and the Sky: Visual Tracking of Humans and Animals*, Cambridge, MA, April 15, 2014.
37. Biomedical Signal Analysis Conference – 3D Imaging in Medicine, *Microscopy Imaging of Living Cells – Research Questions and Solutions, including “I’m Cell: A Touch Pad Tool for Annotating Cell Images”*, Florianópolis, Brazil, March 26, 2014.

38. University of São Paulo, Computer Science Department, *Computer Vision for Tracking of Humans and Animals*, São Paulo, Brazil, March 21, 2014.
39. Massachusetts Institute of Technology, Graphics Group Seminar *Insight into Animals in Flight*, Cambridge, MA, November 20, 2013.
40. 2nd ACM International Workshop on Multimedia Analysis for Ecological Data (MAED 2013), *Understanding Animal Flight with Three-dimensional and Infrared Computer Vision*, Barcelona, Spain, October 21.
41. The 12th European AAATE Conference by the Association for the Advancement of Assistive Technology in Europe, *emPower, an Infrastructure for Remote Assessment of Interfaces for Individuals with Severe Motion Impairments*, Vilamoura, Portugal, September 20, 2013.
42. The 16th International Bat Research Conference, *Seeing in the Dark – an Analysis of Bat Flight through Stereographic Infrared Videography*, San José, Costa Rica, August 15, 2013.
43. Office of Naval Research Investigator Meeting, *Computer Vision Techniques to Estimate Flight Paths of Bats*, Arlington, VA, April 24, 2013.
44. GE Global Research, *Evaluation of Image Segmentation, Cell Morphology Classification, and Computational Models of the Airway Tree*, Niskayuna, NY, January 11, 2013.
45. Video Analytics: Applying Automated Feature Extraction to Questions of Driver Behavior Workshop, *Challenges of Video-based Human-Computer Interfaces and Experiences in Analyzing Videos of Driver Faces*, FHWA Turner-Fairbank Highway Research Center, McLean, VA, October 2012.
46. Fudan University, Shanghai, China, *Seeing in the Dark – Unveiling the Flight Behavior of Gregarious Bats Using Thermal Imaging*, USA-Sino Summer School in Vision, Learning, Pattern Recognition (VLPR 2012), July 29, 2012.
47. The 14th International Conference on Human Computer Interaction (HCI International), *An Information Theoretic Mouse Trajectory Measure*, Orlando, Florida, July 2011.
48. First Workshop on Computer Vision Tracking of Cell Populations, *Cell Tracking and Cell Morphology Classification*, Carnegie Mellon University and Intel Labs Pittsburgh, Pittsburgh, PA, March 2011.
49. University of Washington, *Bio-Inspired Flight Control: Flight Control in Bats*, Investigator Meeting for ONR Project “AIRFOILS: Animal Inspired Robust Flight with Outer and Inner Loop Strategies,” Seattle, WA, October 2010.
50. Keynote Lecture at The 3rd ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), *Assistive Environments that Empower Individuals with Severe Disabilities*, Pythagorion, Samos, Greece, June 2010.
51. National Technical University of Athens, Colloquium, School of Electrical and Computer Engineering, Division of Computer Science, *Image and Video Computing Research in Computer Science at Boston University*, Athens, Greece, June 2010.



52. Keynote Address at the Second Annual New England Undergraduate Computing Symposium: Celebrating Excellence and Diversity in Computing, *Video-based Human-Computer Interaction*, Boston, MA, April 2010.
53. Technical University Berlin, Department of Computer Science, Computer Vision and Remote Sensing Group, *Camera-based Human-Computer Interfaces for People with Disabilities and 3D Video Understanding*, Berlin, March 2010.
54. Deutsches Zentrum für Luft- und Raumfahrt, Institut für Verkehrssystemtechnik, *2D and 3D Feature Tracking for Human-Computer Interfaces and Animal Flight Analysis*, Berlin, March 2010.
55. University of Maryland, Department of Computer Science, *Camera-based Human-Computer Interfaces and 3D Video Understanding*, College Park, MD, September 2009.
56. Naval Undersea Warfare Center, *Automated Video-Based Interpretation of the Behavior of Moving Objects*, Newport, RI, July 2009.
57. IEEE Computer Society Workshop on Mathematical Methods in Biomedical Image Analysis (MMBIA), *Tracking of Cell Populations to Understand their Spatio-Temporal Behavior in Response to Physical Stimuli*, Miami Beach, FL, June 2009.
58. Invited Plenary Lecture at The 2nd International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), *Camera-based Interfaces for People with Severe Motion Impairments*, Corfu, Greece, June 2009.
59. INRIA, the French National Institute for Research in Computer Science and Control, *Diagnostic Image Analysis of the Chest: Computational Models and Approaches*, Sophia Antipolis, May 2009.
60. The 9th International Workshop on Pattern Recognition in Information Systems – PRIS 2009, *RefLink: An Interface that Enables People with Motion Impairments to Analyze Web Content and Dynamically Link to References*, Milan, Italy, May 2009.
61. Tufts University, Colloquium, Computer Science Department, *Visual Tracking of Large Numbers of Bats*, Medford, MA, November 2008.
62. 2007 RUMBUS, Research by Undergraduates in Mathematics Boston University Symposium, *What Is Mathematics?* Boston, MA, November 2007.
63. BBN Technologies, *A Method to Track Large Variable Numbers of Objects in Clutter and its Application to Censusing Millions of Bats*, Cambridge, MA, June 2007.
64. 2007 NSF CISE/CRI PI Meeting, *Overview of Sensorium Research at Boston University with Azer Bestavros*, Boston, MA, June 2007.
65. Harvard University, Women, Science, and Society Lecture Series, *Video-based Tracking for Human-computer Interaction and Conservation Biology* Cambridge, MA, May 2007.
66. Harvard University, National Symposium for the Advancement of Women in Science, *The Future of Computer Science*, Cambridge, MA, April 2007.
67. Massachusetts Institute of Technology, Path of Professorship Workshop @ MIT, *Running A Lab*, Cambridge, MA, October 2006.

68. The 9th International ERCIM Workshop “User Interfaces For All” UI4ALL 2006, *Web Mediators for Accessible Browsing*, Königswinter, Germany, September 2006.
69. The 6th International Workshop on Pattern Recognition in Information Systems – PRIS 2006, *Tracking and Prediction of Tumor Movement in the Abdomen*, Paphos, Cyprus, June 2006.
70. Massachusetts Institute of Technology, Machine Vision Colloquium 2005/2006, *Detection, Segmentation, and Registration Techniques for Lung Image Analysis*, Cambridge, MA, May 2006.
71. University of Massachusetts Lowell, Colloquium Series, Department of Computer Science, *Video-based Communication Interfaces for People with Severe Paralysis*, Lowell, MA, February 2005.
72. Massachusetts Institute of Technology, Human-Computer Interaction Seminar Series, *Communication Interfaces for People with Severe Disabilities via Video-based Gesture Detection*, Cambridge, MA, October 2004.
73. 34th Annual North American Symposium on Bat Research (NASBR 2004), *Censusing Brazilian Free-tailed Bats with Infrared Thermal Imaging – Challenges, Lessons Learned, and Initial Results*, Salt Lake City, UT, October 2004.
74. Tufts University, Computer Science Colloquium, *Video-Based Computer Interfaces for People with Severe Disabilities*, Medford, MA, December 2003.
75. University of Massachusetts, Computer Science Department, *Video-based Human-Computer Interfaces for People with Severe Disabilities*, Boston, MA, April 2003.
76. ERCIM Workshop “User Interfaces for All” (UI4ALL 2002) *Experiments with a Camera-Based Human-Computer Interface System*, Paris, France, October 2002.
77. Childrens Hospital, Communication Enhancement Center, *Video-based Assistive Communication Devices*, Boston, MA, October 2002.
78. Zhejiang University, State Key Laboratory of CAD & CG and Institute of Information & Communication Engineering, *Research on Medical Image Analysis and Video-Based Human Computer Interfaces at Boston University*, Hangzhou, P.R. China, August 2002.
79. Rutgers, The State University of New Jersey, Computer Science Department, *Diagnostic Image Analysis of Chest Computed Tomography Scans*, Piscataway, NJ, May 2002.
80. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI 2001), *Registration of Lung Surfaces in Computed Tomography Scans*, Utrecht, The Netherlands, September 2001.
81. Boston University, TeacherTech’01, Gender Equity and Technology Workshop, *Video-Based Human Computer Interfaces*, Boston, MA, August 2001.
82. University of Maryland, Institute for Advanced Computer Studies, *Image Segmentation and Registration to Support Lung Cancer Detection*, College Park, MD, May 2001.
83. Boston University, Multi-Dimensional Signal Processing Laboratory, *Chest CT: Nodule Detection and Assessment of Change over Time*, Boston, MA, March 2001.

84. Wellesley College, Computer Science Colloquium, *Computer Vision to Support Lung Cancer Diagnosis*, Wellesley, MA, March 2001.
85. Boston University, Cognitive and Neural Systems Department, *Computer Vision to Support Lung Cancer Diagnosis*, Boston, MA, March 2001.
86. Massachusetts General Hospital, Department of Radiation Oncology, *Chest CT: Nodule Detection and Assessment of Change over Time*, Boston, MA, March 2001.
87. New York University, Department of Radiology, *Detection of Pulmonary Nodules on CT and Volumetric Assessment over Time*, New York, NY, September 2000.
88. IEEE CVPR Workshop on Human Modeling, Analysis and Synthesis, *Active Detection of Eye Scleras in Real Time*, Hilton Head Island, SC, June 2000.
89. Boston University, Computer Science Colloquium, *Recognition, Resolution, and Complexity of Objects*, Boston, MA, April 2000.
90. Tufts University, Department of Computer Science and Electrical Engineering, *Recognition, Resolution, and Complexity of Objects*, Boston, MA, March 2000.
91. Boston University, Computer Science Colloquium, *Detection of Pulmonary Nodules on CT and Volumetric Assessment over Time*, Boston, MA, November 1999.
92. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI 1999), *Detection of Pulmonary Nodules on CT and Volumetric Assessment over Time*, Cambridge, UK, September 1999.
93. IEEE International Workshop on Recognition, Analysis, and Tracking of Faces and Gestures in Real-Time Systems, *Gaze Detection via Self-Organizing Gray-Scale Units*, Kerkyra, Greece, September 1999.
94. University of Maryland, Center for Automation Research, Computer Vision Laboratory, *Detection and Tracking Problems in Computer Vision*, College Park, May 1999.
95. International Conference on Computer Vision, *Information-Conserving Object Recognition*, Mumbai, India, January 1998.
96. Boston University, Computer Science Colloquium, *Information-Conserving Object Recognition*, Boston MA, November 1997.
97. IEEE Conference on Intelligent Transportation Systems, *Highway Scene Analysis*, Boston, November 1997.
98. National Institute of Standards and Technology, *Multiple Vehicle Detection and Tracking in Hard Real Time*, Gaithersburg, January 1997.
99. 25th Applied Imagery Pattern Recognition Workshop, *Multiple Vehicle Detection and Tracking in Hard Real Time*, Washington, DC, October 1996.
100. Advanced Telecommunication Research Institute International, Media Integration and Communications Research Laboratories, *Multiple Vehicle Detection and Tracking in Hard Real Time*, Kyoto, Japan, September 1996.

101. IEEE Symposium on Intelligent Vehicles, *Multiple Vehicle Detection and Tracking in Hard Real Time*, Tokyo, Japan, September 1996.
102. Daimler-Benz Research, *Fast Object Recognition in Noisy Images Using Simulated Annealing*, Ulm, Germany, December 1995.
103. Catholic University of America, Computer Science Department, *Fast Object Recognition in Noisy Images Using Simulated Annealing*, Washington, DC, December 1995.
104. Siemens Corporate Research, *Fast Object Recognition in Noisy Images Using Simulated Annealing*, Princeton, November 1995.
105. University of Massachusetts, Computer Science Department, *Fast Object Recognition in Noisy Images Using Simulated Annealing*, March 1995.
106. The Pennsylvania State University, Computer Science Department, *Fast Object Recognition in Noisy Images Using Simulated Annealing*, March 1995.
107. University of Maryland Institute for Advanced Computer Studies, *Fast Object Recognition in Noisy Images Using Simulated Annealing*, College Park, March 1995,
108. Rheinische Friedrich-Wilhelms Universität Bonn, Institut für Informatik, *Fast Object Recognition in Noisy Images Using Simulated Annealing*, Bonn, Germany, December 1994.
109. University of Dortmund, Fachbereich Informatik, *Piecemeal Exploration of General Graphs*, Dortmund, Germany, December 1994.
110. IEEE/RSJ/GI International Conference on Intelligent Robots and Systems 1994, *Mobile Robot Localization Using Landmarks*, Munich, Germany, September 1994.
111. University of Dortmund, Fachbereich Informatik, *Piecemeal Learning and Distributed Algorithms*, Dortmund, Germany, January 1994.
112. Sixth Annual Conference on Computational Learning Theory 1993, *Piecemeal Learning of an Unknown Environment*, Santa Cruz, CA, July 1993.
113. The International Computer Science Institute, *Piecemeal Learning of an Unknown Environment*, Berkeley, CA, July 1993.
114. Action Learning Workshop, *On the Job Learning*, GTE, MA, April 1993.
115. Siemens Corporation, *Exploring Unknown Graphs*, Munich, Germany, January 1991.

## TEACHING ACTIVITIES

- Design of the Boston University graduate program “Master in Artificial Intelligence,” 2018–2019. The program was launched in September 2019.
- Course webpages: <http://www.cs.bu.edu/faculty/betke>

- **Undergraduate Courses:** Algorithms (F 1998), Computers in Management (F 1999, S 2000), Computer Vision (S 1998, S 2000, developed course), Data Structures (F 1997, S 1998, F 1998, S 1999), Introduction to Artificial Intelligence (F 2002–2005, F 2007, F 2009, S 2012, 2015–2019, revamped course several times). Geometric Algorithms (F 2010). Between 20 and 144 students per course.
- **Graduate Courses:** Artificial Intelligence (F 2002–2005, F 2007, F 2009, S 2015–2020, revamped course), Image and Video Computing (S 2001–2011, F 2011, 2012, 2014–2020, partially 2021, revamped course several times), Topics in Computer Science: Video-based Human Computer Interfaces (F 2001, developed course), Graduate Initiation Seminar (S 2017, S 2018, S 2023). Between 20 and 120 students per course.
- Invited lecture “Imagining Possibilities – Research in AI to Bring About Positive Change in the World.” Undergraduate Research Opportunity Program (UROP), Boston University, July 10, 2019. Lecture to 175 students.
- Panelist and Faculty Evaluator of team projects in the MIT course “6.811: Principles and Practice of Assistive Technology,” October 2015.
- Discussion and evaluation of team projects in the undergraduate course “CS 411: Software Engineering,” December 6, 2011.
- Guest Lecture on “The Camera Mouse, a human-computer interface for people with severe motion impairments” in the undergraduate course “CS 101: Introduction to Computers,” February 25, 2011.
- Guest Lecture on “Video-based Human-Computer Interaction and the Camera Mouse” in the undergraduate course “CS 108: Introduction to Application Programming,” April 27, 2010.
- Guest Lecture on “Designing Video-based Interfaces for People with Disability – How Students are Involved” in the course “CS108: Introduction to Application Programming,” November 11, 2008.
- Guest Lecture “A Manual for Writers in Computer Science” in the computer science initiation course for graduate students, May 21, 2008 and April 9, 2010.
- Guest Lecture on “Computer Vision” to students in Boston University’s Trustee Scholars Program, April 14, 2005.
- Guest Lectures in Boston University’s Medical Informatics Program, 2004 and 2005.
- Guest Lecture on “Chest CT: Automated Nodule Detection and Assessment of Change over Time” in the course “CN 730 Models of Visual Perception,” April 14, 2001.
- Ph.D. qualifying exam in computer vision with Prof. Stan Sclaroff. Fall 2002–2009.  
<http://www.cs.bu.edu/groups/ivc/exam>

## RESEARCH ADVISING

Advisor of 4–8 PhD students and several MS or BA students per year.

Co-Director of the **Artificial Intelligence Research (AIR) Initiative** with Prof. Kate Saenko, Prof. Brian Kulis, and Prof. Stan Sclaroff, Fall 2017–present, <http://www.bu.edu/hic/air>

Co-Leader of the **Image and Video Computing Group** with Prof. Stan Sclaroff, Fall 2001–present, and Prof. Kate Saenko, Fall 2016–present, <http://www.cs.bu.edu/groups/ivc>

Co-Leader of the **Artificial Intelligence and Emerging Media (AIEM) Research Group** with Prof. Lei Guo, Prof. Prakash Ishwar, and Prof. Derry Wijaya, Spring 2016–present, <http://sites.bu.edu/aiem>

Created and led the **Computer Vision Research Group** at Boston College, 1998–2001.

### Ph.D. Thesis Supervision

- Wenda Qin, “Image Analysis for Arabic Documents,” expected 2024.
- Yi Zheng, “Text Spotting,” expected 2023.
- Sha Lai, “Machine Learning for News Content Aggregation,” expected 2024.
- Yiwen Gu, “Computer Vision for Rehabilitation,” expected 2024.
- Kaihong Wang, “Segmentation and Pose Estimation,” expected 2024.
- Hao Yu, “Facial Expression Analysis for Intelligent Tutors,” expected 2024.

### Graduated Ph.D. Advisees

1. Elham Saraee, “Data Analytics for Image Visual Complexity and Kinect-Based Videos of Rehabilitation Exercises,” September 2019. Now at Adhark Inc., CA.
2. Ajjen Joshi, “Personalized Face and Gesture Analysis Using Hierarchical Neural Networks,” September 2018. Co-Advised with Stan Sclaroff, Boston University. Now at Affectiva, MA.
3. Wenxin Feng, “Dwell-free Input Methods for People with Motor Impairments,” September 2018. Now at Google Research, CA.
4. Andrew Kurauchi, “Gaze and Motion Based Interfaces,” March 2018. Co-Advised with Prof. Carlos Morimoto, University of Sao Paulo, Brazil.
5. Mehrnoosh Sameki, “Accurate and Budget-efficient Text, Image, and Video Analysis Systems Powered by the Crowd,” September 2017. Now at Microsoft Research, Cambridge, MA.
6. Mikhail Breslav, “3D Pose Estimation of Flying Animals in Multi-view Datasets” September 2016. Now at Microsoft, San Francisco, CA.
7. Diane Hirsh Theriault, “An Optimization-based Model of Collective Motion,” September 2015. Now at Google, Cambridge, MA.
8. Danna Gurari, “Combining Crowd Worker, Algorithm, and Expert Efforts to Find Boundaries of Objects in Images,” September 2015. Now Assistant Professor at University of Colorado Boulder, CO.
9. Samuel Epstein, “Information and Distances,” May 2013. Co-Advised with Leonid Levin, Boston University.

10. Zheng Wu, “Occlusion Reasoning for Multiple Object Visual Tracking,” September 2012. Now at Stealth AI Startup – AI in Medicine, CA.
11. John J. Magee, “Adaptable Interfaces for People with Motion Disabilities,” May 2012. Now Associate Professor at Clark University, Worcester, MA.
12. William Mullally, “Image Registration and Computational Modeling of the Lung,” May 2009. Rapiscan Systems, CA.
13. Jingbin Wang, “Object Segmentation Using Shape Constraints,” May 2007. Now Senior Software Engineer at Google Research, Mountain View, CA.

### **M.A. Thesis Supervision**

- Mahir Patel, “3D multimodal dataset and token-based pose optimization,” MS Thesis defended in April 2022.
- Ajjen Joshi, “A Random Forest Approach to Segmenting and Classifying Gestures,” July 2014. Co-advised with Stan Sclaroff. Currently PhD student at BU.
- Seule Ki Kim, “Integrating Computer Vision Techniques into a Touch Pad System,” May 2013. Now at Intuit in San Francisco.
- Lisa Premerlani, “Stereoscopic Reconstruction and Analysis of Infrared Video of Bats,” May 2007. Now at MIT Lincoln Labs.
- Wajeeha Akram, “Designing and Evaluating Computer Vision Based Interfaces for Users with Disabilities,” May 2007. Computer science professor in Pakistan.
- Angshuman Bagchi, “A Clustered Data Association Technique for Expedited Multi Target Tracking,” September 2006. Now at Bloomberg.
- Johanna Brewer, “3D Tracking and Prediction of Abdominal Tumor Motion using Internal and External Markers,” September 2004. Now in PhD program in Human-Computer Interaction at UC Irvine.
- Stephen C. Crampton, “Counting Fingers in Real Time Using Computer-Vision Techniques,” September 2004. Now at Amazon.
- John J. Magee, “A Real-Time Human-Computer Interface Based on Gaze Detection from a Low-Grade Video Camera,” May 2004. Graduated with a PhD degree from Boston University and is now Professor at Clark University, Worcester, MA.
- Jason Ruel, “Tracking and Predicting of Tumor Motion in the Abdomen,” May 2003. MBA at University of Washington, Seattle, then consultant for Microsoft.
- William Mullally, “Segmentation and Registration of Pulmonary Nodules,” May 2003. Graduated with a PhD degree from Boston University and is now at the KEYW Corporation, Boston, MA.
- Harrison Hong, “Landmark Detection in the Chest and Registration of Lung Surfaces with an Application to Nodule Registration,” May 2003. Now at Reveal Imaging Technologies, Bedford, MA.

### **Supervision of Research Projects by M.S. Students**

- Hantian (Alan) Liu, “Analysis of the Benefits of a Digital Therapeutic,” spring 2022–spring 2023. Co-advisors Prakash Ishwar and Swathi Kiran.

- Saurav Chennuri, “Prediction of Aphasia Severity,” spring 2022–spring 2023. Co-advisors Prakash Ishwar and Swathi Kiran.
- Ge Gao, “Multi-modal, Multi-class Machine Learning for Affect Prediction,” spring–fall 2022. Co-advisor Derry Wijaya.
- Divya Appapogu, “Analysis of the Lung Border in US video,” fall 2021–spring 2022.
- Chenhongyi Yang, “Learning to Separate: Detecting Heavily-Occluded Objects in Urban Scenes,” fall 2019 and spring 2020
- Yiwen Gu, “Home-based Physical Therapy with an Interactive Computer Vision System,” fall 2018, spring–summer 2019
- Shreya Pandit, “ExerciseCheck: A Scalable Platform for Remote Physical Therapy Deployed as a Hybrid Desktop and Web Application,” fall 2018 and spring 2019
- Lunhao Lihang, “Field of View Estimation of Individuals Flying in Group Formations,” fall 2018 and spring 2019.
- Kaihong Wang, “Instagram Image Analysis of Kenyan Foods,” spring 2019.
- Qitong Wang, “Text Spotting,” fall 2018 and spring 2019.
- Zhitong Wu and Chengongyi Yang, “3D view estimation,” co-advisor Dr. Vitaly Ablavsky, fall 2018.
- Siqi Zhang, “ExerciseCheck trajectory comparisons,” spring 2018.
- Muhammad Zuhayr Raghieb, “Using 3D-CNNs for Emotion Perception in Intelligent Tutoring Systems,” spring 2018.
- Rohit Agrawal, “Enabling Early Gesture Recognition by Motion Augmentation,” fall 2017 and spring 2018.
- Wenda Qin “LABA: Logical Layout Analysis of Book Page Images in Arabic Using Multiple Support Vector Machines,” fall 2017

### **M.A. Project Supervision**

In 2017, the CS Department stopped requiring Master’s projects.

1. Srivathsa Rajagopal, “Video Analysis of Politicians,” M.S., January 2017.
2. Saurabh Singh, “Exercising with the Proficio Robotic Arm in Virtual Reality,” M.Eng., January 2017.
3. Jun Xu, “Newborn Recognition using Ear Biometrics Controlling for Growth Pattern,” May 2016. Co-advised with Stan Sclaroff.
4. Ming Chen, “Improving the Selection Mechanism “Goal Crossing” used in Mouse-replacement Interfaces,” May 2014.
5. Andrew Barbarello, “A Semi-supervised Approach for Classifying Tens of Thousands of 3D Trajectories,” 12 pages, December 2013. Now at the National Institute of Standards and Technology (NIST), Gaithersburg, MD.
6. Zhongchen Shen. “Determining the Orientation of Driver’s head by measuring the length of nose shadow,” May 2013.
7. Gordon Towne, “Error Analysis and Design Considerations for Stereo Vision Systems Used to Analyze Animal Behavior,” May 2012. Now at TrainingPeaks.



8. Luis Carrasco, "Picture Identification by Mining Existing Image Search Platforms," January 2012. Now at Microsoft, Seattle.
9. Tianqiang Liu, "Hand Dection and Tracking with Multiple Dynamic Hidden State Shape Models," September 2011. Now at Orbeus.
10. Leyong Tan, "A Gesture-based Human-computer Interface of Google Earth using the Kinect Game Console," September 2011.
11. Christopher Kwan, "Camera Canvas: Image Editing Software for People with Disabilities," May 2011. Now at Lattice Engines.
12. Jiayu Fu, "3D Camera Mouse by Virtual Tracking of 3D Face Features Using Stereo Cameras," May 2011. Co-advisor: Janusz Konrad.
13. Byung Hyung Kim, "Interactive Art Using a Camera-based Hands Tracking Tool for Interaction between Humans and Computers," September 2010. Now at UC Riverside.
14. Chao Chung Hsieh, "Data capture and calibration of a multi-camera system," September 2010.
15. Yili Pan, "Diagnostic Image Analysis of the Chest: Intensity-based Registration Techniques," May 2010. Co-advisor: Thomas Little. Now at Mathworks.
16. Shuo Zeng, "Diagnostic Image Analysis of the Chest: Feature-based Registration Techniques," May 2010. Co-advisor: Thomas Little.
17. Hari Mohan, "Visual Tracking at Sea using the Covariance Tracking Algorithm," May 2010. Co-advisor: Thomas Little.
18. Yun Wang, "Visual Tracking at Sea using the Mean Shift Algorithm," May 2010. Co-advisor: Thomas Little.
19. Harshith Chennamaneni, "MCC: A Multi-Camera Capture System for Human-Computer Interaction," January 2010. Now at WhitePages.
20. Esra Ataer Cansizoglu, "An Information Fusion Approach for Multiview Feature Tracking," May 2009. Now at Northeastern University.
21. Jawad Mahmood, "Facial Modeling: Progeny Phenotype Revelation," January 2009. Co-advisor: M. Alanyali.
22. Kevin Hu, "Segmentation of the Minor Fissure on CT," May 2007. Now at Bloomberg.
23. Marianne Procopio, "Bat Flight Analysis: Further Insight into the Emergence of Brazilian Free-Tailed Bats," May 2007. Now at MIT Lincoln Labs.
24. Jared Wickman, "Graphical User Interface Layouts and the Camera Mouse," May 2007.
25. Benjamin N. Waber, "Web Mediators for Accessible Browsing," May 2006. Now in PhD program at MIT.
26. Laura Tiberii, "A customizable camera-based human computer interaction system allowing people with disabilities autonomous hands free navigation of multiple computing tasks," May 2006. Now at Raytheon.
27. Mikhail Gorman, "MusicMaker: A Camera-based Music Making Tool for Physical Rehabilitation," January 2006. Now at Bluestreak.
28. Omar Al-Hinai, "Real-time Suppression of Tremor Motion from Camera Mouse Signal Using Finite Impulse Response Filters," September 2005. Now at Aramco.

29. Vladimir Rydzevsky, "Computing a Uniform Scaling Parameter for 3D Registration of Lung Surfaces," September 2005.
30. Michael Chau, "Real Time Eye Tracking and Blink Detection with USB Cameras," May 2005. Now analyst at Goldman Sachs in New York.
31. Edward Lee, MA project and NASBR conference abstract on "Bats in Motion: Stereo Object Recognition and Trajectory Analysis of Flying Bats," May 2005.
32. Michelle Paquette, MA project on "IWebExplorer: A Web browser designed for use with an eye controlled mouse device," May 2005. Now at Fidelity.
33. Eugen Tsykinovskyy, "Segmentation of the Respiratory Vessel Tree on CT," May 2005.
34. Shuang Tang, MA project and NASBR conference abstract on "Challenges of censusing colonies of Brazilian free-tailed bats at Eckert James River, Frio, and Davis Blowout caves using infrared thermal imaging and initial censusing results," January 2005.
35. Kashan Arshad, "Dimensionality Reduction and Efficient Retrieval of Medical Images from Large Databases," September 2004 (co-supervision with George Kollios).
36. Peter McNerney, "A Stereo-based Approach to Digital Image Compositing," September 2003 (co-supervision with Janusz Konrad). Now at DreamWorks.
37. Oleg Gusyatin and Mikhail Urinson, "A Method to Extend Functionality of Pointer Input Devices," September 2003.
38. Thomas J. Castelli, "Facial Feature Tracking and Detection of Facial Occlusion due to Hand Gestures," September 2003. Now at Raytheon.
39. Ramasri Raghavan, "Chromosome Detection Using Image Analysis," September 2003.
40. Emily Stuckey, "Methods of Token-Based Authorship Attribution for an English-Language Online Discussion Community," May 2004.
41. Haobing Wang, "Comparison of Methods to Predict Abdominal Tumor Motion," May 2003. Now at Massachusetts Eye and Ear Infirmary.
42. Yannis Minadakis, "GazePoint: Tracking Eye Movement to Determine Gaze Direction," January 2003. Now at Teradyne.
43. Jonathan Lombardi, "A Self-initializing Eyebrow Tracker for Binary Switch Emulation," May 2002. Now at Massachusetts General Hospital.
44. Robyn Cloud, "Experimentation and Evaluation of a Human-Computer Interface System," May 2002. Now at Lockheed Martin.

### **B.A. Thesis Supervision**

- Diane E. Hirsh, "Evaluation of Computer Vision Methods for Analyzing Infrared Thermal Video and Censusing Brazilian Free-tailed Bats," May 2004. Now at Google.
- Christopher Fagiani, "An Evaluation of Tracking Methods for Human-Computer Interaction," Honor's Thesis, May 2002. Now at NBC.
- Kristen Grauman, "Automatic Eye Blink Detection and Duration Analysis in Real Time for Communication Purposes," Honor's Thesis, May 2001. PhD at MIT, now computer science professor at University of Texas at Austin.
- John J. Magee, "Finding Eyes in Faces," May 2001. Now professor at Clark University.

- William Mullally, “Region Classification for Factory Circuit Board Error Detection,” May 2001. Now at Reveal Imaging, Bedford, MA.
- Peter Fleming, “The Camera Mouse,” Honor’s Thesis, May 2000. Now at Accenture, formerly Andersen Consulting.
- Cleo V. Bertrand, “Computer Enhancement Techniques for CT Scans,” May 2000. MA at NYU.
- Jun Kawai, “Gaze Detection via Self-Organizing Gray-Scale Units,” May 1999. J. Kawai works at Sony in Japan.

### **Undergraduate Research Projects, Advisor**

1. Kevin Delgado, “Head pose estimation for intelligent tutors,” spring & summer 2021.
2. Eugenia Shandelman, “Graphical Interface Improvements for ExerciseCheck,” summer 2018–spring 2019.
3. Sabrina Charania, “Data management for ExerciseCheck,” spring 2018.
4. Shreya Ramesh, “Patient Movement Feedback for Exercise Check,” spring 2017, fall 2017, spring 2018.
5. Jia Yao, “Rendering OptFlock in Action to Simulate Group Behavior,” fall 2016.
6. Mattia Gentil, “Crowdsourcing the cell tracking problem” and “Finding the Optimal Number of Crowdworkers to Analyze Political Tweets,” summer 2016.
7. Brian Borucki, “Multi-view Tracking of Fish Schools,” summer 2014. MS 2015.
8. Sridevi Suresh, REU project “Image Segmentation and Multi-view Tracking in Videos of Bat Flight,” Fall 2013, and spring and summer 2014.
9. Dasom Lee, “Multi-view Multi-object Tracking in Videos of Schools of Fish,” February–December 2013.
10. Ester Wu, REU project “Annotating Videos of Bat Flight,” Fall 2013.
11. Tatiana Schmidt Goncalves, REU project “Video Annotation via Crowd Sourcing,” Spring and Summer 2013.
12. Maxwell Porter, UROP project “Expanding a 3D Computer Model of Bats in Flight Using Visible Light Footage,” Summer 2012
13. Seule Ki Kim and Eugene Yang, REU project “Generating Ground Truth for Cell Segmentation,” Summer 2012.
14. Ashley Banks and Alison Greco, REU project “Annotating Ground Truth for 3D Flight Analysis of Foraging Bats,” Summer 2012.
15. Gordon Towne, UROP project “Three Dimensional Reconstruction for Intelligent Tracking Systems,” Summer 2011.
16. Sarah Hall, REU project “Hand gesture based drawing using the Kinect,” AY 2011/2012.
17. Jamal Rasheed, REU project “Visualization of flight paths of bats,” Summer 2011 and AY 2011/2012.
18. Christopher Kwan, UROP project “Camera Canvas: Image Editing Software for People with Disabilities,” Summer 2010, and BA/MA project AY 2010/2011.
19. Gordon Towne, UROP project “A Computer Vision Approach to Track Running Performance,” Summer 2010.

20. Eric Missimer, REU project “Automatic eye blink detection,” Summer 2009 – Summer 2010.
21. Rufat Mammadyarov, REU project “Hand gesture recognition,” Fall 2009.
22. David House, UROP project “Image Analysis of Microorganisms: Developing a System for the Detection, Segmentation, and Tracking of Cells and Cell Populations,” Summer and Fall 2008 and 2009.
23. Caitlin Connor, UROP project “Automated Initialization of HCI and Automated Recovery from Breakdown of HCI Features of Camera Mouse for Users with Severe Disabilities,” Summer and Fall 2008.
24. Emily Yu, Williams College, Computing Research Association Distributed Mentor Project “Improving the Camera Mouse,” Summer 2008.
25. Jacqueline Crescimanno, REU project “Stereo Reconstruction of Bat Flight,” Summer 2008.
26. Eric Immermann, BA’08, “EcoTracker Software,” Spring 2007–2008.
27. Maria Shugrina, BA’07, “Animate!” A program that enables people with disabilities to create animations of an anthropomorphic figure. Spring 2007. Now software engineer at Google, New York, NY.
28. Maria Shugrina, “Empathic Painting: Interactive stylization through observed emotional state.” Spring-Fall 2006.

#### **Doctoral Thesis, Examining Committee Member**

- Geetha M., “Methodology for Continuous Sign Language Recognition with Focus on Movement Epenthesis Segmentation,” Amrita School of Engineering, India, August 2019 (reader).
- Xingchao Peng, “Synthetic-to-Real Adaptation for Object Detection,” August 2019
- Jacob Harer, “Improved Neural Machine Translation Systems for Low Resource Correction Tasks,” July 2019 (3rd reader and committee chair)
- Hanwen Wu, “Session Types in Practical Programming,” September 2018 (Chair).
- Sarah A. Bargal, “Grounding Deep Models of Visual Data,” November 30, 2018 (2nd reader).
- Huijuan Xu, “Vision and Language Understanding with Localized Evidence,” September 2018 (2nd reader).
- Kun He, “Learning Deep Embeddings by Learning to Rank,” September 2018 (Chair).
- Fatih Cakir, “Online Hashing for Fast Similarity Search,” May 2017 (2nd reader).
- Qinxun Bai, January 2017 (3rd reader).
- Jianming Zhang, “Visual Saliency Computation for Image Analysis,” September 2016 (2nd reader).
- Shugao Ma, “Learning Space-time Structures for Human Action Recognition and Localization,” May 2016 (2nd reader).
- Jonathan Wu, “Gesture Passwords: Concepts, Methods, and Challenges.” May 2016 (3rd reader).
- Matthew Walker, “Analysis of Fibroblast Morphology and Migration on Bioengineered Substrata Aided by Machine Vision and Learning Techniques,” May 2013 (4th reader).
- Vitaly Ablavsky, “Layers of Graphical Models for Tracking and Action Recognition,” March 2011 (2nd reader).

- Tai-Peng Tian, “Efficient Discrete Optimization for Large State Space Pictorial Structures with Non-Tree Graphs,” January 2011 (Chair and 5th reader)
- Mingyan Shao, “Feature Analysis of Diagrams with Applications to Retrieval and Classification,” Northeastern University, May 2010 (2nd reader)
- Rui Li, “Switching Dynamic Global Coordination Model,” January 2010 (2nd reader)
- Panagiotis Papapetrou, “Embedding-Based Subsequence Matching,” January 2010 (3rd reader)
- Quan Yuan, “Learning of a Family of Detectors,” January 2010 (2nd reader)
- Kyle Burke, “Science for Fun: New Impartial Board Games,” May 2009 (2nd reader)
- Michael Ocean, “The Sensor Network Workbench: Towards Functional Specification, Verification and Deployment of Constrained Distributed Systems,” January 2009 (4th reader)
- Jason Horn, “Nightly and Seasonal Behavior of Bats in the Atmosphere Assessed with Thermal Infrared Imaging and NEXRAD Doppler Radar,” May 2007 (2nd reader)
- Vassilis Athitsos, “Learning Embeddings for Indexing, Retrieval, and Classification, with Applications to Object and Shape Recognition in Image Databases,” May 2006 (3rd reader)
- Jonathan Alon, “Spatiotemporal Gesture Segmentation,” May 2006 (2nd reader)
- John Isidoro, “Stochastic Mesh-based Multiview Reconstruction,” May 2004 (2nd reader)
- Romer Rosales, “The Specialized Mappings Architecture, with Applications to Vision-Based Estimation of Articulated Body Pose,” January 2002 (4th reader)
- Lifeng Liu, “Shape Model-Based Region Grouping, a Method for Deformable Object Detection and Retrieval,” January 2001 (reader)

#### **Master’s Thesis, Examining Committee Member**

- Harish Sathishchandra, “Compressive Sensing-based Reconstruction of Lissajous-like Nodding LIDAR data,” (3rd reader)
- He Kun, “Stochastic Functional Descent for Learning Support Vector Machines,” August 2013 (2nd reader)
- Gokberk Cinbis, “Learning Actions from the Web,” September 2010 (2nd reader)
- Alexandra Stefan, “Indexing Methods for Efficient Multiclass Recognition,” September 2008 (2nd reader)
- Luke Skelly, “Rotation Invariant 3D Feature Description,” May 2007 (2nd reader)

#### **Bachelor’s Thesis, Examining Committee Member**

- Kunihiko Ken Hayakawa, “Made in our Image: Japanese and Western Views of Robots and Their Creators,” May 2006 (2nd reader)

### **STUDENT AWARDS**

PhD student Mona Jalal won the 2019 Hariri Institute for Computing Graduate Student Fellowship which recognizes outstanding PhD students who pursue computational and data-driven research at Boston University.

PhD student Wenxin Feng received the Department of Computer Science Teaching Fellow Excellence Award for 2017/2018.

PhD student Wenxin Feng and her team at the startup Pison Technolgy won the Assistive Technology Challenge in December 2016. The \$400,000 award was given by two teams by the ALS Association and Price4Life. Wenxin’s team was praised for creating a “motionless communication and control system for people with ALS and other neuromuscular conditions. It will allow a person with little to no movement ability to have full control of a laptop, a phone, and home robotics 24/7.” Wenxin is responsible for designing and implementing the interaction software.

PhD student Danna Gurari won the 2014/2015 Boston University Computer Science Research Excellence Award.

PhD student Ajjen Joshi won the 2014/2015 Boston University Computer Science Teaching Excellence Award.

Ph.D. advisees Danna Gurari, Diane Theriault and Mehrnoosh Sameki were authors of the paper “How to use level set methods to accurately find boundaries of cells in biomedical images? Evaluation of six methods paired with automated and crowdsourced initial contours,” which won the “Best Paper Award for Innovative Idea” at the MICCAI Workshop on Interactive Medical Image Computation (IMIC) in September 2014. BU Announcement.

Ph.D. student Danna Gurari and MA. student Seule Ki Kim were first and second authors on the paper “SAGE: An Approach and Implementation Empowering Quick and Reliable Quantitative Analysis of Segmentation Quality,” which won a “Best Paper Award” at the IEEE Workshop on the Applications of Computer Vision (WACV) in Clearwater, Florida, in January 2013. This was one of two awards selected among 161 submitted and 75 accepted papers at WACV.

Ph.D. advisee Zheng Wu won the Boston University Computer Science Department’s Research Achievement Award for 2011–2012 for his contributions to “video-based multi-object tracking.” BU CS Award Announcement.

Ph.D. student Samuel Epstein won a 2011 Solomonoff Student Prize at the Fourth Conference on Artificial General Intelligence (AGI) for the co-authored paper “An Information Theoretic Representation of Agent Dynamics as Set Intersections,” August 2011.

MA student Christopher Kwan won the Graduate School of Arts and Sciences Award on his work entitled “Camera Canvas: Image Editing Software for People with Disabilities,” Boston University Science Day, March 2011. Award Announcement

Undergraduate research assistant Christopher Kwan won the 2nd Place Poster Award at the Boston University Undergraduate Research Symposium for the presentation *Camera Canvas: Image Editing Software for People with Disabilities* in Fall 2010. UROP News.

Undergraduate research assistant David House won the “Best Poster Award” at the Boston University Undergraduate Research Symposium for the presentation of *Image Analysis of Microorganisms: Developing a System for Tracking Cell Populations* in Fall 2009. BU CAS Magazine.

Undergraduate research assistant Caitlin Connor was selected the 2008 Clare Boothe Luce Summer Research Fellow.

Undergraduate research assistant Maria Shugrina won the Boston University “College Prize for Excellence in Computer Science” in May 2007.

Ph.D. advisee Jingbin Wang won the Boston University Computer Science Department’s Research Achievement Award for 2006–2007. BU CS Announcement.

Undergraduate research assistant Benjamin Waber won the Boston University Computer Science Department “Research Achievement Award” in May 2006.

Research assistant Michael Chau won the Boston University “College Prize for Excellence in Computer Science” in May 2005.

Boston University President’s Award for Science and Technology to Betke’s graduate student Angshuman Bagchi for *Tracking Large Variable Numbers of Objects in Clutter*, selected from more than 150 contenders, March 2005. BU Research Spotlight.

Lubee Bat Conservancy Award at the 33rd Annual North American Symposium on Bat Research to Betke’s undergraduate student Diane E. Hirsh for the outstanding oral presentation on *Censusing Brazilian Free-tailed Bats Using Infrared Thermal Imaging and Computer Vision Methods*, October 2003. Award Report. She also won the Boston University Computer Science Department “Academic Achievement Award” in May 2004.

Boston University Chancellor’s Award for Science and Technology to Betke’s graduate student Stephen Crampton for *Counting Fingers in Real Time: A Webcam-based Human-Computer Interface with Game Applications*, selected from 165 contenders, March 2003. BU Research.

Boston University Provost’s Award for Science and Technology to Betke’s graduate student Harrison Hong for *Automatic 3D Registration of Lung Surfaces in Computed Tomography Scans*, selected from more than 120 contenders, March 2002. BU Bridge.

## MENTORING AND OUTREACH

Mentor for postdoctoral researcher Randa Elanwar, 2015–present. Sponsored by the Cairo Initiative Scholarship Program of the U.S.–Egypt Higher Education Initiative.

Mentor of Associate Professor John J. Magee, Department of Computer Science, Clark University, MA, 2012–.

Mentor of Assistant Professor Emily Whiting, Department of Computer Science, Boston University, 2017–2020.

Mentor of Associate Professor Rosina Georgiadis, Department of Chemistry, Boston University, Boston University, 2019–2020.

Co-Host of about 15 middle school children who visited the BU CS Department on a field trip during the Driscoll Science Solstice Day, December 17, 2018.

Lecturer for Artemis project, a five-week summer day camp for twenty 9th grade girls who are interested in exploring computer science, June 2012, July 2013, July 2017, and July 2018

Supervised PhD student Ajjen Joshi in developing “Interactive Projections” for the Experimental Performance “Victory Over the Sun: The First Futurist Opera” by Aleksei Kruchenykh, directed by Anna Winestein, in collaboration with Yuri Corrigan, Assist. Prof. of Russian and Comparative Literature, and Minou Arjomand, Assist. Prof. of English, Boston, MA, April 23, 2015.

Mentor for six computer science undergraduate students attending the 2014 Grace Hopper Celebration of Women in Computing conference, Phoenix, AZ, October 2014.

Panelist for the Massachusetts Institute of Technology EECS Postdoc Career Workshop, “Academic Life” Cambridge, MA, January 30, 2014.

Mentor on proposal writing, in particular, NSF Career Grants, for junior faculty at Sargent College, Boston University, June 11, 2013. Helped secure a NSF Career grant for Assistant Professor Cara Stepp, Sargent College and Hariri Junior Faculty Fellow, Boston University, awarded in December 2014.

Mentor for Christopher Hung in the Boston University “Research Internship in Science & Engineering” summer program for high school students. Summer 2013.

Mentor for postdoctoral researcher Zheng Wu, 2012–2013.

Lecture on “Fostering Interest in Computer Science via Computer Vision Case Studies” at the Workshop “Counselors for Computing” by the National Center for Women and Information Technology, Boston, November 2012.

Lecturer and host for Boston University Workshop on “Designing Leadership – Celebrating Creativity and Innovation,” September 24, 2011.

Lecturer and host for a laboratory visit of the Artemis project, a five-week summer day camp for twenty 9th grade girls who are interested in exploring computer science. Summer 2011.

Director of Undergraduate Studies. Advised undergraduate students in computer science and other disciplines. This involved discussion of the student’s current and past course performance, course selection for the upcoming semester, course substitutions and credit transfer, career opportunities, continued education in graduate programs, scholarships, etc.

Mentor for the women students in the Computer Science Department. During AYs 2000–2009, Prof. Betke was the only female faculty member in the Computer Science Department at Boston University. She organizes meetings with the students and provides them with information about fellowship programs for women, support networks, career opportunities, conferences, etc.

Host for visit of 20 high school students in the “Pathways to Science” one-week summer program at Boston University to the Image and Video Computing laboratory in 2007– 2018.

Host for the visit of 20 middle school girls in the Tech Savvy Camp at Boston University to Image and Video Computing laboratory, July 2010.

Panelist, “Women in Networks: Pre-tenure Mentoring Panel,” Boston University, Fall 2009.

Mentor, Collaborative Research Opportunity for Undergraduate Women (CREW) Project, Computing Research Association, AY 2002/3 and 2003/4.



Mentor, CRA-W Distributed Mentor Project, Computing Research Association's Committee on the Status of Women in Computing Research, Summer 2002 and Summer 2003.

Supervisor for the senior thesis of high school student Tameem Hasan, Boston University Academy, 2002/2003.

Organizer and Mentor, Pathways to Science, one-day visit of hundreds of female public high school students in Massachusetts at Boston University, 2001–2003.

Panelist for the Massachusetts Institute of Technology 2002 Seminar Series on Academic Careers: "Why Choose an Academic Career?" Cambridge, MA, June 2002.

Lecturer, GirlTECH's TeacherTECH'01 Workshop for increasing the participation of inner-city girls in science, mathematics, and technology, Summer 2001.

Co-Host, Belmont Brownie Troop 19-19, November 2002, and Belmont GirlScouts, May 2005, May 2009, and November 2010.

## **SERVICE TO PROFESSION**

### **Editorship**

Associate Editor, Editorial Board of the journal *IEEE Transactions on Pattern Analysis and Machine Intelligence* (PAMI), August 2016–present.

Associate Editor, Editorial Board of the journal *Computer Vision and Image Understanding* (CVIU), August 2016–present.

Co-Editor, 2011–2012. Special issue "Assistive Environments for the Disabled and Senior Citizens: Theme Issue of the PETRA 2010 and 2011 Conferences" of the journal *Personal and Ubiquitous Computing*, January 2014 (online November 4, 2012).

Co-Editor, 2013. Special issue "Animal and Insect Behaviour Understanding in Image Sequences," *EURASIP Journal on Image and Video Processing*. Published online August 12, 2013.

Co-Editor, 2011–2013. Special issue "Pervasive technologies and assistive environments: Cognitive systems for assistive environments: Special issue of PETRA 2010 and 2011 conferences" in the *International Journal Universal Access in the Information Society*. Published online, July 19, 2013.

### **Chair of Program Committees**

Area Chair, IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2022), November 2021–June 2022.

Workshop Co-Chair, IEEE Winter Conference on Applications of Computer Vision (WACV), July 2021–February 2022.

Workshop Co-Chair, IEEE Winter Conference on Applications of Computer Vision (WACV), July 2020–February 2021.

Area Chair, IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2020), November 2019–June 2020.

Program Committee Chair, The Academic Data Science Alliance (ADSA) 2019 Leadership Summit, November 2018–November 2019.

Area Chair, IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2018), November 2017–June 2018.

Area Chair, IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2017), November 2016–June 2017.

Program Committee Chair, The 7th International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), Rhodes, Greece, May 2014.

Program Committee Chair, The 6th International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), Rhodes, Greece, May 2013.

Program Committee Chair, The 5th International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), Crete, Greece, June 2012.

Program Committee Chair, The 4th International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), Crete, Greece, May 2011.

Workshop Co-Chair, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Columbus, Ohio, June 2014.

Organizing Chair, IEEE International Workshop on Cues in Communication, Cues 2001.

### **Member of Technical Program Committees**

The Academic Data Science Alliance (ADSA) 2020 Leadership Summit

International Conference on Pervasive Technologies Related to Assistive Environments (PETRA) 2016, 2017, 2021, 2022, 2023

IEEE Workshop on Perception Beyond the Visible Spectrum (PBVS) 2013, 2015, 2016, 2017, 2018, 2019, 2022, 2023

International Workshop on Visual Observation and Analysis of Vertebrate and Insect Behavior (VAIB) 2014, 2016, 2022

HCOMP 2019: The 7th AAAI Conference on Human Computation and Crowdsourcing

CVPR 2018 Workshop and Challenge: Automated Analysis of Marine Video for Environmental Monitoring

Workshop on Computer Vision for Microscopy Image Analysis (CVMI) at CVPR 2016, 2017, 2018, 2019

IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2003, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014

European Conference on Computer Vision (ECCV) 2010, 2014

IEEE International Conference on Computer Vision (ICCV) 2003, 2005, 2007, 2009

The Eleventh IEEE International Conference on Automatic Face and Gesture Recognition (FG), 2015

Workshop on Automated Analysis of Video Data for Wildlife Surveillance (AVDWS), 2015, 2016

International Conference on Universal Access in Human-Computer Interaction (UAHCI) 2011, 2012

International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) 2004, 2007, 2008, 2009, 2010

The International Conference on Human Computer Interaction (HCI International) 2011, 2013, 2014

International Conference on Pattern Recognition (ICPR) 2006, 2010, 2014

IEEE International Workshop on Human Computer Interaction (HCI) 2007

IEEE International Conference on Image Processing (ICIP) 2003, 2004, 2005

The 12th European AAATE Conference by the Association for the Advancement of Assistive Technology in Europe, 2013

International Workshop on Video and Image Ground Truth for Computer Vision Applications (VIGTA) 2013

3rd ACM International Regular-Data Challenge Workshop on Multimedia Analysis of Ecological Data (MAED) 2014

International Workshop on Visual Observation and Analysis of Animal and Insect Behavior (VAIB) 2012

IEEE Workshop on Projector-Camera Systems (ProCams) 2006, 2007

IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2005

IEEE ICCV Workshop on Computer Vision for Biomedical Image Applications 2005

IEEE Workshop on Applications of Computer Vision (WACS) 2005

4th Indian Conference on Computer Vision, Graphics, and Image Processing (ICVGIP) 2004

IEEE Workshop on Articulated and Nonrigid Motion (ANM) 2004

IEEE Symposium on Bioinformatics and Bioengineering (BIBE) 2003

IEEE Workshop on Motion and Video Computing (WMVC) 2002

IEEE Intelligent Vehicles Symposium (IV) 2000.

## Other Professional Service

- Reviewer, U.S. Israel Binational Science Foundation grant proposal, March 2022.
- Member, Site Visit Review Panel, Insight Science Foundation Ireland Research Centre for Data Analytics, National University of Ireland, Fall 2021.
- Reviewer, Grant proposal, AI Singapore, National Research Foundation, Singapore, November 2021.
- Advisory Board Member for the NSF-funded “Growing Convergence Research” project *Understanding virus evolution through deep Raman spectroscopy* led by Mauricio Terrones, Department of Physics, The Pennsylvania State University
- Evaluator, U.S. permanent residency applications for outstanding researchers, 2012–present
- Full professor promotion evaluator, external, Fall 2021
- Tenure evaluator, external cases, Summer and Fall 2021
- Tenure evaluator, internal, Fall 2020
- Member of the Faculty Search Committee, University of Luxembourg, June 2020
- Tenure evaluator, external, October 2019
- Tenure evaluator, external, September 2019
- Interviewee “Executive Order on Maintaining American Leadership in Artificial Intelligence,” Boston University Public Relations, May 1, 2019
- Tenure evaluator, external, May 2019
- Tenure evaluator, internal, 2018–2019
- Center Director evaluator, January 2019
- Full professor promotion evaluator, 2018
- Co-sponsor and speaker, 2019 Workshop on Human Community and Perpetual Contact
- Co-sponsor and speaker, 2019 Workshop on Should Robots Be Our Friends. Ethical and social scientific implications of the growing emotional engagement of humans with AI agents and robots
- Tenure evaluator, external, April 2018
- Reviewer of research programs at a foreign university. Review process was conducted by the Oak Ridge Associated Universities (ORAU), 2012–2016, 2018, and twice in 2019.
- Reviewer, American Institute of Biological Sciences, April 2017.
- Promotion evaluator, internal, September 2017
- Promotion evaluator, external, September 2016
- Ad hoc Reviewer, National Science Foundation, 2016 and 2017.
- Reviewer, National Academies for Science, Engineering, and Medicine, September 2014.
- Promotion evaluator, external, May 2015
- Tenure evaluator, external, October 2009
- Member, Site Visit Panel of the National Science Foundation, May 2002.
- Member, National Science Foundation Panels, 1999, 2000, 2001, 2003, 2004, 2005, 2007, 2008, 2010, 2012, 2014, 2015
- Reviewer, Dutch National Science Foundation, May 2007.
- Member, Bat Working Group, National Center for Ecological Analysis and Synthesis, January 2003–2009.
- Session Chair, International Conference on Universal Access in Human-Computer Interaction (UAHCI) 2011, The 3rd International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), June 2010, The 2nd International Conference on Pervasive Technologies Related to Assistive Environments (PETRA), June 2009, IEEE Computer Society Workshop on Mathematical Methods in Biomedical Image Analysis, June 2009, IEEE Workshop on Applications in Computer Vision, December 2002.

- Reviewer for Journals:
  - Algorithmica
  - Annals of Biomedical Engineering
  - Assistive Technology
  - Autonomous Robots
  - Behavior & Information Technology
  - Biological Cybernetics Review
  - British Journal of Applied Science & Technology
  - Computer Aided Surgery
  - Computer Vision and Image Understanding
  - Ecological Informatics
  - EURASIP Journal on Image and Video Processing
  - IEEE Transactions on Education
  - IEEE Transactions on Human-Machine Systems
  - IEEE Transactions on Information Theory
  - IEEE Transactions on Intelligent Transportation Systems
  - IEEE Transactions on Robotics and Automation
  - IEEE Transactions on Medical Imaging
  - IEEE Transactions on Pattern Recognition and Machine Intelligence
  - IEEE Transactions on Vehicular Technology
  - IEE Proceedings – Vision, Image and Signal Processing
  - Image and Video Computing
  - Information and Computation
  - Integrated Computer-Aided Engineering
  - Interacting with Computers
  - International Journal of Computer Vision
  - International Journal on Human-Computer Interaction
  - International Journal of Pattern Recognition and Artificial Intelligence
  - Iranian Journal of Electrical and Computer Engineering
  - Journal of Field Robotics
  - Journal of Zhejiang University – Science
  - Machine Vision and Applications
  - Medical Image Analysis
  - Medical Physics
  - Methods in Oceanography
  - Multimedia Systems Journal
  - Neurocomputing
  - Optics Letters
  - Pattern Recognition Letters
  - Proceedings of the IEEE
  - Proceedings A, The Royal Society
  - Real-Time Imaging
  - Sensors
  - Signal, Image and Video Processing
  - Transactions on Accessible Computing
  - Universal Access in the Information Society
- Reviewer for Conferences:

ACM Conference on Human Factors in Computing Systems (CHI) 2016, IEEE International Conference on Robotics and Automation (ICRA) 1999, 2003, IEEE Computer Vision and Pattern Recognition Conference (CVPR) 2001, Sixth International Conference on Computer Vision (ICCV) 1998, Annual ACM Conference on Computational Learning Theory (COLT) 1993, 1996, 1995, 1997, 4th Workshop on Computational Learning and Natural Learning (CLNL) 1993.

## INSTITUTE AND CENTER AFFILIATIONS

Data Science Faculty Fellow of the Boston University Rafik B. Hariri Institute for Computing and Computational Science and Engineering, September 2018.

Faculty Member of the Center for Systems Neuroscience at Boston University since 2019.

Faculty Affiliate of the Boston University Rafik B. Hariri Institute for Computing and Computational Science and Engineering since 2011.

Participating Faculty at the Boston University Center for Reliable Information Systems and Cyber Security (RISCS) since 2005.

Faculty Associate at the Boston University Center for Ecology and Conservation Biology (CECB) since 2004.

## UNIVERSITY SERVICE

Co-Director of the Boston University Artificial Intelligence Research (AIR) Initiative	2017–present
Member of the “BU Strategic Planning Task Force,” charged by Provost Morrison	2018–2020
Member of the Data Science Faculty Fellow Advisory Committee, charged by Director Bestavros	2018–2019
Member of the “Envision BU Data Sciences” Committee, charged by President Brown	2018–2019
Member of the Search Committee for the Dean of the BU College of Communications, charged by Provost Morrison	2018–2019
Member of the Graduate Academic Affairs Committee, Graduate School of Arts and Sciences, charged by Graduate School Dean Hughes	2014–2017
Member of the Office of the Provost Committee on Senior Faculty Hiring, charged by Provost Morrison	2013–present
Member of the Executive Steering Committee of the Boston University Rafik B. Hariri Institute for Computing and Computational Science and Engineering	2010–2017
Member of the Committee for the Provost Faculty Hiring Initiative in Data Science	2014–2016
Participant of the Academic Program Review Process, Department of Biology	3/2013
Member of the Teaching & Learning Technologies Governance Committee	2010–2012
Member of the Faculty Advisory Committee for the Undergraduate Research Opportunity Program (UROP)	2006–2009
Chair, Women in Science and Engineering (WISE) Faculty Group	2008–2009
Member, faculty focus group on restructuring of BU’s research administration	12/2009
Member of the Search Committee for the Boston University Vice President of Information Systems and Technology	2008–2009
Speaker and Panel Leader, College of Arts and Sciences Leadership Advisory Board meeting	10/2008

Speaker, College of Arts and Sciences “CAS 101” meeting with The Office of Development and Alumni Relations	1/2008
Member of the University Appointment, Promotion and Tenure Committee (UAPT)	2007–2008
Co-Chair, Women in Science and Engineering (WISE) Faculty Group	2007–2008
Alternate Member of the Faculty Council	2002–2007
Faculty Advisor during Summer Academic Orientation	2005, 2007
Speaker, Spring Open House, College of Arts and Sciences	2007, 2008
Member of the “Institute for the Environment and Global Health” Planning Committee	2006
Member of the Faculty Search Committee, Metropolitan College	2002–2003
Member of the Pathways Planning Committee	2001–2003

### **SERVICE TO COMPUTER SCIENCE DEPARTMENT**

Director of MS in AI Program	2019–2021
Member of the Tenure & Promotion Committee	2020
Director of Graduate Studies	2014–2020
Admissions Director of the “Master in Artificial Intelligence” program	2019–2021
Chair of the “Professor of the Practice in AI” Search Committee	2019–2021
Member of the 5-Year Merit Review Committee for Research Faculty	2019
Co-Chair of the Computer Vision Doctoral Written Examination Committee	2001–present
Developer of the “Master in Artificial Intelligence” program	2018–2019
Chair of the Faculty Search Committee	2014–2015
Associate Chair	2009–2012
Member of the New Building Planning Committee	2011–2013
Member of the Annual Faculty Merit Review Committee	2002, 2003, 2009, 2013
Member of the CS Distinguished Alumni Award Selection Committee	2009
Director of Undergraduate Studies	2004–2006, 2007–2008
Member, Committee to Study Enrollments in Computer Science Courses	2007–2008
Member of the Faculty Search Committee	2001, 2004, 2005, 2007
Chair of the Space Committee	2001–2004
Member, Committee for the Selection of the Graduate Research Excellence Award	Spring 2004, 2014–present
Member of the Outreach and Public Relations Committee	2003–2004
Member of the Sensorium Acquisition and Hiring Committee	2003
Member of the Planning Committee for the New Computer Science Building	2000–2002
Computer Science Colloquium Chair	2000–2001

### **SERVICE TO FACULTY OF COMPUTING AND DATA SCIENCE**

Member of the Executive Committee	2021–present
Member of the Faculty Search Committee	2021–present