

Walter J. Scheirer

Dept. of Computer Science & Engineering
University of Notre Dame
Stinson-Remick Hall of Engineering
Room 321C
Notre Dame, IN 46556

Phone: (574) 631-2436
Fax: (574) 631-9260
walter.scheirer@nd.edu
<http://www.wjscheirer.com>
Google Scholar Profile: <http://goo.gl/tmFCY>

Education

University of Colorado, Colorado Springs, CO

Ph.D. in Engineering, Concentration in Computer Science, May 2009

Thesis Title: *Improving the Privacy, Security, and Performance of Biometric Systems*

Advisor: Prof. Terrance Boulton

Lehigh University, Bethlehem, PA

M.S. in Computer Science, January 2006

Thesis Title: *Syntax Versus Semantics: Two Competing Approaches to Dynamic Network Intrusion Detection Systems*

B.A., *cum laude*, in Computer Science and International Relations, June 2004

Research Interests

Primary interests in Computer Vision, Machine Learning, Biometrics, and Digital Humanities. Specific areas of research include Open Set Recognition, Extreme Value Theory Models for Visual Recognition, Biologically-inspired Learning Algorithms, and Stylometry.

Work Experience

Assistant Professor July 2015 – Present
University of Notre Dame Notre Dame, IN
Tenure-track appointment in the Department of Computer Science & Engineering. Affiliated with the Computer Vision Research Laboratory. Leading research connected to the fundamental problem of recognition in sensory processing and language understanding. Teaching courses related to computer vision, machine learning and security.

Research Associate July 2015 – Present
Harvard University Cambridge, MA
Appointment in the Department of Molecular & Cellular Biology. Affiliated with the CoxLab. Working with experimentalists to design wet lab experiments and process data from behavioral measurements and 2-photon microscopy in rodents to support the development of biologically-informed machine learning algorithms.

Postdoctoral Fellow October 2012 – July 2015
Harvard University Cambridge, MA
Appointments in the Department of Molecular & Cellular Biology, School of Engineering and Applied Sciences, and Center for Brain Science, working with Prof. David Cox. Research includes investigating the computational underpinnings of visual object recognition, biologically-inspired approaches to machine learning, and parallel processing techniques for large-scale vision applications.

Assistant Professor Adjunct September 2009 – July 2015
University of Colorado, Colorado Springs Colorado Springs, CO
Conducted computer vision and digital humanities related research at the Vision and Security Technology Lab in the College of Engineering & Applied Science. Additional responsibilities included advising students, as well as raising research money.

Director of Research & Development August 2007 – September 2012
Securics, Inc. Colorado Springs, CO

Responsible for all research and development activities within Securics, Inc. Led advanced research in template protection systems for biometrics, multi-biometric fusion, and face recognition technology. Oversaw the design and implementation of commercial products utilizing the developed technology. Coordinated business development activities, which brought in over 4.1 million dollars in revenue.

Research Assistant August 2006 – January 2008
Vision and Security Technology Lab University of Colorado, Colorado Springs

Worked on the construction of a large scale, distributed steganography detection framework as part of an AFRL research program. Other work included the design and implementation of template protection systems for biometrics, and low-cost spectrometer design.

Research Assistant August 2004 – May 2006
Wireless Internet and Network Security Lab Lehigh University

Worked with Prof. Mooi Choo Chuah. Investigated dynamic approaches to network intrusion detection. As part of the DARPA DTN program, implemented security features to the bundle protocol for delay tolerant networks.

System Administrator June 2004 – August 2004
Department of Computer Science and Engineering Lehigh University

Deployed hardware development tools (Cadence, Mentor Graphics, ISE Tools) on a research network. Maintained a heterogeneous (Unix/Microsoft) network environment.

Research Assistant May 2002 – June 2004
Vision and Software Technology Lab Lehigh University

Worked with Prof. Terrance Boulton, CSE department chair. Carried out a large-scale biometric security experiment involving facial recognition under varying weather conditions. Implemented a network interface for an experimental vision tracking system. Created custom vision tracking security systems for a private vendor.

Publications

Journal Articles

J.1. A. Rocha, W. Scheirer, C. Forstall, T. Cavalcante, A. Theophilo, B. Shen, A. Carvalho, E. Stamatatos, “Authorship Attribution for Social Media Forensics,” to appear in *IEEE Transactions on Information Forensics and Security (T-IFS)*, accepted for publication in August 2016.

J.2. M. Joesch, D. Mankus, M. Yamagata, A. Shahbazi, R. Schalek, A. Suissa-Peleg, M. Meister, J. Lichtman, W. Scheirer, and J. Sanes, “Reconstruction of Genetically Identified Neurons Imaged by Serial-Section Electron Microscopy,” *eLife*, Vol. 5, e15015, 2016.

J.3. W. Scheirer, C. Forstall, and N. Coffee, “The Sense of a Connection: Automatic Tracing of Intertextuality by Meaning,” appears in *Digital Scholarship in the Humanities (DSH)*, Vol. 31, No. 1, April 2016.

J.4. A. Rattani, W. Scheirer, and A. Ross, “Open Set Fingerprint Spoof Detection Across Novel Fabrication Materials,” appears in *IEEE Transactions on Information Forensics and Security (T-IFS)*, Vol. 10, No. 11, November 2015.

J.5. W. Scheirer, L. Jain and T. Boulton, “Probability Models for Open Set Recognition,” appears in *IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI)*, Vol. 36, No. 11, November 2014.

J.6. M. Milford, E. Vig, W. Scheirer, and D. D. Cox, “Vision-based SLAM in Changing Outdoor Environments,” appears in the *Journal of Field Robotics (JFR)*, Vol. 31, No. 5, September / October 2014.

J.7. W. Scheirer, S. Anthony, K. Nakayama and D.D. Cox, “Perceptual Annotation: Measuring Human Vision to Improve Computer Vision,” appears in *IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI)*, Vol. 36, No. 8, August 2014.

J.8. W. Scheirer, M. Wilber, M. Eckmann and T. Boulton, “Good Recognition is Non-Metric,” appears in *Pattern Recognition*, Vol. 47, No. 8, August 2014.

J.9. F. Costa, E. Silva, M. Eckmann, W. Scheirer and A. Rocha, “Open Set Source Camera Attribution and Device Linking,” appears in *Pattern Recognition Letters (PRL)*, Vol. 39, April 2014.

J.10. W. Scheirer, A. Rocha, A. Sapkota and T. Boulton, “Towards Open Set Recognition,” appears in *IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI)*, Vol. 35, No. 7, July 2013.

J.11. W. Scheirer, A. Rocha, J. Parris and T. Boulton, “Learning for Meta-Recognition,” appears in *IEEE Transactions on Information Forensics and Security (T-IFS)*, Vol. 7, No. 4, August 2012.

J.12. A. Rocha, W. Scheirer, T. Boulton and S. Goldenstein, “Vision of the Unseen: Current Trends and Challenges in Digital Image and Video Forensics,” appears in *ACM Computing Surveys*, Vol. 33, No. 4, October 2011.

J.13. C. Forstall, S. Jacobson and W. Scheirer, “Evidence of Intertextuality: Investigating Paul the Deacon’s *Angustae Vitae*,” appears in *Literary and Linguistic Computing (LLC)*, Vol. 26, No. 3, September 2011.

J.14. W. Scheirer, A. Rocha, R. Micheals and T. Boulton, “Meta-Recognition: The Theory and Practice of Recognition Score Analysis,” appears in *IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI)*, Vol. 33, No. 8, August 2011.

J.15. W. Scheirer and M. Chuah, “Syntax vs. Semantics: Competing Approaches to Dynamic Network Intrusion Detection,” appears in the *International Journal of Security and Networks (IJSN)*, Vol. 3 No. 1, 2008.

Refereed Conference Papers

C.1 V. Fragoso, W. Scheirer, J. Hespanha, and M. Turk, “One-Class Slab Support Vector Machine,” to appear at the *23rd International Conference on Pattern Recognition*, December 2016, Cancun, Mexico.

C.2 P. Jonathon Phillips, W. Scheirer, P. Flynn, C. Ding, G. Guo, V. Struc, M. Al Jazaery, K. Grm, S. Dobrisek, D. Tao, Y. Zhu, J. Brogan, S. Banerjee, A. Bharati, and B. RichardWebster, “Report on the BTAS 2016 Video Person Recognition Evaluation,” oral presentation at the *Eighth IEEE International Conference on Biometrics: Theory, Applications, and Systems (BTAS 2016)*, September 2016, Niagara, NY.

C.3 L. Jain, W. Scheirer and T. Bout, “Multi-Class Open Set Recognition Using Probability of Inclusion,” presented at the *13th European Conference on Computer Vision (ECCV 2014)*, September 2014, Zurich, Switzerland.

- C.4. M. Milford, W. Scheirer, E. Vig, A. Glover, O. Baumann, J. Mattingley and D.D. Cox, "Condition-Invariant, Top-Down Visual Place Recognition," oral presentation at the *IEEE International Conference on Robotics and Automation (ICRA 2014)*, June 2014, Hong Kong, China.
- C.5. M. Milford, E. Vig, W. Scheirer and D.D. Cox, "Towards Condition-Invariant, Top-Down Visual Place Recognition," presented at the *Australasian Conference on Robotics and Automation (ACRA 2013)*, December 2013, Sydney, Australia. Best Paper Finalist.
- C.6. R.C. Johnson, T. Boulton and W. Scheirer, "Voice Authentication Using Short Phrases: Examining Accuracy, Security and Privacy Issues," oral presentation at the *Sixth IEEE International Conference on Biometrics: Theory, Applications, and Systems (BTAS 2013)*, September 2013, Washington D.C. Best Reviewed Paper.
- C.7. B. Heflin, W. Scheirer and T. Boulton, "Detecting and Classifying Scars, Marks, and Tattoos Found in the Wild," oral presentation at the *Fifth IEEE International Conference on Biometrics: Theory, Applications, and Systems (BTAS 2012)*, September 2012, Washington D.C.
- C.8. F. Costa, M. Eckmann, W. Scheirer and A. Rocha, "Open-set Source Camera Attribution," presented at *Sibgrapi 2012 (XXV Conference on Graphics, Patterns and Images)*, August 2012, Ouro Preto, Brazil. Best Student Paper Award.
- C.9. W. Scheirer, N. Kumar, P. Belhumeur and T. Boulton, "Multi-Attribute Spaces: Calibration for Attribute Fusion and Similarity Search," presented at the *IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2012)*, June 2012, Providence, RI.
- C.10. W. Scheirer, N. Kumar, K. Ricanek, P. Belhumeur and T. Boulton, "Fusing with Context: a Bayesian Approach to Combining Descriptive Attributes," oral presentation at the *International Joint Conference on Biometrics (IJCB 2011)*, October 2011, Washington D.C.
- C.11. B. Heflin, B. Parks, W. Scheirer and T. Boulton, "Single Image Deblurring for a Real-Time Face Recognition System," oral presentation at the *36th Annual Conference of the IEEE Industrial Electronics Society (IECON 2010)*, November 2010, Phoenix, AZ.
- C.12. B. Heflin, W. Scheirer and T. Boulton, "Correcting Rolling-Shutter Distortion of CMOS Sensors using Facial Feature Detection," oral presentation at the *Fourth IEEE International Conference on Biometrics: Theory, Applications, and Systems (BTAS 2010)*, September 2010, Washington D.C. Best Student Paper Award Runner Up.
- C.13. V. Iyer, W. Scheirer and T. Boulton, "Face System Evaluation Toolkit: Recognition is Harder Than it Seems," presented at the *Fourth IEEE International Conference on Biometrics: Theory, Applications, and Systems (BTAS 2010)*, September 2010, Washington D.C.
- C.14. W. Scheirer, A. Rocha, R. Micheals and T. Boulton, "Robust Fusion: Extreme Value Theory for Recognition Score Normalization," presented at the *11th European Conference on Computer Vision (ECCV 2010)*, September 2010, Crete, Greece.
- C.15. C. Forstall and W. Scheirer "Features from Frequency: Authorship and Stylistic Analysis Using Repetitive Sound," oral presentation at the *4th Annual Chicago Colloquium on Digital Humanities and Computer Science*, Chicago, IL, November 2009.
- C.16. W. Scheirer, A. Rocha, B. Heflin and T. Boulton, "Difficult Detection: A Comparison of Two Different Approaches to Eye Detection for Unconstrained Environments," oral presentation at the *Third IEEE International Conference on Biometrics: Theory, Applications, and Systems (BTAS 2009)*, September 2009, Washington, D.C.

- C.17. W. Scheirer and T. Boulton, “Bipartite Biotokens: Definition, Implementation, and Analysis,” oral presentation at the *3rd IAPR/IEEE International Conference on Biometrics (ICB 2009)*, June 2009, Alghero, Italy.
- C.18. W. Scheirer and T. Boulton, “A Fusion Based Approach to Enhancing Multi-Modal Biometric Recognition System Failure Prediction and Overall Performance,” presented at the *Second IEEE International Conference on Biometrics: Theory, Applications, and Systems (BTAS 2008)*, September 2008, Washington, D.C.
- C.19. W. Scheirer and T. Boulton, “Bio-Cryptographic Protocols with Bipartite Biotokens,” oral presentation at the *2008 Biometrics Symposium*, held in conjunction with the *Biometrics Consortium Conference (BCC 2008)*, September 2008, Tampa, FL.
- C.20. W. Scheirer and T. Boulton, “Cracking Fuzzy Vaults and Biometric Encryption,” oral presentation at the *2007 Biometrics Symposium*, held in conjunction with the *Biometrics Consortium Conference (BCC 2007)*, September 2007, Baltimore, MD.
- C.21. T. Boulton, W. Scheirer and R. Woodworth, “Revocable Fingerprint Biotokens: Accuracy and Security Analysis,” presented at the *IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2007)*, June 2007, Minneapolis, MN.
- C.22. D. Lopresti, S. Maas, D. Drake, R. Kaushal, S. Hookway, W. Scheirer, M. Strohmaier and C. Wojciechowski, “A Bioinformatics Approach to Identify Recoding Events of A-to-I RNA Editing,” presented at the *Computational Systems Bioinformatics Conference*, August 2006, Palo Alto, CA.

Refereed Workshop Papers

- W.1. R.C. Johnson, W. Scheirer and T. Boulton, “Secure Voice Based Authentication for Mobile Devices: Vaulted Voice Verification,” presented at the *SPIE Defense, Security and Sensing Symposium*, May 2013, Baltimore MD.
- W.2. M. Wilber, W. Scheirer, P. Leitner, B. Heflin, J. Zott, D. Reinke, D. Delaney and T. Boulton, “Animal Recognition in the Mojave Desert: Vision Tools for Field Biologists,” presented at the *IEEE Workshop on Applications of Computer Vision (WACV 2013)*, January 2013, Clearwater Beach, FL. Best Paper Award (selected by conference attendees).
- W.3. M. Wilber, W. Scheirer and T. Boulton, “PRIVV: Private Remote Iris-authentication with Vaulted Verification,” presented at the *IEEE Computer Society Workshop on Biometrics*, June 2012, Providence, RI.
- W.4. B. Heflin, W. Scheirer and T. Boulton, “For Your Eyes Only,” presented at the *IEEE Workshop on Applications of Computer Vision (WACV 2012)*, January 2012, Breckenridge, CO.
- W.5. W. Scheirer, B. Bishop and T. Boulton, “Beyond PKI: The Biocryptographic Key Infrastructure,” oral presentation at the *IEEE International Workshop on Information Forensics and Security (WIFS 2010)*, December 2010, Seattle, WA.
- W.6. A. Sapkota, B. Parks, W. Scheirer and T. Boulton, “FACE-GRAB: Face Recognition with General Region Assigned to Binary Operator,” oral presentation at the *IEEE Computer Society Workshop on Biometrics*, June 2010, San Francisco, CA.
- W.7. V. Iyer, S. Kirkbride, B. Parks, W. Scheirer and T. Boulton, “A Taxonomy of Face Models for System Evaluation,” presented at the *IEEE Workshop on Analysis and Modeling of Faces and Gestures (AMFG 2010)*, June, 2010, San Francisco, CA.

W.8. W. Scheirer, R. White and T. Boulton, “Privacy Enhancement via Adaptive Cryptographic Embedding,” oral presentation at the *National Homeland Defense Foundation’s Emerging Technology Day*, October 2008, Colorado Springs, CO.

W.9. W. Scheirer, A. Bendale and T. Boulton, “Predicting Biometric Facial Recognition Failure With Similarity Surfaces and Support Vector Machines,” oral presentation at the *IEEE Computer Society Workshop on Biometrics*, June 2008, Anchorage, AK.

W.10. T. Boulton, W. Scheirer and R. Woodworth, “FAAD: Face at a Distance,” oral presentation at the *SPIE Defense and Security Symposium*, March 2008, Orlando FL.

W.11. W. Scheirer, S. Kirkbride and T. Boulton, “INSPEC²T: Inexpensive Spectrometer Color Camera Technology,” presented at the *IEEE Workshop on Applications of Computer Vision (WACV 2008)*, January 2008, Copper Mountain, CO.

W.12. W. Scheirer and M. Chuah, “Network Intrusion Detection with Semantics-Aware Capability,” oral presentation at the *2nd International Workshop on Security in Systems and Networks (SSN 2006)*, April 2006, Rhodes, Greece.

Book Chapters

B.1. W. Scheirer, B. Bishop and T. Boulton, “Beyond PKI: The Biocryptographic Key Infrastructure,” in P. Campisi editor, *Security and Privacy in Biometrics*. Springer-Verlag, 2013.

B.2. B. Heflin, W. Scheirer, A. Rocha and T. Boulton, “A Look at Eye Detection for Unconstrained Environments,” in P. Wang editor, *Pattern Recognition, Machine Intelligence and Biometrics*. Higher Education Press & Springer-Verlag, 2011.

B.3. T. Boulton and W. Scheirer, “Long Range Facial Image Acquisition and Quality,” in M. Tistarelli, S. Li and R. Chellappa, editors, *Biometrics for Surveillance and Security*. Springer-Verlag, 2009.

Edited Volumes

E.1 I. Kakadiaris, A. Kumar and W. Scheirer (eds.), *Biometric and Surveillance Technology for Human and Activity Identification XII*, Proc. of SPIE Vol. 9457, 2015.

E.2 I. Kakadiaris, W. Scheirer and C. Busch (eds.), *Biometric and Surveillance Technology for Human and Activity Identification XI*, Proc. of SPIE Vol. 9075, 2014.

E.3 I. Kakadiaris, W. Scheirer and L. Hasebrook (eds.), *Biometric and Surveillance Technology for Human and Activity Identification X*, Proc. of SPIE Vol. 8712, 2013.

Monographs

M.1 W. Scheirer, “Extreme Value Theory-based Methods for Visual Recognition,” forthcoming from Morgan & Claypool in 2016.

M.2 C. Forstall and W. Scheirer, “Quantitative Intertextuality,” forthcoming from Springer-Verlag in 2016.

Non-Refereed Papers

N.1 A. Rocha and W. Scheirer, “Large-Scale Learning for Media Understanding,” Editorial introducing special issue of same name in *EURASIP Journal on Image and Video Processing*, Vol. 2015.

N.2 W. Scheirer, N. Kumar, V. Iyer, T. Boult and P. Belhumeur, “How Reliable are Your Visual Attributes?” Invited Paper at the *SPIE Defense and Security Symposium*, May 2013, Baltimore MD.

N.3. W. Scheirer, A. Rocha, T. Boult and S. Goldenstein, “The Unseen Challenge Data Sets,” Invited Paper at the *First IEEE Workitorial on Vision of the Unseen*, June 2008, Anchorage, AK.

N.4. W. Scheirer and M. Chuah, “The Strength of Syntax Based Approaches to Dynamic Network Intrusion Detection,” Invited Paper at the *40th Annual Conference on Information Sciences and Systems (CISS 2006)*, March 2006, Princeton, NJ.

Patents

U.S. Patent Pending: Systems and Methods for Machine Learning Enhanced by Human Measurements, Application #US 61/840,871, Filed June 2013.

U.S. Patent Pending: Method and System for Authenticating Remote Users, Application #US 13/853,783, Filed March 2013.

U.S. Patent Pending: System and Apparatus for Failure Prediction and Fusion in Classification and Recognition, Application #US 12/766,283, Filed April 2010.

U.S. Patent Pending: Bio-Cryptography : Secure Cryptographic Protocols with Bipartite Biotokens, Application #PCT/US2008/013190, Filed November 2008.

Current Research Support

Co-PI (Notre Dame), “CI-New: Collaborative Research: COVE: Computer Vision Exchange for Data, Annotation and Tools,” NSF CISE Research Infrastructure Grant, \$200,686 for 2016 – 2019. Consortium project with University of Michigan (lead institution) and Boston University.

PI, “Restoration and Enhancement Techniques for Images Acquired by Small Unmanned Aerial Vehicles,” IARPA Office of Smart Collection, \$184,708.00 for 2016 – 2017.

Co-PI, “Infrastructure for Supporting Biomedical Application Algorithms, Runtime Development and Resource Management,” NSF CISE Research Infrastructure Grant, \$500,000 for 2016 – 2019.

Co-PI (with Lei Li in the Dept. of Biological Sciences at Notre Dame), “Melatonin Modulation of the Olfacto-Retinal Centrifugal Visual Pathway,” Department of Army, \$50,000 for 2016 – 2017.

Co-PI (with Patrick Flynn in the Dept. of Computer Science and Engineering and Geoffrey Puls in the Dept. of Athletics), “Markerless Video Analytics for Athletic Performance Characterization,” Notre Dame FRSP Regular Grant, \$99,961 for 2016 – 2017.

Lead Co-PI (Notre Dame), “Media Forensics Integrity Analytics,” DARPA MediFor Program, \$1,163,391 for 2016 – 2020. Large consortium project with Purdue (lead institution), USC, NYU, University of Siena, and Politecnico di Milano.

Co-PI (Notre Dame), “Algorithms for Representation and Inference informed by the Acquisition of Data from Neuroscience Experiments (ARIADNE),” IARPA MICrONS Program, \$825,531 for 2016 – 2021. Large consortium project with Harvard (lead institution), MIT, University of Chicago, NYU, and the Rockefeller University.

NVIDIA Corporation, Hardware Grant, 2015, 2016 (Notre Dame).

Past Research Support

Campus-PI (UCCS), “Tesserae: A Search Engine for Allusion,” National Endowment for the Humanities Start-up Grant, \$49,835 for 2012–2014 (\$10,000 to UCCS). Joint work with the University at Buffalo.

Principal Investigator, “AACTIONS: Automated Animal Classification and Tracking in Outdoor Niche Settings,” Air Force Phase II SBIR, \$749,961 for 2012 (project concluded in 2015).

Principal Investigator, “Forensic Facial Image Analysis Providing 3D Mapping, Metatagging, Comparative Operation and Search System,” Army Phase II SBIR, \$729,800 for 2012 (project concluded in 2014). Joint work with InCadence Strategic Solutions and Intelligent Software Solutions.

Principal Investigator, “Standoff-Biometric for Non-Cooperative Moving Subjects,” Army Phase II SBIR, \$730,000 for 2012 (project concluded in 2014). Joint work with Animetrics, Inc. and the CGI Group.

Principal Investigator, “FaceTracer: Organization, Search and Manipulation of Large Databases of Face Images,” Office of Naval Research Phase II SBIR, \$750,000 for 2011–2012. Joint work with Automatic Face Systems, Inc.

Principal Investigator, “Forensic Facial Image Analysis Providing 3D Mapping, Metatagging, Comparative Operation and Search System,” Army Phase I SBIR, \$120,000 for 2011–2012.

Principal Investigator, “Standoff-Biometric for Non-Cooperative Moving Subjects,” Army Phase I SBIR, \$120,000 for 2011–2012. Joint work with Animetrics, Inc.

Principal Investigator (UCCS), “Group Travel Grant for the Doctoral Consortium at the IEEE Conference on Computer Vision and Pattern Recognition,” NSF Grant, \$14,525 for 2011–2012.

Principal Investigator, “Improving Privacy and Security in Biometrics,” National Science Foundation Phase II STTR, \$656,692 for 2008–2011.

Principal Investigator, “AACTIONS: Automated Animal Classification and Tracking in Outdoor Niche Settings,” Air Force Phase I SBIR, \$100,000 for 2010.

Principal Investigator, “FaceTracer: Organization, Search and Manipulation of Large Databases of Face Images,” Office of Naval Research Phase I SBIR, \$70,000 for 2009–2010. Joint work with Automatic Face Systems, Inc.

Principal Investigator, “Optimizing Remote Capture of Biometrics for Screening Processes,” Department of Homeland Security Phase I SBIR, \$100,000 for 2008.

PA Digital Greenhouse. Awarded \$8,000 for network intrusion detection research. (Fall 2004 - Spring 2005)

Technical Skills

Programming Languages: Python, C/C++, Java, Matlab, R, perl, Assembly Language (x86, MIPS), Bash, SQL, HTML

Operating Systems: Linux, OS X, 4.4BSD (OpenBSD, NetBSD, FreeBSD), Microsoft Windows

Software Development: gcc/g++, git, vagrant, virtual box, Java SE, Visual Studio

System Administration: Over 15 years of experience building and maintaining Unix networks.

Document Publishing: L^AT_EX, iWork, Microsoft Office

Professional Activities

Professional and Academic Membership:

Senior Member of the IEEE, IEEE Computer Society, IEEE Signal Processing Society, and Society for Neuroscience

Academic Service:

Chair, SPIE Conference on Biometric and Surveillance Technology for Human and Activity Identification, 2013, 2014, 2015

Program Chair, SIBGRAPI 2014

Program Chair, IEEE WACV 2013, 2014

Program Chair, IEEE AMFG 2015

Program Chair, IAPR/IEEE IJCB 2017

General Chair, IEEE WACV 2012

Area Chair, IAPR/IEEE ICB 2015, 2016

Area Chair, IEEE ICIP 2016

Finance Chair, IEEE BTAS 2015

Finance Chair, IEEE CVPR 2011, 2012, 2013, 2017, 2018, 2019

Finance Chair, IEEE FG 2011, 2013, 2015, 2017

Industry Chair, IEEE ICCV 2017

Corporate Relations Chair, Doctoral Consortium Chair, IEEE CVPR 2011

Computer Vision Foundation Liaison, IEEE CVPR 2015

Publications Chair, IEEE BTAS 2012

Publications Chair, IEEE WIFS 2011

Publications Chair, IEEE WACV 2008

Publications Chair, IEEE ICCV 2007

Competition Chair, IAPR/IEEE IJCB 2014

Tutorial Chair, IEEE ISBA 2016

Publicity Chair, IEEE BTAS 2016

Doctoral Consortium Mentor, BTAS 2015, 2016

Organizer, Video Person Recognition Evaluation, BTAS 2016

Communication Officer, IEEE PAMI-TC, 2010 - present

IEEE Biometrics Council Conference Committee Member, 2011 - present

Elected Member, IEEE IFS-TC, Term 2015 - 2017

Chief Technical Officer, Computer Vision Foundation

Conference/Workshop Reviewing:

Reviewer, IEEE CVPR 2010–2016

Reviewer, IEEE ICCV 2013, 2015

Reviewer, ECCV 2012, 2014, 2016

Reviewer, BMVC 2015, 2016

Program Committee, ACCV 2012, 2014

Program Committee, IEEE FG 2013, 2015, 2017

Program Committee, IAPR/IEEE ICB 2013, 2015, 2016

Program Committee, IEEE WACV 2009, 2011, 2012, 2015, 2016, 2017

Program Committee, IEEE BTAS 2012, 2013, 2015, 2016

Reviewer, IAPR/IEEE International Joint Conference on Biometrics, 2011, 2014

Program Committee, International Workshop on Biometrics in The Wild, 2015, 2017

Reviewer, IEEE WBCV 2011

Reviewer, IEEE ICIP 2015, 2016

Reviewer, IEEE ICASSP 2016, 2017

Reviewer, SIBGRAPI 2016

Reviewer, NSF Data Science Workshop at UW, 2015

Program Committee, Computer Vision Winter Workshop, 2016
Program Committee, IEEE WIFS 2011, 2012, 2015, 2016
Program Committee, IEEE ICME 2012 (Academic Track)
Program Committee, IEEE ICME 2011 (Academic & Industrial Track)
Program Committee, First IEEE Intl. Conference on Biometrics, Identity and Security, 2009
Reviewer, Biometrics Symposium, 2008
Program Committee, First IEEE Workitorial on *Vision of the Unseen*, 2008

Journal Reviewing:

Reviewer, IEEE Transactions on Pattern Analysis and Machine Intelligence
Reviewer, IEEE Transactions on Information Forensics & Security
Reviewer, IEEE Transactions on Image Processing
Reviewer, IEEE Transactions on Multimedia
Reviewer, IEEE Transactions on Systems, Man, and Cybernetics
Reviewer, IEEE Transactions on Circuits and Systems for Video Technology
Reviewer, IEEE Transactions on Neural Networks and Learning Systems
Reviewer, IEEE Transactions on Aerospace and Electronic Systems
Reviewer, IEEE Transactions on Human-Machine Systems
Reviewer, IEEE Signal Processing Letters
Reviewer, IEEE Multimedia Magazine
Reviewer, IEEE Access
Reviewer, PLOS Computational Biology
Reviewer, International Journal of Computer Vision
Reviewer, Pattern Recognition
Reviewer, Pattern Recognition Letters
Reviewer, Image and Vision Computing
Reviewer, Computer Vision and Image Understanding
Reviewer, EURASIP Journal on Advances in Signal Processing
Reviewer, International Journal of Remote Sensing
Reviewer, Journal of Visual Communication and Image Representation
Reviewer, Neurocomputing
Reviewer, Information Fusion
Reviewer, Machine Learning
Reviewer, Digital Humanities Quarterly

Editorships:

Editorial Board Member, IEEE Biometrics Compendium

Guest Editor, EURASIP International Journal of Image and Video Processing, Special Issue on Large Scale Learning for Media Understanding (<http://jivp.urasipjournals.com/series/LSLMU>), Vol. 2015.

Book Reviews:

Reviewer, Edited Volume, Security and Privacy in Biometrics, Springer 2012

Proposal Review Panels:

Reviewer, Israel Science Foundation, 2016
Reviewer, Maine Technology Institute, 2014
Reviewer, King Abdulaziz City for Science and Technology, 2013
Reviewer, National Science Foundation (Robust Intelligence, SBIR), 2012
Reviewer, National Institute of Justice, 2011

University Service:

Graduate Student Admissions Committee, Department of Computer Science and Engineering, University of Notre Dame, 2016

Research Experiences for Teachers (RET) in Engineering and Computer Science Mentor, Department of Computer Science and Engineering, University of Notre Dame, 2016

Invited Talks

“Perceptual Annotation: Measuring Human Vision to Improve Computer Vision,” invited talk at the University of Michigan, sponsored by the Department of Electrical Engineering and Computer Science, Ann Arbor, MI, December 2016.

“The Lannisters Send Their Regards: Intertextual Tools and Theory in the Age of Fandom,” with C. Forstall, talk based on extended abstract at the *11th Annual Chicago Colloquium on Digital Humanities and Computer Science*, Chicago, IL, November 2016.

“Quantitative Intertextuality for Texts Ancient and Modern,” with C. Forstall, invited talk at the College of the Holy Cross, Department of Classics, October 2016.

“The Impact of the Open Set Recognition Problem on Deep Learning,” invited talk at the Di-Carlo Lab, Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology, Cambridge, MA, June 2016.

“The Impact of the Open Set Recognition Problem on Deep Learning,” invited talk at the Robotics: Science and Systems (RSS 2016) Workshop “Are the Sceptics Right? Limits and Potentials of Deep Learning in Robotics,” Ann Arbor, MI, June 2016.

“Scalable Strategies for Image Analysis in Neuroscience,” invited talk at Argonne National Laboratory, sponsored by the X-Ray Science Division, Lemont, IL, June 2016.

“Perceptual Annotation: Measuring Human Vision to Improve Computer Vision,” invited talk at Michigan State University, sponsored by the Department of Computer Science and Engineering, East Lansing, MI, April 2016.

“On the Automatic Tracing of Intertextuality by Meaning,” invited talk at the Faculté de Lettres, Unité de Latin, Université de Genève, Geneva, Switzerland, May 2015.

“Perceptual Annotation: Measuring Human Vision to Improve Computer Vision,” invited talk at the Centre Universitaire D’Informatique, Université de Genève, Geneva, Switzerland, May 2015.

“Perceptual Annotation: Measuring Human Vision to Improve Computer Vision,” invited talk at the University of South Florida, sponsored by the Department of Computer Science and Engineering, Tampa, FL, January 2015.

“Perceptual Annotation: Measuring Human Vision to Improve Computer Vision,” invited talk at the University of California, Santa Barbara, sponsored by the Department of Computer Science, Santa Barbara, CA, December 2014.

“Using Brain Function to Fuel Advances in Computer Vision,” invited talk at the Johns Hopkins University Applied Physics Laboratory, sponsored by the Applied Neuroscience team, Laurel, MD, December 2014.

“Perceptual Annotation: Measuring Human Vision to Improve Computer Vision,” invited talk at the University of Notre Dame, sponsored by the Department of Computer Science and Engineering, South Bend, IN, October 2014.

“Perceptual Annotation: Measuring Human Vision to Improve Computer Vision,” invited talk at Xerox Research Centre Europe, Grenoble, September 2014.

“Emerging Work in Open Set Recognition for Vision and Language,” invited talk at Fundação Getulio Vargas, sponsored by the Escola de Matemática Aplicada, Rio de Janeiro, August 2014.

“Perceptual Annotation: Measuring Human Vision to Improve Computer Vision,” talk delivered at the Samsung Research Institute Brazil and the Universidade Estadual de Campinas as part of the Samsung Distinguished Speaker Program, Campinas, August 2014.

“Biocryptographic Authentication,” with T. Boulton and R.C. Johnson, talk based on extended abstract at the *Who are you?! Adventures in Authentication: WAY Workshop*, Menlo Park, CA, July 2014.

“Towards Open Set Recognition,” with A. Rocha, A. Sapkota, and T. Boulton, talk based on extended abstract at the *2nd Workshop on Web-scale Vision and Social Media (VSM)*, Columbus, OH, June 2014.

“The Open Set Recognition Problem,” invited talk at the Queensland University of Technology, sponsored by the School of Electrical Engineering and Computer Science, December 2013.

“An Extreme Value Theory Approach to Visual Attributes,” invited talk at Universidade Estadual de Campinas, sponsored by the Instituto de Computação, August 2013.

“Meta-Recognition: Score Analysis and Calibration for Recognition Problems,” invited talk at Boston University, hosted by the Department of Computer Science, April 2013.

“A Snapshot of Security and Privacy in Biometrics,” invited talk at *ICMedia: the International Conference on Multimedia Forensics, Surveillance, and Security*, sponsored by the Polícia Federal, Brasília, September 2012.

“Meta-Recognition: Score Analysis and Calibration for Recognition Problems,” invited talk at the University at Buffalo, hosted by the Computer Science and Engineering Department, May 2012.

“Meta-Recognition, Machine Learning and the Open Set Problem,” invited talk at Universidade Estadual de Campinas, sponsored by the Instituto de Computação, December 2011.

“Biometrics: New Solutions for Privacy and Security,” invited talk at Colorado State University, hosted by the Department of Computer Science, March 2011.

“Literary and Linguistic Computing: Motivation and a Prodigious Case Study,” invited talk at the University at Buffalo, sponsored by the Digital Humanities Initiative and Department of Classics, April 2010.

“Issues in Non-Cooperative Face Recognition,” invited talk at ROBUST 2008, Honolulu, HI, November 2008.

“The Integration of the Bundle Security Protocol Features into DTN2,” invited talk at the DTNRG meeting at IETF 65 in Dallas, TX, March 2006.

“Comparison of Three Sliding-Window Based Worm Signature Generation Schemes,” invited talk at the Lehigh University Network/Computer Security Workshop, August 2005.

Poster Presentations

“Using Human Brain Activity to Guide Machine Learning,” with R. Fong and D. D. Cox, poster presentation at the *11th Annual Women in Machine Learning Workshop*, Barcelona, December 2016.

“Cross-modal Sensory Information Integration in Modulation of Vertebrate Visual System Functions,” with S. Banerjee and L. Li, poster presentation at the *46th Annual Meeting of the Society for Neuroscience*, San Diego, CA, November 2016.

“Use of Shallow, Non-invariant Representations in High-level Face Perception Tasks,” with S. Anthony, poster presentation at the *15th Annual Meeting of the Vision Sciences Society*, St. Pete Beach, FL, May 2015. Abstract appears in *Journal of Vision* 15(12):934.

“Euterpe’s Hidden Song: Patterns in Elegy,” with C. Forstall, poster presentation at *Digital Humanities 2014*, École Polytechnique Fédérale De Lausanne, July 2014.

“Real-World Computer Vision Applications Are Open, So Should Your Recognition,” with L. Jain and T. Boulton, poster presentation at *The International Workshop on Large Scale Visual Recognition and Retrieval (BigVision 2014)*, Columbus, OH, June 2014.

“Judgments of Personality Traits from Real-World Face Images,” with S. Anthony and K. Nakayama, poster presentation at the *14th Annual Meeting of the Vision Sciences Society*, St. Pete Beach, FL, May 2014. Abstract appears in *Journal of Vision* 14(10):1280.

“Using Brain Structure and Function to Fuel Advances in Machine Learning,” with D. D. Cox, C.-Y. Tsai and N. Kasthuri, *IARPA Machine Intelligence from Cortical Networks Workshop*, Arlington, VA, February 2014.

“Mind the Gap: Creating A Rosetta Stone for Unbiased Comparison of Cell Types and Connectivity between Primate and Mouse Brains,” with N. Kasthuri, D. D. Cox, C.-Y. Tsai, R. Schalek, D.-I. Lee, D. Berger and J. Lichtman, *IARPA Machine Intelligence from Cortical Networks Workshop*, Arlington, VA, February 2014.

“Modelling the Interpretation of Literary Allusion with Machine Learning Techniques,” with N. Coffee, J. Gawley, C. Forstall, D. Johnson, J. Corso and B. Parks, poster presentation at *Digital Humanities 2013*, University of Nebraska-Lincoln, July 2013. Presentation also appears in *The Journal of Digital Humanities*, Vol. 3, No. 1 Spring 2014.

“Human and Computer Face Detection Under Occlusion,” with S. Anthony, D.D. Cox and K. Nakayama, poster presentation at the *13th Annual Meeting of the Vision Sciences Society*, Naples, FL, May 2013. Student Poster Award.

“What makes an Allusion? A Digital Approach,” with C. Forstall, N. Coffee and J. Gawley, poster presentation at the *Digital Classics Association Conference*, Buffalo, NY, April 2013.

“Revealing Hidden Patterns in the Meter of Homer’s *Iliad*,” with C. Forstall, poster presentation at the *7th Annual Chicago Colloquium on Digital Humanities and Computer Science*, Chicago, IL, November 2012.

“Visualizing Sound as Functional n-grams in Homeric Greek Poetry,” with C. Forstall, poster presentation at *Digital Humanities 2011*, Stanford University, June 2011.

“Aspects of Digital Criticism,” with C. Forstall and N. Coffee, installation at E-Poetry [2011]: International Digital Language | Media | Arts Festival, University at Buffalo, May 2011.

“A Statistical Study of Latin Elegiac Couplets,” with C. Forstall, poster presentation at the *5th Annual Chicago Colloquium on Digital Humanities and Computer Science*, Chicago, IL, November 2010.

“Evidence of Intertextuality: Investigating Paul the Deacon’s *Angustae Vitae*,” with C. Forstall and S. Jacobson, poster presentation at *Digital Humanities 2010*, King’s College London, July 2010.

“A Bioinformatics Approach to Identify Recoding Events of A-to-I RNA Editing,” poster presentation at the Greater Philadelphia Bioinformatics Alliance 3rd Annual Retreat, Great Valley, PA, October 2005.

Tutorials and Seminars

Tutorial Author, “The Open Set Recognition Problem and Its Implications and Opportunities in Visual Computing, Forensics and Security,” *IEEE International Conference on Image Processing*, Phoenix, AZ, September 2016.

Tutorial Speaker, “Statistical Methods for Open Set Recognition,” *IEEE Conference on Computer Vision and Pattern Recognition*, Las Vegas, NV, June 2016.

Tutorial Speaker, “The Open Set Recognition Problem in Information Forensics and Security,” *IEEE International Workshop on Information Forensics and Security*, Roma Tre University, Italy, November 2015.

Tutorial Speaker, “Biometrics: Practical Issues in Privacy and Security,” *International Joint Conference on Biometrics*, Washington D.C., October 2011.

Tutorial Speaker, “Face Recognition: Long-Range and Surveillance,” *IEEE Conference on Automatic Face and Gesture Recognition*, Santa Barbara, CA, March 2011.

Tutorial Author, “Biometrics: Privacy and Social Acceptance,” IEEE Expert Now Series, online course material available in the IEEE eLearning Library, December 2010.

Tutorial Author, “Face Biometrics for Security: Long-Range and Surveillance,” IEEE Expert Now Series, online course material available in the IEEE eLearning Library, December 2010.

Tutorial Speaker, “Biometrics: Understanding Advances in Privacy and Security,” *IEEE Conference on Computer Vision and Pattern Recognition*, San Francisco, CA, June 2010.

Tutorial Speaker, “Template Protection,” *First IEEE International Conference on Biometrics, Identity and Security*, held in conjunction with the *Biometrics Consortium Conference*, Tampa, FL, September 2009.

Tutorial Speaker, “Biometrics: Ethics, Privacy, and Security,” *3rd IAPR/IEEE International Conference on Biometrics*, Alghero, Italy, June 2009.

Tutorial Speaker, First IEEE Workitorial on *Vision of the Unseen*, Anchorage, AK, June 2008.

Seminar Instructor, “Unix-based Forensics Training for Law Enforcement,” led a comprehensive seminar series for law enforcement encompassing several months of lectures and laboratory exercises, Fall 2004.

Student Advising

Doctoral Committees

Giovani Chiachia (UNICAMP, Ph.D. defended August 2013, now postdoc at UNICAMP)
Archana Sapkota (UCCS, Ph.D. defended November 2013, now at Aware, Inc.)
R.C. Johnson (UCCS, Ph.D. defended March 2014, now at Paypal)
Victor Fragoso (UCSB, Ph.D. defended December 2014, now assistant prof. at WVU)
Abdullah Albahdal (UCCS, Ph.D. defended February 2015, now at Salman Bin Abdulaziz U.)
Lalit Jain (UCCS, Ph.D. defended April 2015, now at VMware)
Hamdan Alzahrani (UCCS, Ph.D. defended April 2016)
Ethan Rudd (UCCS, Ph.D. expected Spring 2017)
Jianxu Chen (Notre Dame, Ph.D. expected Spring 2017)
Tariq Iqbal (Notre Dame, Ph.D. expected Spring 2017)
Fattaneh Bayatbabolghani (Notre Dame, Ph.D. expected Spring 2017)
Svati Dhamija (UCCS, Ph.D. expected Fall 2017)

Master's Committees

Chris Eberle (UCCS, Master's defended March 2014, now at Amazon)

Graduate Advising

Otávio Penatti (UNICAMP, Summer 2012, now at Samsung Research Institute Brazil)
Klemen Grm (University of Ljubljana, Fall 2016)
Brandon RichardWebster (Notre Dame, Summer 2015 - present, NSF GRFP winner)
Elia Shahbazi (Notre Dame, Summer 2015 - present)
Sreya Banerjee (Notre Dame, Spring 2016 - present)
Nathaniel Blanchard (Notre Dame, Summer 2016 - present)
Katherine Finley (Notre Dame, Summer 2016 - present, Co-advised with Patrick Flynn)
Jeffrey Kinnison (Notre Dame, Fall 2016 - present)
Bingyu Shen (Notre Dame, Fall 2016 - present)

Undergraduate Advising

Michael Wilber (UCCS, Fall 2009 - Spring 2013, NSF GRFP winner, now grad. student at Cornell)
Jessica Tolbert (Oberlin, Summer 2013)
Shantanu Sinha (IIT Bombay, Summer 2013, now grad. student at MIT)
Vanessa Tan (Harvard, Summer 2013 - Fall 2013, now at Quora)
Chase Morrin (Harvard, Summer 2014)
Anupa Murali (Harvard, Fall 2014 - Spring 2015)
Amna Hashmi (Harvard, Spring 2015)
Ruth Fong (Harvard, Spring 2014 - Summer 2015, Rhodes Scholarship winner, now grad. student at Oxford)
James Bowyer (Notre Dame, Fall 2015, CSE 48901 Independent Study)
Kevin Shin (Notre Dame, Spring 2015)
Zachary Janicki (Notre Dame, Spring 2015)
Mel McMcCurrie (Notre Dame, Spring 2016, CSE 48901 Independent Study; Summer 2016, RA)
Fernando Beletti (Notre Dame, Summer 2016)
Lucas Parzianello (Notre Dame, Summer 2016)
Matthew Staffelbach (Notre Dame, Fall 2016 - present)
Michael O'Malley (Notre Dame, Fall 2016 - present)

High School Mentoring

Michael Gohde (Harvard Intern, Spring 2015)

Postdoctoral Fellows Advised

Daniel Moreira (Notre Dame, Summer 2016 - present)
Christopher Forstall (Notre Dame, Fall 2016 - present)

Teaching (Notre Dame)

CSE 40537/60537 Biometrics, Fall 2015

CSE 40567/60567 Computer Security, Spring 2016, Spring 2017

Awards & Honors

Samsung Distinguished Speaker (2014)

IJCB Best Reviewer Award (2014)

CVPR Outstanding Reviewer Award (2013, 2015)

ICB Best Reviewer Award (2013)

ECCV Outstanding Reviewer Award (2012, 2014)

ACCV Best Reviewer Award (2012, 2014)

ICME Quality Reviewer Award (2011)

Outstanding Ph.D. Student of the Year, Department of Computer Science, University of Colorado, Colorado Springs (2009)

Chancellor's Scholarship, University of Colorado, Colorado Springs (2006)

Lehigh University Fellowship (2005)

Press Coverage

1. "Computer IDs Culprits with Tattoo Recognition," *Innovation News Daily*, appeared in NBC News, Yahoo News, and Discovery News, Sept. 6 2012.
2. "The Rise of Voice Biometrics for Mobile Phones," *MIT Technology Review*, Dec. 5 2012.
3. "Smartphones Make Identifying Endangered Animals Easy," *New Scientist Magazine*, Issue 2899, Jan. 10 2013.
4. "Using Mobile Devices in Fieldwork," *National Wildlife*, May 28 2014.
5. "Machine-Vision Algorithm Learns to Judge People by Their Faces," *ACM TechNews*, Nov. 7 2016.

Biographical Information

Citizenship: United States

Co-organizer and co-founder of the Dream Ride (<http://www.dream-ride.org>), a yearly bicycle ride for charity. Since 2007, the organization has raised over \$78,000 for humanitarian causes in the developing world including education for women, health care, and vaccine research.

Hobbies: Literature, Classical Music, Traveling, Cooking, Cycling, Hiking, Skiing, Golf