Committee on Science, Space, and Technology
Online Imposters and Disinformation

Hany Farid, Ph.D.

Background

Rumors quickly spread in Trent, Italy that members of the Jewish community murdered a young boy and drained and drank his blood to celebrate Passover. Before long, the city's entire Jewish community is arrested and tortured, fifteen of which are found guilty and executed. The year was 1475.

Fast forward to 2018. Rumors quickly spread in Athimoor-Kaliyam, India that roving gangs are kidnapping children. Over a period of several months, nearly two dozen innocent people are dragged from their vehicles and killed. The rumors this time spread through WhatsApp instead of word of mouth.

Disinformation is not new, nor are its deadly consequences. What is new, thanks to the internet and social media, is its reach and frequency. Today, disinformation propagates around the world at the speed of light. From small- to large-scale fraud, to sowing civil unrest, interfering with democratic elections, and inciting violence, disinformation campaigns today are leading to dangerous and deadly outcomes.

Add to this phenomenon the ability to create increasingly more compelling and sophisticated fake videos of anybody saying and doing anything – popularly referred to as deep fakes – and the threat only increases. This is the landscape that awaits us in 2019 and beyond.

Creating Deep Fakes

Advances in machine learning and access to large and diverse data sets have led to computer systems that are able to synthesize images of people who don't exist, videos of people doing things they never did, and audio recordings of them saying things they never said. These deep fakes are a dangerous

addition to an already volatile on-line world in which rumors, conspiracies, and disinformation spread often and quickly.

By providing millions of images of people to a machine-learning system, the system can learn to synthesize realistic images of people who don't exist. Similar technologies can, in live-stream videos, convert an adult face into a child's face, raising concerns that this technology will be used by child predators.

With just hundreds of images of someone, a machine-learning system can learn to insert them into a video. This face-swap deep fake can be highly entertaining, as in its use to insert Nic Cage into movies in which he never appeared. The same technology, however, can also be used to create non-consensual pornography or to impersonate a world leader. Similar technologies can also be used to alter a video to make a person's mouth consistent with a new audio recording of them saying something that they never said. When paired with highly realistic voice synthesis technologies that can synthesize speech in a particular person's voice, these lip-sync deep fakes can make a CEO announce that their profits are down, leading to global stock manipulation, a world-leader announce military action, leading to global conflict, or a presidential candidate confess complicity in a crime, leading to the disruption of an election.

What is perhaps most alarming about these deep-fake technologies is that they are not only in the hands of sophisticated Hollywood studios. Software to generate fake content is widely and freely available on-line, putting in the hands of many the ability to create increasingly compelling and sophisticated fakes. Coupled with the speed and reach of social media, convincing fake content can instantaneously reach millions.

How do we manage a digital landscape when it becomes increasingly more difficult to believe not just what we read, but also what we see and hear with our own eyes and ears? How do we manage a digital landscape where if anything can be fake, then everyone has plausible deniability to claim that any digital evidence is fake?

Detecting Deep Fakes

Despite efforts by digital forensic researchers, no current technology exists that can contend with the vast array of different types of deep fakes at a speed and accuracy that can be deployed at internet-scale.

There are several challenges that the digital forensic community is facing.

Deep fakes are relatively new and have developed in sophistication much faster than expected. There are significantly more researchers working to develop techniques for synthesizing increasingly more realistic audio, images, and video, than there are those of us trying to detect this content. This means that the nature and quality of deep fakes is developing at an unprecedented rate that is difficult to keep pace with. In addition, the scale and speed of the internet makes deploying effective technology incredibly challenging: Facebook, for examples, sees some one billion daily uploads and YouTube sees some 500 hundred hours of video uploaded every minute. The sheer amount of information uploaded everyday makes any filtering technology incredibly difficult.

There is, however, a family of technologies that could be considered for wide deployment. Control-capture technologies can authenticate content at the point of recording by extracting, at the time of recording, a unique digital signature from any recorded digital content, cryptographically signing this signature, and then placing it on a secure central server or a distributed immutable ledger like the blockchain.[1] This signature can then be compared to any version of the same content found online to determine if the content has been altered from the time of recording. Although this approach tackles disinformation differently than forensic techniques – by telling us what is real instead of what is fake – these technologies are available today and can operate at internet-scale.

We should be exploring the further development and deployment of both control-capture and forensic technologies.

The Future

Despite the challenges, I propose several calls to action.

1. Funding agencies have to invest at least as much financial support to programs that seek to build systems to detect fake content as they do to programs in computer vision and computer graphics that are giving rise to the sophisticated synthesis technologies described above.

2. Researchers that are developing technologies that we now know can be weaponized should give more thought to how they can put proper

[1]For full disclosure, I am a paid advisor to a company, Truepic, that develops control-capture technology.

safeguards in place so that their technologies are not misused.

3. No matter how quickly forensic technology advances, it will be useless without the collaboration of the giants of the technology sector. The major technology companies (including, Facebook, Google/YouTube, and Twitter) must more aggressively and proactively deploy technologies to combat disinformation campaigns, and more aggressively and consistently enforce their policies. For example, Facebook's terms of service state that users may not use their products to share anything that is "unlawful, misleading, discriminatory or fraudulent". This is a sensible policy — Facebook should enforce their rules.

4. Lastly, we should not ignore the non-technological component to the issue of disinformation: us the users. We need to educate the public on how to consume trusted information, we need to educate the public on how to be better digital citizens, and we need to educate the public on how not to fall victim to scams, fraud, and disinformation.

Conclusions

I will end where I began. Disinformation is not new. Deep fakes is only the latest incarnation. We should not lose sight of the fact that more traditional human-generated disinformation campaigns are still highly effective, and we will undoubtedly be contending with yet another technological innovation a few years from now. In responding to deep fakes, therefore, we should make every effort to consider the past, present and future as we try to navigate the complex interplay of technology, policy, regulation, and human nature.

Lastly, I would be remiss in not mentioning that although there are serious issues of on-line privacy, moves by some of the technology giants to transform their platform to an end-to-end encrypted system will only make the problem of disinformation worse. Such end-to-end encrypted systems will make it even more difficult to understand and slow or stop the spread of disinformation. We should make every effort to consider the balance between privacy and safety and how these can be best accomplished.

Committee on Science, Space, and Technology
Online Imposters and Disinformation

Hany Farid, Ph.D.

Biography

Hany Farid is a Professor at the University of California, Berkeley with a joint appointment in Electrical Engineering Computer Science and the School of Information. His research focuses on digital forensics, image analysis, and human perception. He received his undergraduate degree in Computer Science and Applied Mathematics from the University of Rochester in 1989, his M.S. in Computer Science from SUNY Albany, and his Ph.D. in Computer Science from the University of Pennsylvania in 1997. Following a two-year post-doctoral fellowship in Brain and Cognitive Sciences at MIT, he joined the faculty at Dartmouth College in 1999 where he remained until 2019. He is the recipient of an Alfred P. Sloan Fellowship, a John Simon Guggenheim Fellowship, and is a Fellow of the National Academy of Inventors.

Hany Farid hfarid@berkeley.edu

APPOINTMENTS

University of California, Berkeley **2019 (as of July 1) –**
Professor, Electrical Engineering and Computer Science (50%)
Professor, School of Information (50%)
Member, Berkeley Artificial Intelligence Lab
Member, Center for Innovation in Vision and Optics
Member, Vision Science Program

Dartmouth College, Department of Computer Science **2019 – present**
Adjunct Professor

Dartmouth College, Department of Computer Science **1999 – 2019**
Albert Bradley 1915 Third Century Professor *2016 – 2019*
Professor *2011 – 2016*
William H. Neukom 1964 Distinguished Professor of Computational Science *2008 – 2011*
David T. McLaughlin Distinguished Professor of Computer Science *2007 – 2008*
Professor *2006 – 2007*
Associate Professor *2004 – 2006*
Assistant Professor *1999 – 2004*

Dartmouth College, Tuck School of Business **2016 – 2019**
Adjunct Professor of Business Administration

Dartmouth College, Neukom Institute for Computational Science **2008 – 2011**
Director

PROFESSIONAL

AI Foundation **2019 – present**
Board of Directors & Global AI Council

Counter Extremism Project **2016 – present**
Senior Advisor

Human Rights Center, University of California, Berkeley, School of Law **2019 – present**
Advisory Board

Office of the Prosecutor, International Criminal Court **2018 – present**
Technology Advisory Board

Truepic, Inc. **2018 – present**
Senior Advisor & Board of Advisors

Fourandsix Technologies, Inc. **2011 – 2018**
Chief Technology Officer & Co-founder

EDUCATION

Massachusetts Institute of Technology **1997 – 1999**
Postdoctoral Fellow, Brain and Cognitive Sciences (advisor: Ted Adelson)

University of Pennsylvania **1993 – 1997**
Ph.D., Computer Science (advisor: Eero Simoncelli)

State University of New York at Albany **1990 – 1992**
M.S., Computer Science

University of Rochester **1984 – 1988**
B.S., Computer Science with Applied Mathematics

AWARDS

National Academy of Inventors (NAI), Fellow, 2016
John Simon Guggenheim Fellowship, 2006
Alfred P. Sloan Fellowship, 2002

FUNDING

Facebook. *Multimedia Tamper Detection*, (1.2M), 2019
Google. *Exploiting Physiological Signals to Expose AI-Generated Fake Videos*, (50K), Co-PI, 2019
DARPA. *Photons, Pixels, Photoshop and the Internet*, (929K), Co-PI, 2016
National Institute of Justice. *Degrade It*, (124K), 2016
Microsoft Corp. *Combating On-line Extremism*, 2016
NVIDIA Corp. *How Realistic is Photorealistic?*, (Equipment Grant), 2015
National Science Foundation. *GridIron* (474K), Co-PI, 2012
National Science Foundation. *Instrument Development for Biological Research* (212K), Co-PI, 2008
National Science Foundation. *Digital Imaging Laboratory at Dartmouth* (427K), 2007
Department of Homeland Security. *Digital Video Forensics* (255K), 2007
Howard Hughes Medical Institute. *Undergraduate Science Education* (1.5M), Co-PI, 2006

United States Air Force. *Digital Image Forensics* (380K), 2006
National Science Foundation. *The Evolution of Mate Choice in Damselflies* (535K), Co-PI, 2005
Bureau of Justice Assistance. *Digital Image Forensics* (125K), 2005
Microsoft Corp. (375K), 2005, 2006, 2007, 2009, 2016
Adobe Systems, Inc. (110K), 2004, 2006, 2008
National Institute of Justice. *Digital Tampering and Secrets* (690K), 2003
National Institute of Justice. *Detecting Digital Tampering* (250K), 2000
National Science Foundation. *CAREER: Mixing and Separating Digital Images* (315K), 2000

PUBLICATIONS (IMPACT)

h-index=60; total citations=15,273; i500-index=6; i250-index=18; i100-index=42; i10-index=106.[1]

PUBLICATIONS (BOOK)

H. Farid. Fake Photos, MIT Press, Essential Knowledge Series, 2019.

H. Farid. Photo Forensics, MIT Press, 2016.

PUBLICATIONS (JOURNAL)

S.J. Nightingale, K.A. Wade, H. Farid, and D.G. Watson. Can People Detect Errors in Shadows and Reflections? *Attention, Perception, & Psychophysics*, 2019 (*in press*).

H. Farid. Image Forensics. *Annual Review of Vision Science*, 2019. (*in press*)

H. Farid. Reining in Online Abuses. *Technology and Innovation*, 19(3):593-599, 2018.

J. Dressel and H. Farid. The Accuracy, Fairness, and Limits of Predicting Recidivism, *Science Advances*, 4(1):eaao5580, 2018.

B. Mader, M.S. Banks, and H. Farid. Identifying Computer-Generated Portraits: The Importance of Training and Incentives. *Perception*, 46(9):1062-1076, 2017.

K. Greenham, P. Lou, J.R. Puzey, G. Kumar, C. Arnevik, H. Farid, J. H. Willis, and C.R McClung. Geographic Variation of Plant Circadian Clock Function in Natural and Agricultural Settings. *Journal of Biological Rhythms*, 32(1):26-34, 2016.

M.J. Bravo and H. Farid. Observers Change their Target Template Based on Expected Context. *Attention, Perception, & Psychophysics*, 78(3):829-837, 2016.

O. Holmes, M.S. Banks, and H. Farid. Assessing and Improving the Identification of Computer Generated Portraits. *ACM Transactions on Applied Perception*, 13(2):7:1-7:12, 2016.

E.A. Cooper and H. Farid. Does the Sun Revolve Around the Earth? A Comparison between the General Public and On-line Survey Respondents in Basic Scientific Knowledge. *Public Understanding of Science*, 25(2):146-153, 2016.

S. Pittala, E. Whiting, and H. Farid. A 3-D Stability Analysis of Lee Harvey Oswald in the Backyard Photo. *Journal of Digital Forensics, Security and Law*, 10(3):87-98, 2015.

K. Greenham, P. Lou, S. E. Remsen, H. Farid, and C.R McClung. TRiP: Tracking Rhythms in Plants, an automated leaf movement analysis program for circadian period estimation. *Plant Methods*, 11(33):1-11, 2015.

E. Kee, J. O'Brien, and H. Farid. Exposing Photo Manipulation from Shading and Shadows. *ACM Transactions on Graphics*, 33(5):165:1-165:21, 2014.

M. Bravo and H. Farid. Informative Cues Can Slow Search: The cost of matching a specific template. *Perception*, 76(1):32-39, 2014.

[1] h-index = largest number h such that h publications have at least h citations; iN-index = number of publications with at least N citations. Citation counts according to GoogleScholar as of September 2019.

E. Kee, J. O'Brien, and H. Farid. Exposing Photo Manipulation with Inconsistent Shadows. *ACM Transactions on Graphics*, 32(4):28:1-12, 2013 (presented at SIGGRAPH).

D.T. Bolger, T.A. Morrison, B. Vance, D. Lee, and H. Farid. A Computer-Assisted System for Photographic Mark-Recapture Analysis. *Methods in Ecology and Evolution*, 3(5):813-822, 2012.

J. O'Brien and H. Farid. Exposing Photo Manipulation with Inconsistent Reflections. *ACM Transactions on Graphics*, 31(1):4:1-4:11, 2012 (presented at SIGGRAPH).

H. Farid and M.J. Bravo. Perceptual Discrimination of Computer Generated and Photographic Faces. *Digital Investigation*, 8:226-235, 2012.

M.J. Bravo and H. Farid. Task Demands Determine the Specificity of the Search Template. *Attention, Perception, & Psychophysics*, 74(1):124-131, 2012.

V. Conotter, J. O'Brien, and H. Farid. Exposing Digital Forgeries in Ballistic Motion. *IEEE Transactions on Information Forensics and Security*, 7(1):283-296, 2012.

E. Kee and H. Farid. A Perceptual Metric for Photo Retouching. *Proceedings of the National Academy of Sciences*, 108(50):19907-19912, 2011.

E. Kee, M. K. Johnson, and H. Farid. Digital Image Authentication from JPEG Headers. *IEEE Transactions on Information Forensics and Security*, 6(3):1066-1075, 2011.

H. Farid. The Lee Harvey Oswald Backyard Photos: Real or Fake? *Perception*, 38(11):1731-1734, 2009.

H. Farid. A Survey of Image Forgery Detection. *IEEE Signal Processing Magazine*, 26(2):16-25, 2009.

L. Shen, H. Farid and M.A. McPeek. Modeling 3-Dimensional Morphological Structures using Spherical Harmonics. *Evolution*, 63(4):1003-1016, 2009.

H. Farid. Exposing Digital Forgeries from JPEG Ghosts. *IEEE Transactions on Information Forensics and Security*, 4(1):154-160, 2009.

M.J. Bravo and H. Farid. The Specificity of the Search Template. *Journal of Vision*, 9(1):34, 1-9, 2009.

M.A. McPeek, L. Shen and H. Farid. The Correlated Evolution of 3-Dimensional Reproductive Structure Between Male and Female Damselflies. *Evolution*, 63(1):73-83, 2009.

M.A. McPeek, L. Shen, J.Z. Torrey and H. Farid. The Tempo and Mode of 3-Dimensional Morphological Evolution in Male Reproductive Structures. *American Naturalist*, 171(5):E158-E178, 2008.

M.J. Bravo and H. Farid. A Scale Invariant Measure of Image Clutter. *Journal of Vision*, 8(1):1-9, 2008.

M.K. Johnson and H. Farid. Exposing Digital Forgeries in Complex Lighting Environments. *IEEE Transactions on Information Forensics and Security*, 2(3):450-461, 2007.

W. Wang and H. Farid. Exposing Digital Forgeries in Interlaced and De-Interlaced Video. *IEEE Transactions on Information Forensics and Security*, 2(3):438-449, 2007.

H. Farid and J. Kosecka. Estimating Planar Surface Orientation Using Bispectral Analysis. *IEEE Transactions on Image Processing*, 16(8):2154-2160, 2007.

M.J. Bravo and H. Farid. The Depth of Distractor Processing in Search with Clutter. *Perception*, 36(6):821-829, 2007.

M.J. Bravo and H. Farid. Object Recognition in Clutter. *Perception & Psychophysics*, 68(6):911-918,

2006.

D. Rockmore, S. Lyu and H. Farid. A Digital Technique for Authentication in the Visual Arts. *International Foundation for Art Research*, (8)2:12-23, 2006.

S. Lyu and H. Farid. Steganalysis Using Higher-Order Image Statistics. *IEEE Transactions on Information Forensics and Security*, (1)1:111-119, 2006. *[IEEE SPS Best Paper Award, 2010]*

S. Periaswamy and H. Farid. Medical Image Registration with Partial Data. *Medical Image Analysis*, 10:452-464, 2006.

A.C. Popescu and H. Farid. Exposing Digital Forgeries in Color Filter Array Interpolated Images. *IEEE Transactions on Signal Processing*, 53(10):3948-3959, 2005.

H. Sun, K.E. Lunn, H. Farid, Z. Wu, D.W. Roberts, A. Hartov and K.D. Paulsen. Stereopsis-Guided Brain Shift Compensation. *IEEE Transactions on Medical Imaging*, 24(8):1039-1052, 2005.

S. Lyu and H. Farid. How Realistic is Photorealistic? *IEEE Transactions on Signal Processing*, 53(2):845-850, 2005.

A.C. Popescu and H. Farid. Exposing Digital Forgeries by Detecting Traces of Re-sampling. *IEEE Transactions on Signal Processing*, 53(2):758-767, 2005.

H. Sun, D.W. Roberts, H. Farid, Z. Wu, A. Hartov and K.D. Paulsen. Cortical Surface Tracking Using a Stereoscopic Operating Microscope. *Neurosurgery*, 56:86-97, 2005.

S. Lyu, D. Rockmore and H. Farid. A Digital Technique for Art Authentication. *Proceedings of the National Academy of Sciences*, 101(49):17006-17010, 2004.

M.J. Bravo and H. Farid. Search For a Category Target in Clutter. *Perception*, 33:643-652, 2004.

H. Farid and E.P. Simoncelli. Differentiation of Discrete Multi-Dimensional Signals. *IEEE Transactions on Image Processing*, 13(4):496-508, 2004.

M.J. Bravo and H. Farid. Recognizing and Segmenting Objects in Clutter. *Vision Research*, 44(4):385-396, 2004.

H. Sun, H. Farid, D.W. Roberts, K. Rick, A. Hartov, and K.D. Paulsen. A Non-Contacting 3-D Digitizer for Use in Image-Guided Neurosurgery. *Steroetactic and Functional Neurosurgery*, 80(1-4):120-124, 2003.

R.H. Lilien, H. Farid and B.R. Donald. Probabilistic Disease Classification of Expression-Dependent Proteomic Data from Mass Spectrometry of Human Serum. *Journal of Computational Biology*, 10(6):925-946, 2003.

S. Periaswamy and H. Farid. Elastic Registration in the Presence of Intensity Variations. *IEEE Transactions on Medical Imaging*, 22(7):865-874, 2003.

M.J. Bravo and H. Farid. Object Segmentation by Top-Down Processes. *Visual Cognition*, 10(4):471-491, 2003.

A. Heimsath and H. Farid. Hillslope Topography from Unconstrained Photographs. *Mathematical Geology*, 34(8):929-952, 2002.

H. Farid. Temporal Synchrony in Perceptual Grouping: A Critique. *Trends in Cognitive Sciences*, 6(7):284-288, 2002.

H. Farid and E.H. Adelson. Synchrony Does Not Promote Grouping in Temporally Structured Displays. *Nature Neuroscience*, 4(9):875-876, 2001.

H. Farid and A.C. Popescu. Blind Removal of Lens Distortions. *Journal of the Optical Society of America*, 18(9):2072-2078, 2001.

H. Farid. Blind Inverse Gamma Correction. *IEEE Transactions on Image Processing*, 10(10):1428-1433, 2001.

M.J. Bravo and H. Farid. Texture Perception on Folded Surfaces. *Perception*, 30(7):819-832, 2001.

R. van Ee, B. Anderson, and H. Farid. Occlusion Junctions do not Improve Stereoacuity. *Spatial Vision*, 15(1):45-49, 2001.

M.J. Bravo and H. Farid. Effects of 3D Structure on Motion Segmentation. *Vision Research*, 40(6):695-704, 2000.

X. Jiang, H. Farid, E. Pistor and R. S. Farid. A New Approach to the Design of Uniquely Folded Thermally Stable Proteins. *Protein Science*, 9:403-416, 2000.

E.H. Adelson and H. Farid. Filtering Reveals Form in Temporally Structured Displays. *Science*, 286:2231, 1999.

H. Farid and E.H. Adelson. Separating Reflections from Images by use of Independent Components Analysis. *Journal of the Optical Society of America*, 16(9):2136-2145, 1999.

H. Farid and E.P. Simoncelli. Range Estimation by Optical Differentiation. *Journal of the Optical Society of America*, 15(7): 1777-1786, 1998.

E.P. Simoncelli and H. Farid. Steerable Wedge Filters for Local Orientation Analysis. *IEEE Transactions on Image Processing*, 5(9):1377-1382, 1996.

P.S. Shenkin, H. Farid and J.S. Fetrow. Prediction and Evaluation of Side-chain Conformations for Protein Backbone Structures. *Proteins: Structure, Function and Genetics*, 26:323-352, 1996.

PUBLICATIONS (MAGAZINE)

H. Farid. How to Detect Faked Photos. *American Scientist*, March-April, 2017.

H. Farid. Seeing Is Not Believing. *IEEE Spectrum*, 46(8):44-48, 2009.

H. Farid. Digital Image Forensics. *Scientific American*, 298(6):66-71, 2008.

H. Farid. Digital Doctoring: How to tell the real from the fake. *Significance*, 3(4):162-166, 2006.

H. Farid. Digital Doctoring: How to tell the real from the fake. *Digitális Fotó Magazin*, 9:100-103, 2006.

H. Farid. Is Seeing Believing. *New Scientist*, 179(2411):38-41, 2003.

H. Farid and S. Farid. Unfolding Sennedjem's Tomb. *KMT: A Modern Journal of Ancient Egypt*, 12(1):46-59, 2001.

PUBLICATIONS (BOOK CHAPTERS)

H. Farid. Photo Fakery and Forensics. In *Advances in Computers*, Volume 77, Academic Press, 2009

H. Farid. Digital Doctoring: can we trust photographs? In *Deception: From Ancient Empires to Internet Dating*, Stanford University Press, 2009.

PUBLICATIONS (REFEREED CONFERENCE PAPER)

S. Agarwal, H. Farid, Y. Gu, M. He, K. Nagano, and H. Li. Protecting World Leaders Against Deep Fakes, *Workshop on Media Forensics at CVPR*, Long Beach, CA, 2019.

E. A. AlBadawy, S. Lyu, and H. Farid. Detecting AI-Synthesized Speech Using Bispectral Analysis. *Workshop on Media Forensics at CVPR*, Long Beach, CA, 2019.

P. Singh and H. Farid. Robust Homomorphic Image Hashing. *Workshop on Media Forensics at CVPR*, Long Beach, CA, 2019.

B. Lorch, S. Agarwal, and H. Farid. Forensic Reconstruction of Severely Degraded License Plates. *IS&T Electronic Imaging*, San Francisco, CA, 2019.

W. Fan, S. Agarwal, and H. Farid. Rebroadcast Attacks: Defenses, Reattacks, and Redefenses. *European Signal Processing Conference*, Rome, Italy, 2018.

S. Agarwal, W. Fan, and H. Farid. A Diverse Large-Scale Dataset for Evaluating Rebroadcast Attacks. *IEEE International Conference on Acoustics, Speech and Signal Processing*, Calgary, Alberta, Canada, 2018.

S. Agarwal and H. Farid. Photo Forensics from JPEG Dimples. *IEEE Workshop on Image Forensics and Security*, Rennes, France, 2017.

S. Agarwal, D. Tran, L. Torresani, and H. Farid. Deciphering Severely Degraded License Plates. *SPIE Symposium on Electronic Imaging*, San Francisco, CA 2017.

T. Carvalho, H. Farid, and E. Kee. Exposing Photo Manipulation From User-Guided 3-D Lighting Analysis. *SPIE Symposium on Electronic Imaging*, San Francisco, CA, 2015.

V. Conotter, E. Bodnari, G. Boato, and H. Farid. Physiologically-based Detection of Computer Generated Faces in Video. *International Conference on Image Processing*, Paris, France, 2014.

M. Kirchner, P. Winkler and H. Farid. Impeding Forgers at Photo Inception. *SPIE Symposium on Electronic Imaging*, San Francisco, CA, 2013.

E. Kee and H. Farid. Exposing Digital Forgeries from 3-D Lighting Environments. *IEEE Workshop on Information Forensics and Security*, Seattle, WA, 2010.

V. Conotter, G. Boato and H. Farid. Detecting Photo Manipulation on Signs and Billboards. *International Conference on Image Processing*, Hong Kong, 2010.

H. Malik and H. Farid. Audio Forensics from Acoustic Reverberation. *International Conference on Acoustics, Speech, and Signal Processing*, Dallas, TX, 2010.

E. Kee and H. Farid. Digital Image Authentication from Thumbnails. *SPIE Symposium on Electronic Imaging*, San Jose, CA, 2010.

H. Farid and M.J. Bravo. Image Forensic Analyses that Elude the Human Visual System. *SPIE Symposium on Electronic Imaging*, San Jose, CA, 2010.

W. Wang and H. Farid. Exposing Digital Forgeries in Video by Detecting Double Quantization. *ACM Multimedia and Security Workshop*, Princeton, NJ, 2009.

E. Kee and H. Farid. Printer Profiling for Forensics and Ballistics. *ACM Multimedia and Security Workshop*, Oxford, UK, 2008.

W. Wang and H. Farid. Detecting Re-Projected Video. *10th International Workshop on Information Hiding*, Santa Barbara, CA, 2008.

M.K. Johnson and H. Farid. Detecting Photographic Composites of People. *6th International Workshop on Digital Watermarking*, Guangzhou, China, 2007.

W. Wang and H. Farid. Exposing Digital Forgeries in Video by Detecting Duplication. *ACM Multimedia and Security Workshop*, Dallas, TX, 2007.

M.K. Johnson and H. Farid. Exposing Digital Forgeries Through Specular Highlights on the Eye.

9th International Workshop on Information Hiding, Saint Malo, France, 2007.

H. Farid. Exposing Digital Forgeries in Scientific Images. *ACM Multimedia and Security Workshop*, Geneva, Switzerland, 2006.

W. Wang and H. Farid. Exposing Digital Forgeries in Video by Detecting Double MPEG Compression. *ACM Multimedia and Security Workshop*, Geneva, Switzerland, 2006.

M.K. Johnson and H. Farid. Exposing Digital Forgeries Through Chromatic Aberration. *ACM Multimedia and Security Workshop*, Geneva, Switzerland, 2006.

M.K. Johnson and H. Farid. Exposing Digital Forgeries by Detecting Inconsistencies in Lighting. *ACM Multimedia and Security Workshop*, New York, NY, 2005.

S. Lyu, D. Rockmore, and H. Farid. Wavelet Analysis for Authentication. *Art + Math = X*, Boulder, CO, 2005.

J.E. Dobson, J.B. Woodward, S.A. Schwarz, J.C. Marchesini, H. Farid, and S.W. Smith. The Dartmouth Green Grid. *Workshop on High Performance Computing in Academia (in conjunction with International Conference on Computational Science)*, Atlanta, GA, 2005.

M.K. Johnson, S. Lyu and H. Farid. Steganalysis in Recorded Speech. *SPIE Symposium on Electronic Imaging*, San Jose, CA, 2005.

A.C. Popescu and H. Farid. Statistical Tools for Digital Forensics. *6th International Workshop on Information Hiding*, Toronto, CA, 2004.

S. Lyu and H. Farid. Steganalysis Using Color Wavelet Statistics and One-Class Support Vector Machines. *SPIE Symposium on Electronic Imaging*, San Jose, CA, 2004.

H. Sun, H. Farid, K. Rick, A. Hartov, D.W. Roberts, and K.D. Paulsen. Estimating Cortical Surface Motion Using Stereopsis for Brain Deformation Models. *Medical Image Computing & Computer Assisted Intervention (MICCAI)*, Montreal, Canada, 2003.

J. Ford, H. Farid, F. Makedon, L.A. Flashman, T.W. McAllister, V. Megalooikonomou, and A.J. Saykin. Patient Classification of fMRI Activation Maps. *Medical Image Computing & Computer Assisted Intervention (MICCAI)*, Montreal, Canada, 2003.

S. Periaswamy and H. Farid. Elastic Registration with Partial Data. *Second International Workshop on Biomedical Image Registration*, Philadelphia, PA, 2003.

H. Farid and S. Lyu. Higher-order Wavelet Statistics and their Application to Digital Forensics. *IEEE Workshop on Statistical Analysis in Computer Vision (in conjunction with CVPR)*, Madison, Wisconsin, 2003.

S. Lyu and H. Farid. Detecting Hidden Messages Using Higher-Order Statistics and Support Vector Machines. *5th International Workshop on Information Hiding*, Noordwijkerhout, The Netherlands, 2002.

H. Farid. Detecting Hidden Messages Using Higher-Order Statistical Models. *International Conference on Image Processing*, Rochester, NY, 2002.

H. Sun, H. Farid, A. Hartov, K.E. Lunn, D.W. Roberts, K.D. Paulsen. Real-time Correction Scheme for Calibration and Implementation of Microscope-based Image-guided Neurosurgery. *SPIE's International Symposium on Medical Imaging*, San Diego, CA, 2002.

H. Farid and A.C. Popescu. Blind Removal of Image Non-Linearities. *International Conference on Computer Vision (ICCV)*, Vancouver, Canada, 2001.

H. Farid. Reconstructing Ancient Egyptian Tombs. *The International Symposium on Virtual and Augmented Architecture*, Dublin, Ireland, 2001.

S. Periaswamy, J.B. Weaver, D.M. Healy Jr., D. Rockmore, P.J. Kostelec, and H. Farid. Differential Affine Motion Estimation for Medical Image Registration. *SPIE's 45th Annual Meeting*, San Diego, CA, 2000.

H. Farid and E.H. Adelson. Separating Reflections and Lighting in Images Using Independent Components Analysis. *Computer Vision and Pattern Recognition (CVPR),* June 1999.

H. Farid and E.P. Simoncelli. Optimally Rotation-Equivariant Directional Derivative Kernels. *Computer Analysis of Images and Patterns (CAIP),* Kiel, Germany, 1997.

H. Farid and E.P. Simoncelli. A Differential Optical Range Camera. *Optical Society of America*, Rochester, NY, 1996.

E.P. Simoncelli and H. Farid. Direct Differential Range Estimation Using Optical Masks. *European Conference on Computer Vision (ECCV),* Cambridge, UK, 1996.

E.P. Simoncelli and H. Farid. Steerable Wedge Filters. *International Conference on Computer Vision (ICCV)*, Boston, MA, 1995.

H. Fuchs, G. Bishop, K. Arthur, L. McMillan, R. Bajcsy, S.W. Lee, H. Farid and T. Kanade. Virtual Space Teleconferencing Using a Sea of Cameras. *First International Symposium on Medical Robotics and Computer Assisted Surgery,* Pittsburgh, PA, 1994.

K. Arthur, G. Bishop, R. Bajcsy, H. Farid, H. Fuchs, S.W. Lee, L. McMillan and A. State. Virtual Reality and Telepresence for 21st Century Remote Medical Consultation. *Second Carolina Conference in Biomedical Engineering,* 1994.

PUBLICATIONS (CONFERENCE ABSTRACT)

S. Nightingale, K. Wade, H. Farid, and D. Watson. Can Shadows and Reflections Help in the Detection of Photo Forgeries? *Society for Applied Research in Memory and Cognition*, Sydney, Australia, 2017.

D. Finnegan, G. Hamilton, L. Stearns, A. LeWinter, H. Farid, and H. Renedo. Tidewater Glacier Velocities from Repeat Ground-Based Terrestrial LiDAR Scanning; Helheim Glacier, Southeast Greenland. *Transactions of the American Geophysical Union*, San Francisco, CA, 2014.

M.J. Bravo and H. Farid. Search Templates Can be Adapted to the Context, but Only for Unfamiliar Targets. *Vision Sciences*, St. Pete Beach, FL, 2014.

M.J. Bravo and H. Farid. Symbolic Distractor Cues Facilitate Search. *Vision Sciences*, Naples, FL, 2012.

M.J. Bravo and H. Farid. Diagnostic Features are Prominent in Object Representations. *Vision Sciences*, Naples, FL, 2011.

D.T. Bolger, T. Morrison, B. Vance and H. Farid. Development and Application of a Computer-Assisted System for Photographic Mark-Recapture Analysis. *Ecological Society of America*, Pittsburgh, PA, 2010.

D.T. Bolger, T. Morrison, B. Vance and H. Farid. A New Software Application for Photographic Mark Recapture Analysis. *Society for Conservation Biology*, Edmonton Alberta, Canada, 2010.

H. Farid and M.J. Bravo. Photo Forensics: How Reliable is the Visual System? *Vision Sciences*, Naples, FL, 2010.

M.J. Bravo and H. Farid. Training Determines the Target Representation for Search. *Vision Sciences*, Naples, FL, 2009.

H. Farid. Digital Image Forensics. *American Academy of Forensic Sciences*, Washington, DC, 2008.

H. Farid. Digital Video Forensics. *American Academy of Forensic Sciences*, Washington, DC, 2008.

H. Farid and M.J. Bravo. Photorealistic Rendering: How Realistic Is It? *Vision Sciences*, Sarasota, FL, 2007.

M.J. Bravo and H. Farid. A Measure of Relative Set Size for Search in Clutter. *Vision Sciences*, Sarasota, FL, 2007.

D.C. Finnegan, H. Farid, D.E. Lawson and W. Krabill. Quantifying Surface Fluctuations using Optical Flow Techniques and Multi-Temporal LiDAR. *Transactions of the American Geophysical Union*, San Francisco, CA, 2006.

M.J. Bravo and H. Farid. Using an Interest Point Detector to Find Potential Fragments for Recognition. *Vision Sciences*, Sarasota, FL, 2006.

V. Maljkovic, P. Martini and H. Farid. The Contribution of Statistical Image Differences to Human Rapid Categorization of Natural Scenes is Negligible. *Vision Sciences*, Sarasota, FL, 2006.

H. Farid and D.C. Finnegan. Quantifying Planetary and Terrestrial Geologic Surfaces Using Wavelet Statistics. *Transactions of the American Geophysical Union*, San Francisco, CA, 2005.

M.J. Bravo and H. Farid. The Depth of Distractor Processing in Search Through Clutter. *Vision Sciences*, Sarasota, FL, 2005.

M.J. Bravo and H. Farid. Still Searching a Cluttered Scene. *Vision Sciences*, Sarasota, FL, 2004.

V. Maljkovic, P. Martini and H. Farid. The Time-Course of Categorization of Real-Life Scenes with Affective Content. *Vision Sciences*, Sarasota, FL, 2004.

H. Sun, H. Farid D. Roberts, K. Rick, A. Kartov, and K. Paulsen. A Non-contacting 3-D Digitizer For Use in Image-Guided Neurosurgery. *American Society for Stereotactic and Functional Neurosurgery*, New York City, 2003.

M.J. Bravo and H. Farid. Searching a Cluttered Scene. *Vision Sciences*, Sarasota, FL, 2003.

A.M. Heimsath and H. Farid. Hillslope Topography from Unconstrained Photographs. *Transactions of the American Geophysical Union*, San Francisco, CA, 2002.

H. Farid and E.H. Adelson. Energy versus Synchrony in Perceptual Grouping. *Vision Sciences*, Sarasota, FL, 2002.

M.J. Bravo and H. Farid. Segmentation in Clutter. *Vision Sciences*, Sarasota, FL, 2002.

S. Inati, H. Farid, K. Sherwin, and S. Grafton. A Global Probabilistic Approach to Fiber Tractography with Diffusion Tensor MRI. *Human Brain Mapping*, Brighton, UK, 2001.

M.J. Bravo and H. Farid. Top-Down and Bottom-Up Processes for Object Segmentation. *Vision Sciences*, Sarasota, FL, 2001.

J.B. Weaver, S. Periaswamy, H. Farid, D.N. Rockmore, C.J. Kasales, W. Black, and D.M. Healy Jr. Lesion Size Estimation Using Warped Registration of Interval Images. *International Society for Magnetic Resonance in Medicine*, 2001.

H. Farid and E.H. Adelson. Standard Mechanisms Can Explain Grouping in Temporally Synchronous Displays. *Investigative Opthalmology and Visual Science*, Fort Lauderdale, FL, 2000.

M.J. Bravo and H. Farid. The Role of Object Recognition in Scene Segmentation. *Investigative*

Opthalmology and Visual Science, Fort Lauderdale, FL, 2000.

M.J. Bravo and H. Farid. Segmentation in 3D. *Investigative Opthalmology and Visual Science,* Fort Lauderdale, FL, 1999.

M.J. Bravo and H. Farid. The Effects of 2D and 3D Smoothness on Motion Segmentation. *Investigative Opthalmology and Visual Science,* Fort Lauderdale, FL, 1998.

H. Farid, E.P. Simoncelli, M.J. Bravo and P.R. Schrater. Effects of Contrast and Period on Perceived Coherence of Moving Square-Wave Plaids (evidence for a speed bias in the human visual system). *Investigative Opthalmology and Visual Science,* Fort Lauderdale, FL, 1995.

H. Farid and E.P. Simoncelli. The Perception of Transparency in Moving Square-Wave Plaids. *Investigative Opthalmology and Visual Science,* Sarasota, FL, 1994.

H. Farid, P.S. Shenkin, J. Greene and J.S. Fetrow. Prediction of Side Chain Conformations in Protein Cores and Loops From Rotamer Libraries. *ASBMB/Biophysical Society Joint Meeting*, Houston, TX, 1992.

PUBLICATIONS (OP-ED)

H. Farid. Deepfakes Give New Meaning to the Concept of 'fake news,' and They're Here to Stay, *Fox News*, 2019.

H. Farid. Facebook's Plan for End-to-End Encryption Sacrifices a Lot of Security for Just a Little Bit of Privacy, *Fox News*, 2019.

H. Farid and M. Wallace. Tech Companies Must Act to Stop Horrific Exploitation of their Platforms. *The Hill*, 2019.

H. Farid. Facebook, YouTube and Social Media are Failing Society: Pull their ads until they change. *USA Today*, 2019.

H. Farid. Reining in a Morally Bankrupt Technology Sector. *Our World*, 2019.

H. Farid. Recruiting Terrorists: Were losing the fight against online extremism heres why, *The Hill*, 2018.

H. Farid. Verifying #BigTech Promises. *EUReporter*, 2018.

H. Farid. Are Universities Fueling Silicon Valley Crisis?, *Union Leader*, 2018.

H. Farid. Are Internet Companies Complicit in Promoting Hateful and Harmful Content?, *New Europe*, 2017.

H. Farid. Technology Sector Should not be Shielding Sex Traffickers Online, *The Hill*, 2017.

H. Farid. Internet Companies Right to Close Neo-Nazi Sites, but Terror Still too Easy to Find, *The Hill*, 2017.

PUBLICATIONS (MISCELLANEOUS)

H. Farid. Image Forensics. *Handbook on Computer Vision*, 2019. (*in press*)

B. Winder, and H. Farid. YouTube's Paedophile Problem is Only a Small Part of the Internet's Issue with Child Sexual Abuse. *The Conversation*, 2019.

H. Farid. Don't be Fooled by Fake Images and Videos Online. *The Conversation*, 2019.

H. Farid. The Dystopian Digital Future of Fake Media. *Quartz*, 2018. (commentary)

H. Farid. Digital Forensics in a Post-Truth Age. *Forensic Science International*, 289: 268-269, 2018. (commentary)

H. Farid. Man Versus Machine: How do we make technology work better for us – start with tech companies, *Vice*, 2017. (commentary)

H. Farid. Digital Imaging, *Encyclopedia of Perception*, 2009.

H. Farid. Photography Changes What We are Willing to Believe, *Smithsonian Photography Initiative: Click! Photography Changes Everything*, 2008.

PUBLICATIONS (TECHNICAL REPORT)

P. Raiturkar, H. Farid, and E. Jain. Identifying Computer-Generated Portraits: An Eye Tracking Study. University of Florida, August 2018.

S. Agarwal and H. Farid. A JPEG Corner Artifact from Directed Rounding of DCT Coefficients. TR2018-838, Department of Computer Science, Dartmouth College, February 2018.

W. Fan and H. Farid. A Statistical Prior for Photo Forensics: Object Removal. TR2017-837, Department of Computer Science, Dartmouth College, October 2017.

H. Farid. A 3-D Lighting and Shadow Analysis of the JFK Zapruder Film (Frame 317). TR2010-677, Department of Computer Science, Dartmouth College, November 2010.

H. Farid. A 3-D Photo Forensic Analysis of the Lee Harvey Oswald Backyard Photo. TR2010-669, Department of Computer Science, Dartmouth College, May 2010.

E. Kee and H. Farid. Detecting Photographic Composites of Famous People. TR2009-656, Department of Computer Science, Dartmouth College, October 2009.

H. Farid. Digital Image Ballistics from JPEG Quantization: A Followup Study. TR2008-638, Department of Computer Science, Dartmouth College, September 2008.

H. Farid and J.B. Woodward. Video Stabilization and Enhancement. TR2007-605, Department of Computer Science, Dartmouth College, September 2007.

H. Farid. Digital Image Ballistics from JPEG Quantization. TR2006-583, Department of Computer Science, Dartmouth College, September 2006.

K. Johnson and H. Farid. Metric Measurements on a Plane from a Single Image. TR2006-579, Department of Computer Science, Dartmouth College, August 2006.

H. Farid. Discrete-Time Fractional Differentiation from Integer Derivatives. TR2004-528, Department of Computer Science, Dartmouth College, December 2004.

H. Farid. Creating and Detecting Doctored and Virtual Images: Implications to The Child Pornography Prevention Act. TR2004-518, Department of Computer Science, Dartmouth College, October 2004.

A.C. Popescu and H. Farid. Exposing Digital Forgeries by Detecting Duplicated Image Regions. TR2004-515, Department of Computer Science, Dartmouth College, September 2004.

S. Lyu, D. Rockmore, and H. Farid. Digital Art Forensics. TR2003-466, Department of Computer Science, Dartmouth College, June 2003.

H. Farid. Detecting Steganographic Messages in Digital Images. TR2001-412, Department of Computer Science, Dartmouth College, September 2001.

S. Periaswamy and H. Farid. Differential Elastic Image Registration. TR2001-413, Department of Computer Science, Dartmouth College, September 2001.

H. Farid. Detecting Digital Forgeries Using Bispectral Analysis. MIT AI Memo 1657, June 1999.

H. Farid, S.W. Lee, and R. Bajcsy. View Selection Strategies for Multi-View, Wide-Baseline Stereo. Technical Report, Department of Computer Science, University of Pennsylvania, 1994.

PATENTS

Photo Forensics Using Image Signatures (9,031,329), 2015
Detecting Image Inconsistencies (8,965,106), 2015
Device and Method for Detecting Dust on an Image Sensor (8,654,217), 2014
Perceptual Rating Of Digital Image Retouching (14/359,169), 2014
Device and Method for Detecting Whether an Image is Blurred (8,538,140), 2013
Single Lens Range Imaging Method and Apparatus (5,703,677), 1997

IN THE NEWS (SELECTED)

Are Deepfakes the Next Fake News?, *WNYC, The Takeaway*, 7.22.19
TechPlomacy Talk with the Danish Tech Ambassador, 7.22.19 (podcast)
The Rise Of Deepfakes: Things Are Not What They Appear To Be, *NPR, On Point*, 6.20.19
New Software Could Detect Deepfakes, *CBS This Morning*, 6.17.19
The Fight to Stay Ahead of Deepfake Videos Before the 2020 US Election, *CNN*, 6.12.19
After Doctored Pelosi Video, Expert Warns of Unchecked 'Misinformation Campaigns', *PolitiFact*, 5.28.19
Digital Forensics Expert Weighs In On Doctored Video Of House Speaker Nancy Pelosi, *NPR, All Things Considered*, 5.24.19
The Fight to Stay Ahead of Deepfake Videos before the 2020 US Election, *CNN*, 4.26.19
Leading Anti-Terror Technologist Says Facebook Failed In Its Response To Mosque Shootings, *NPR, All Things Considered*, 3.22.19
'Deepfake' Videos: How to Spot Them and Why They're Dangerous, *KQED, The Forum*, 3.15.19
Facebook Challenged to Rein in Extremism, *CBS*, 2.12.19
Information Warfare, *CNN*, 1.31.19
When Seeing is No Longer Believing, *CNN*, 1.28.19
Looks Can Be Deceiving: Deepfakes , *Pew Charitable Trust, After the Fact*, 1.18.19
In the Age of A.I., Is Seeing Still Believing?, *The New Yorker*, 11.12.8
Deepfake Videos are Getting Real and That's a Problem, *Wall Street Journal*, 10.15.18
Tracking Down Fake Videos, *NPR, All Things Considered*, 9.25.18
YouTube is Still Failing to Take Down Jihadi Propaganda, *Daily Mail*, 7.24.18
The Fight Against 'Deepfake' Videos, *CBC, The Current*, 7.21.18
The Most Creative People in Business 2018, *Fast Company*, 5.30.18
Removing Online Extremist Content, *Bloomberg News*, 4.4.18
Would a Global Cyber Ethics Commission Help 'counter the lies' of Tech?, *Deutsche Welle*, 3.27.18
Pattern of 'denial and inaction' in Tech Firms' Response to Misuse, *The Straits Times*, 3.27.18
Is Hate in America Fueling Fake News, *CNN*, 3.21.18
Expert Warns of "Terrifying" Potential of Digitally-Altered Video, *CBS This Morning*, 3.12.18
Combating Extremism Online, *The Open Mind, PBS*, 3.3.18
'Deep fakes': How to know what's true in the fake-Obama video era, *ABC News (Australia)*, 3.3.18
Are Computers Better than People at Predicting Crime?, *Science News*, 2.20.18
Do Predictive Algorithms Have A Place In Public Policy?, *Science Friday*, 1.19.18
Can Software Predict Crime? Maybe So, but No Better Than a Human, *New York Times*, 1.19.18
Algorithms that Change Lives Should be Trialled Like New Drugs, *New Scientist*, 1.18.18
A Popular Algorithm Is No Better at Predicting Crimes Than Random People, *The Atlantic*, 1.17.18
Are Programs Better Than People at Predicting Reoffending?, *The Economist*, 1.17.18
Does Big Data Belong in Courtrooms?, *Pacific Standard*, 1.17.18
Crime-Predicting Algorithms May Not Fare Much Better Than Untrained Humans, *Wired*, 1.17.18
Technology Can't Rescue Us From AI-Generated Fake News, *Wired*, 1.9.18
New Hampshire's People of the Year, *NH Magazine*, 12.1.17
Social Media Companies Can Block Foreign Interference, *NPR, All Things Considered*, 11.4.17
The Scientist Who Spots Fake Videos, *Nature*, 10.6.17
Breaking News, *Radiolab*, 7.28.17
Spot Faked Photos Using Digital Forensic Techniques, *Popular Science*, 7.21.17
The Hidden Signs That Reveal a Fake Photo, *BBC*, 6.30.17
Cyberethics & The Digital Bystander, *NHPR, The Exchange*, 6.12.17
Tech Firms Resisting Free Anti-Extremist Algorithm, *CNN, The Lead With Jake Tapper*, 6.5.17
How Tech Isn't Stopping Terror, *On The Media*, 5.27.17
When Hatred Goes Viral, *Scientific American*, 5.24.17
Facebook isn't Doing Enough to Control Violent Posts *CBC, The Current*, 4.28.17
Inside YouTube's Battle Against the Internet's Darkest Corners, *Bloomberg*, 3.30.17
How Algorithms Can Help Beat Islamic State, *Wall Street Journal*, 3.11.17

Fighting Digital Depravity, *Enterprise Magazine, Valley News*, 2.27.17
Theres an Algorithm to Fight Online Extremism, *Science Friday*, 1.27.17
Tech Companies Announce Plan to Identify Extremist Content, *NPR, All Things Considered*, 12.6.16
Blocking Terrorist Propaganda, *NHPR, Word of Mouth*, 8.30.16
How The War on Child Porn is Helping us Fight ISIS Propaganda, *Huffington Post*, 7.8.16
Software Looks to Stop The Spread of Extremist Videos, *VPR's Morning Edition*, 7.5.16
Using New Technologies To Fight ISIS Online, *NPR, Here & Now*, 6.23.16
Halting the Hate, *The Economist*, 6.23.16
New Technology Fights Online Extremism, *Morning Joe*, 6.23.16
A Tool to Delete Beheading Videos Before They Even Appear Online, *The Atlantic*, 6.22.16
New Tool to Take Down Terrorism Images Online Spurs Debate, *Washington Post*, 6.21.16
How Tech Can be Used to Track Terrorists, *Risk & Reward*, 12.12.15
Why Anti-Terror Technology Has Its Limits, *NPR, Weekend Edition*, 12.12.15
Was Controversial Lee Harvey Oswald Photo Faked?, *BBC Radio*, 10.21.15
Verdict is in on Whether Lee Harvey Oswald Photo is a Fake, *USA Today*, 10.20.15
Fake Photos on *All Sides with Ann Fisher*, 8.27.13
Software That Exposes Faked Photos, *New York Times*, 8.19.13
Crowdsourcing the Boston Marathon Investigation, *NPR, Here & Now*, 4.18.13
The Gaussian Blurred Line Of Photoshop In Advertising, *NPR, Colin McEnroe Show*, 1.16.13
Photo Retouching and Body Image, *CNN*, 8.12.12
From North Korea, an Altered Procession, *New York Times*, 12.28.11
Photo Retouching on *BBC World Service*, 12.20.11
New Technology to Catch Photoshop Fakes on *Marketplace*, 12.19.11
Exposing Digitally Doctored Photos in *Boston Globe*, 12.5.11
Retouching Reality in *TIME Magazine*, 11.30.11
They Aren't That Thin - Digital Retouching Gets Graded in *NPR, The Two-Way*, 11.30.11
Computer Model Spots Image Fraud in *Scientific American*, 11.29.11
The Secrets of Photoshop Unmasked, *The Independent*, 11.29.11
Software Reveals How Much Photos Have Been Retouched, *The Guardian*, 11.29.11
Photoshopped or Not? A Tool to Tell, *New York Times*, 11.28.11
Digital Retouching: Physical Implausibility, *The Economist*, 11.28.11
Altered-image Ratings Tell You Just How Fake Photos Are, *New Scientist*, 11.28.11
Facebook's New Way to Combat Child Pornography, *New York Times*, 5.19.11
Automating the Hunt for Child Pornographers, *New Scientist*, 4.6.11
Detecting Fake Photos with Digital Detective Work, *Columbia Journalism Review*, 3.23.11
Hany Farid vs. Photoshop, *Business Week*, 12.20.10
Airbrush Alert: UK Wants to Keep Fashion Ads Real *Associated Press*, 9.20.10
Can You Believe Your Eyes the Digital World?, *BBC News*, 8.2.10
The Technology Behind Spying, *NPR, All Things Considered*, 7.1.10
Child Porn Too Big For Law Enforcement?, *The Christian Science Monitor*, 6.13.10
How to Spot a Doctored Photo, *Wired*, 5.5.10
High Tech Child Porn Tracker, *NHPR, Word of Mouth*, 12.21.09
Dartmouth Scientist Says Oswald Rifle Photo Real, *Vermont Public Radio*, 11.24.09
Is That Picture Real?, *NH Chronicle*, 11.23.09
Can You Believe Your Eyes?, *New York Times, Upfront*, 11.23.09
Dartmouth Scientist Says Oswald Rifle Photo Real, *Associated Press*, 11.5.09
Professor: Photoshopping Person's Race Common, *NPR, All Things Considered*, 8.28.09
Faked Photographs: Look, and Then Look Again *New York Times*, 8.23.09
Photoshop Detective. *Studio 360*, 12.26.08
Real? Or Photoshopped? 'Airbrushing' Run Amok in *ABC News*, 12.19.08
The Digital Detective, *San Jose Mercury News*, 12.14.08
Photos as Weapons, *New York Times*, 8.11.08
In A Photoshop Age, Can You Believe Your Eyes?, *NPR, Talk of the Nation*, 7.23.08
Iran Doctors Missile of Photo Launch, *CNN*, 7.11.08
Detecting Digital Alterations in Media, *Vermont Public Radio*, 7.2.08
Profile: Hany Farid, *NOVA, Science Now*, 6.25.08
Tampered Photos, *PRI, The World*, 6.3.08
Journals Find Fakery in Many Images, *Chronicle of Higher Education*, 5.29.08
Digital Detectives, *NHPR, Word of Mouth*, 5.15.08
Identifying Manipulated Images, *MIT Technology Review*, 3.16.08
Researchers Look to Spot Photo Hoaxes, *The Associated Press*, 2.25.08
Photo Tech Complicates Child-Porn Cases, *The Associated Press*, 2.25.08
An End to Picture Perfect Frauds, *Discovery Channel Magazine*, 2.1.08

How Can You Tell if a Picture is Real?, *The Today Show*, 12.21.07
Digital Forensics, *BBC, Night Waves*, 10.17.07
Proving That Seeing Shouldn't Always Be Believing, *New York Times*, 10.2.07
Digital Detectives Discern Photoshop Fakery, *The Christian Science Monitor*, 8.29.07
Distorted Picture, *American Journalism Review*, 7.30.07
Magazines' Extreme Touch-ups, *The Today Show*, 7.23.07
Photo Tampering an Age-Old Practice, *The Chronicle of Higher Education*, 6.27.07
Great Shots That Never Happened, *Washington Post*, 4.15.07
Computing Photographic Forgeries, *Science News*, 3.17.07
Adobe Tackles Photo Forgeries, *Wired*, 3.8.07
Picture Imperfect, *Nature News*, 2.20.07
Science Fights the Fakes, *MSNBC*, 2.20.07
Surveillance: Video Evidence, *Newsweek International*, 1.15.07
Detecting Video Forgeries, *MIT Technology Review*, 11.29.06
Seeing is Believing?, *CBS News Sunday Morning*, 10.29.06
Digital Photo Manipulation, *BBC Digital Planet*, 9.4.06
Keeping It Real, *The Economist*, 8.17.06
Digital Art Authentication, *NPR, 1370 Connection*, 8.11.06
A Digital Life, *CNN*, 2.2.06
Should Journals Police Scientific Fraud?, *Nature News*, 2.2.06
Image Check for Scientific Journals, *Der Spiegel*, 1.30.06
It May Look Authentic; Here's How to Tell It Isn't, *New York Times*, 1.24.06
Technology Seen Abetting Manipulation of Research, *Boston Globe*, 1.10.06
Can Photos be Trusted, *Popular Science*, 9.1.05
Spotting a Digital Hoax, *The Discovery Channel*, 3.16.05
In The Photoshop Era, It's Harder To Trust Your Eyes, *USA Today*, 2.2.05
Seeing is No Longer Believing, *The Christian Science Monitor*, 2.2.05
Professors Who Are Changing the World, *New Hampshire Magazine*, 2.1.05
Photoshop Sleuths, *MIT Technology Review*, 1.17.05
Art Forgeries (with John Myatt), *BBC World Service*, 12.15.04
Digital Forensics, *NHPR, Front Porch*, 12.14.04
Debunking Photoshop Fakery, *New York Times (Year in Ideas)*, 12.12.04
Is It Real or Is It Photoshopped, *Discover Magazine*, 9.27.04
Doctored Digital Images, *NPR, Future Tense*, 7.27.04
A New Flavor of Digital Truth Serum, *New York Times*, 7.22.04
Is Seeing Believing, *BBC News*, 9.8.03
History Undercover with Arthur Kent: Cyberterrorism, *The History Channel*, 7.26.03
Mapping with Math, *BBC News*, 12.3.02
Digital Tours of Murals, *The Chronicle of Higher Education*, 7.9.02
Hidden Messages, *WCAX TV News*, 10.19.01
Statistics Sniff Out Secrets appearing in *Technology Research News*, 9.26.01

INVITED TALKS

Photo Forensics, *Amazon*. 8.19
Creating, Weaponizing, and Detecting Deep Fakes, *USENIX*, 8.19 (keynote)
Creating, Weaponizing, and Detecting Deep Fakes, *San Francisco Electronic Crimes Task Force*, 7.19
Creation, Weaponization, and Detection of Deep Fakes, *D.C. Circuit Judicial Conference*, 6.19
Digital Forensics: past, present, and future, *AI Foundation*, 6.19
Digital Forensics: past, present, and future, *Workshop on Media Forensics at CVPR* (keynote), 6.19
Protecting Children Online, *Missing & Exploited Children Training Conference*, 5.19
Detecting Deep Fakes, *IEEE International Workshop on Fake Multimedia*, 3.19 (keynote)
Fake Photos, *University of Florida*, 3.19
Digital Forensics, *Google*, 3.19
Digital Forensics, *Yahoo Research*, 12.18
Photo Forensics from JPEG Coding Artifacts, *Stanford University*, 11.18
Reining in Online Abuses, *University of California, Santa Barbara*, 10.18
How Realistic is Photorealistic?, *University of California, Berkeley*, 10.18
Digital Forensics, *SIGGRAPH Workshop on Truth in Images, Videos, and Graphics*, 8.18
The Danger of Predictive Algorithms in Criminal Justice, *TEDx AmoskeagMillyard*, 6.18
Reining in Online Abuses, *Plymouth State University*, 3.18
Photo Forensics, *University of Pennsylvania*, 12.17
Reining in Online Abuses, *Building Alliances - Preventing Terror*, Brussels Belgium, 10.17
Reining in Online Abuses, *SUNY Albany, Massry Lecture*, 9.17

Photo Forensics, *University of California, Berkeley*, 9.17
Reining in Online Abuses, *University of California, Berkeley*, 9.17
Photographs, Hoaxes, and Conspiracies, *Gordon Conference: Visualization in Science*, 7.17
Photo Forensics from JPEG Coding Artifacts, *Media Forensics Workshop at CVPR (keynote)*, 7.17
Digital Video Forensics, *The Federal Judiciary Center*, 6.17
Reining in Online Abuses, *Williams College*, 5.17
Photo Forensics, *Williams College*, 5.17
Digital Image Forensics, *Office of Research Integrity*, 4.17
Digital Forensics: From Social Media to Social Impact, *National Academy of Inventors*, 4.17
Reining in Online Abuses, *Council of Engineering Systems Universities*, 3.17
Photo Forensics, *International Center of Photography*, 12.16
Photo Forensics, *Columbia University*, 12.16
Combating On-line Extremism, *United Nations*, 11.16
Photo Forensics from Lighting and Shadows, *Duke University*, 3.16
How Realistic is Photorealistic?, *Duke University*, 3.16
Photo Forensics, *Middlebury College*, 10.15
Photo Forensics and Verification, *TechRaking at MIT*, 9.15
Photo Forensics, *University of Wisconsin, Madison*, 4.15
Photo Forensics from Shadows & Shading, *SPIE Media Security, and Forensics (keynote)*, 1.14
Photo Forensics, *University of Oregon*, 1.14
Photo Forensics, *University of California, Riverside*, 1.14
Photo Forensics, *University of Delaware*, 9.13
Photo Forensics, *International Conference on Computational Photography (keynote)*, 4.13
Image Manipulation in News, *Computation + Journalism Symposium*, 2.13
Digital Forensics, *The World Bank*, 6.12
Photo Retouching, *Information Hiding (keynote)*, 5.12
Photo Forensics, *Stanford University*, 1.12
Ethics and Forensics in the Age of Photoshop Photojournalism, *MIT*, 4.11
Photo Forensics, *National Geographic*, 1.11
Photo Forensics: Lighting and Shadows, *Harvard University*, 9.10
Photo Forensics, *Applied Perception in Graphics & Visualization (keynote)*, 7.10
Limitations of Visually-Based Image Forensics, *Massachusetts Institute of Technology*, 4.10
Photo Forensics, *Massachusetts Institute of Technology*, 4.10
Digital Image Forensics, *Yale University*, 4.10
Digital Image Forensics, *IDGA Biometrics for National Security and Defense*, 3.10
Visually-Based Image Forensics, *IDGA Biometrics for National Security and Defense*, 3.10
Photo Forensics, *Smith-Kettlewell Eye Research Institute*, 2.10
Digital Image Forensics, *Adobe Inc*, 1.10
Digital Image Forensics, *University of Rochester*, 11.09
On the Limitations of Visually-Based Image Forensics, *University of Rochester*, 11.09
Photo Forensics, *Brown University*, 10.09
Digital Forensics, *Biometrics: Theory, Applications and Systems (keynote)*, 9.09
Digital Tampering and Forensics, *University of California, San Diego*, 4.09
Image Forensics, *University of California, Berkeley*, 3.09
Estimating and Modeling Complex Lighting Environments, *University of Pennsylvania*, 10.08
Digital Tampering and Forensics, *National Institute of Standards*, 10.08
Digital Tampering and Forensics, *University of Massachusetts, Amherst*, 10.08
Digital Image Forensics, *American Society of Clinical Radiologists*, 9.08
Digital Tampering and Forensics, *SUNY Albany*, 9.08
Digital Tampering and Forensics, *Electronic Imaging Symposium (plenary talk)*, 1.08
Digital Image Forensics, *The National Academies*, 1.08
Digital Image Forensics, *IBM Almaden*, 11.07
Digital Image Forensics, *University of California, Berkeley*, 11.07
A Digital Technique for Art Authentication, *Harvard University Art Museum*, 10.07
Digital Image Forensics, *Google*, 4.07
Digital Image Forensics, *Foveon Inc.*, 4.07
Exposing Digital Forgeries from Inconsistencies in Lighting, *Carnegie Mellon University*, 3.07
Digital Forensics, *American Association for the Advancement of Science*, 2.07
Digital Image Forensics, *The Associated Press*, 2.07
Exposing Digital Forgeries from Inconsistencies in Lighting, *University of Pennsylvania*, 2.07
Digital Tampering in the Media, Politics and Law, *University of Pennsylvania*, 2.07
Digital Image Forensics, *Central Intelligence Agency*, 12.06
From Photons to Pixels to Photoshop, *Project Safe Childhood Conference*, 12.06

Digital Image Forensics, *Stanford University*, 10.06
From Photons to Pixels to Photoshop, *Crimes Against Children Conference*, 8.06
Digital Image Forensics, *Microsoft Corp.*, 6.06
A Digital Technique for Art Authentication, *Rochester Memorial Art Gallery*, 5.06
Digital Image Forensics, *Eastman Kodak*, 5.06
Digital Image Forensics, *Google*, 5.06
Digital Image Forensics, *University of California, Davis*, 5.06
Digital Image Forensics, *National Academy of Sciences*, 5.06
A Digital Technique for Art Authentication, *San Diego Museum of Art*, 3.06
A Picture is Worth a Thousand Lies, *Dartmouth College*, 2.06
Digital Image Forensics, *Ricoh Innovations*, 11.05
Energy vs. Synchrony in Perceptual Grouping, *University of California, San Diego*, 11.05
From Photons to Pixels to Photoshop, *Delaware Department of Justice*, 9.05
From Photons to Pixels to Photoshop, *High Tech. Crime Investigation Assoc.*, 8.05
Digital Image Forensics, *National Association of Attorneys General*, 6.05
How Realistic is Photorealistic?,*University of California, Santa Cruz*, 6.05
Digital Image Forensics, *University of California, Berkeley*, 5.05
Digital Image Forensics, *University of California, Santa Cruz*, 5.05
Digital Image Forensics, *National Association of Attorneys General*, 5.05
Digital Image Forensics, *Adobe Systems*, 4.05
Digital Image Forensics, *Office of Research Integrity*, 1.05
Digital Image Forensics, *University of New Hampshire*, 12.04
Digital Image Forensics, *New Hampshire Cyber Crime Network*, 12.04
Digital Image Forensics, *Leslie Center for the Humanities, Dartmouth College*, 11.04
Reconstructing Ancient Egyptian Tombs, *Society for Imaging Science and Tech.*, 10.04
Digital Image Forensics, *Adobe Systems*, 10.04
Digital Image Forensics, *National Association of Attorneys General*, 9.04
Digital Image Forensics, *University of Pennsylvania*, 7.04
How Realistic is Photorealistic?, *University of Illinois*, 4.04
Universal Steganalysis, *Central Intelligence Agency*, 2.04
How Realistic is Photorealistic?, *The Salk Institute*, 1.04
Grouping by Temporal Synchrony?, *The Salk Institute*, 1.04
How Realistic is Photorealistic?, *Stevens Institute of Technology*, 12.03
How Realistic is Photorealistic?, *Massachusetts Institute of Technology*, 11.03
How Realistic is Photorealistic?, *Harvard University*, 11.03
How Realistic is Photorealistic?, *University of Chicago*, 11.03
How Realistic is Photorealistic?, *University of Maryland*, 11.03
Grouping by Temporal Synchrony?, *University of Chicago*, 10.03
Mixing and Unmixing Digital Images, *Harvard University*, 10.02
Temporal Synchrony in Perceptual Grouping?, *University of Rochester*, 9.02
Mixing and Unmixing Digital Images, *New York University*, 4.02
Mixing and Unmixing Digital Images, *University of Pennsylvania*, 3.02
Digital Tampering, *Washington University, St. Louis*, 1.02
Digital Secrets, *Boston University*, 12.01
Grouping by Temporal Synchrony, *Harvard University*, 11.01
Blind Removal of Image Non-Linearities, *Columbia University*, 11.01
Blind Removal of Image Non-Linearities, *Massachusetts Institute of Technology*, 10.01
Grouping by Temporal Synchrony, *New York University*, 10.01
Grouping by Temporal Synchrony, *Massachusetts Institute of Technology*, 3.01
Grouping by Temporal Synchrony, *University of Pennsylvania*, 3.01
Grouping by Temporal Synchrony, *Boston University*, 2.01
Blind Removal of Image Non-Linearities, *University of Pennsylvania*, 3.00
Digital Image Separation, *George Mason University*, 3.00
Grouping in Temporally Synchronous Displays, *Dartmouth College*, 12.99
Separating Digital Images, *Brooklyn Polytechnic University*, 3.99
Separating Digital Images, *Dartmouth College*, 3.99
ICA for Separating Images, *Massachusetts Institute of Technology*, 2.99
Separating Images, *University of Pennsylvania*, 10.98
Monocular Stereo, *Polaroid Inc*, 7.98
Digital Image Enhancement, *Williams College*, 4.98
Monocular Stereo, *Massachusetts Institute of Technology*, 3.98
Range Estimation by Optical Differentiation, *University of California, Berkeley*, 3.97
A Differential Optical Range Camera, *Sensar Inc.*, 11.96

Direct Differential Range Estimation, *Columbia University*, 5.96
Steerable Filters for Low-level Image Processing, *SUNY Albany*, 11.95
3-D Scene Reconstruction for Telepresence, *UNC, Chapel Hill*, 6.94

PROFESSIONAL ACTIVITIES

IEEE Fellow, 2018
Phi Beta Kappa (honorary), 2017

ASSOCIATE EDITOR

IEEE Transactions on Information Forensics and Security, 2005-2008

PROGRAM COMMITTEE

IEEE Workshop on Image Forensics (WIFS), 2019
Workshop on Image Forensics, CVPR, 2017
IEEE Workshop on Image Forensics (WIFS), 2017
International Conference on Computational Photography, 2012-2015
Information Hiding, 2010
Media Security and Forensics (Electronic Imaging), 2009-2011
Technical Advisory Board for Berkman's Internet Safety Task Force, 2008
Vision of the Unseen (CVPR Workshop), 2008
Statistical Learning in Computer Vision (ECCV Workshop), 2004
American Association for Artificial Intelligence (Vision/Perception), 2004
Statistical Analysis in Computer Vision (CVPR Workshop), 2003

REVIEWER

NSF review panel (SBIR/STTR Phase I), 2018
NSF review panel (RI Small), 2013
NSF review panel (ITR Medium), 2003
NSF review panel (CAREER: RHA/CV), 2000, 2002, 2003
NSF review panel (RHA/CV), 2000
American Association for Artificial Intelligence (AAAI), Computer Analysis of Images and Patterns (CAIP), Computer Vision and Pattern, Recognition (CVPR), Electronics Letters, European Conference on Computer Vision (ECCV), IEEE Transactions on Image Processing, IEEE Transactions on Multimedia, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Signal Processing, IEEE Transactions on Information Security and Forensics, Information Hiding, International Conference on Computer Vision (ICCV), International Journal of Computer Vision, International Journal of Imaging Systems and Technology, Journal of Cognitive Neuroscience, Journal of the Optical Society of America, Journal of Visual Communication and Image Representation, Medical Physics, Perception, Proceedings of the Royal Society: Biological Sciences, SIGGRAPH, Vision and Applications, Vision Research

STUDENTS

Shruti Agarwal, Ph.D. advisor
Tiago Carvalho (2014), visiting Ph.D. student (UNICAMP, Brazil)
Emma Chiu '19, research advisor
Valentina Conotter (2011), Ph.D. co-advisor (University of Trento)
Julia Dressel '17, senior thesis advisor
Marc Faddoul (2019), M.S. advisor
Wei Fan (2018), postdoctoral advisor
Olivia Holmes '15, senior thesis advisor
Daniel Hopkins '10, research advisor
Kimo Johnson (2007), Ph.D. advisor
Eric Kee (2013), Ph.D. advisor
Jethro Rothe-Kushel '03, research advisor
Benedikt Lorch (2018), visiting M.S. student (University of Erlangen)
Siwei Lyu (2005), Ph.D. advisor
Brandon Mader '16, research advisor
David Martin '00, senior thesis advisor
Kiley McEvoy '06, research advisor
Sophie Nightingale (current), postdoctoral advisor
Joseph Pechter '04, senior thesis advisor
William Pechter '04, senior thesis advisor
Senthil Periaswamy (2003), Ph.D. advisor
Coralie Phanord '16, research advisor
Andrew Pierce '02, research advisor

Alin Popescu (2005), Ph.D. advisor
Nelson Rosa '06, research advisor
Katherine Sherwin '01, research advisor
Priyanka Singh (2019), postdoctoral advisor
Hai Sun (2004), Ph.D. co-advisor
Sydni Topper '18, research advisor
Joshua Wang '15, thesis advisor
Weihong Wang (2009), Ph.D. advisor
Angela Zhu '17, research advisor

TEACHING

Foundations of Applied Computer Science, CS1 11, Spring 2018
Data Structures and Analytics, Tuck School of Business, Spring 2017
Fundamentals of Web Programming, Tuck School of Business, Spring 2017
Introduction to Programming and Computation, CS 1, Fall 2016
Fundamentals of Web Programming, Tuck School of Business, Spring 2016
Numerical and Computational Tools for Applied Science, CS 70/170, Spring 2016
Introduction to Programming and Computation, CS 1, Fall 2015
Numerical and Computational Tools for Applied Science, CS 70/170, Spring 2015
Introduction to Programming and Computation, CS 1, Fall 2014
Introduction to Programming and Computation, CS 1, Spring 2014
Introduction to Programming and Computation, CS 1, Spring 2013
Digital Image Forensics, CS 89/189, Spring 2013
Digital Forensics, University of Trento, Italy, Spring 2011
Numerical and Computational Tools for Applied Science, CS 36/136, Summer 2008
Concepts in Computing, CS 4, Summer 2008
Numerical and Computational Tools for Applied Science, CS 36/136, Summer 2007
Concepts in Computing, CS 4, Summer 2007
Concepts in Computing, CS 4, Winter 2006
Numerical Methods in Computer Vision, CS 88/188, Fall 2004
Concepts in Computing, CS 4, Summer 2003
Concepts in Computing, CS 4, Summer 2002
Data Structures and Programming, CS 15, Winter 2002
Data Structures and Programming, CS 15, Fall 2001
Numerical Linear Algebra, CS106, Spring 2001
Data Structures and Programming, CS 15, Winter 2001
Data Structures and Programming, CS 15, Fall 2000
Fundamentals of Image Processing, CS 88/188, Spring 2000
Programming Languages, CS 68, Winter 2000
Data Structures and Programming, CS 15, Fall 1999

COLLEGE COMMITTEES

Department Chair, 2015-2018
Committee Advisory to the President (tenure & promotions), 2016-2018
Department Associate Chair, 2004-2009
Ph.D. Advisor, 2004-2006
Steering Committee, Neuroscience Major, 2004-2008
Director Search, Neukom Institute for Computational Science, 2005
HHMI Undergraduate Biological Sciences Education Proposal, 2005
Green Grid Computing, 2004-2005
Computer Science Building Expansion, 2003-2005
Faculty Search, Thayer School of Engineering, 2004
Department Web Master, 1999-2004
Faculty Recruiting, 2003, 2010-2011
Ph.D. Admissions 2001-2003, 2010, 2012
Associate Director Search, ISTS, 2002
M.D./Ph.D. Admissions, 2001

TESTIMONY

European Parliament Special Committee on Terrorism, 4.24.18
Singapore Select Committee on Deliberate Online Falsehoods, 3.27.18
United States Senate Judiciary, 9.3.17 (topic: on-line extremism)
United Nations Counter-Terrorism Committee Executive Directorate, 11.30.16

EXPERT WITNESS TESTIMONY

Qualcomm Inc. v. Apple Inc., U.S. International Trade Commission, 2018
Qualcomm Inc. v. Apple Inc., U.S. District Court of Southern District of California, 2018
Lanutti v. Children's Hospital of Pennsylvania, Philadelphia, Pennsylvania, 2018
Salenger v. Inergy, 2017
United States of America v. Sweeney, 2016
Adobe v. Everyscape, Boston, Massachusetts, 2015
Hargett v. Frost, Indianapolis, Indiana, 2014 (deposition)
Ceglia v. Zuckerberg, 2012, (deposition)
United States of America v. Paul Burdulis, Worcester, Massachusetts, 2012
Garza, et al. v. Allied Chemical Corporation, et al., Hidalgo County, Texas, 2009
Operation Algebra, Edinburgh, Scotland, 2009
Pack v. Ross, et al, Nashville, Tennessee, 2009
State of New Hampshire. v. Katherine Johnson, 2009
DesertMicro v. Piersall, Jacksonville, Florida, 2007
State of Florida v. Michael Quattrocchi, 2007
State of Maine v. Melvin Logan, 2007
United States of America v. San Diego Gas & Electric Company, et al., 2007
State of Ohio v. David Harrison, 2006
State of New Hampshire v. John Lacroix, 2005
Graphic Security Systems v. Nautilus Security, 2005
State of Ohio v. Mark A. Heilman, 2004