Media Watermarking, Security, and Forensics 2023

Conference Chairs
Adnan M. Alattar, Digimarc Corp. (US)
Nasir D. Memon, Tandon School of Engineering, New York Univ. (US)
Gaurav Sharma, University of Rochester (US)

PROGRAM AND PROCEEDINGS

Media Watermarking, Security, and Forensics 2023

Conference overview

The ease of capturing, manipulating, distributing, and consuming digital media (e.g., images, audio, video, graphics, and text) has enabled new applications and brought a number of important security challenges to the forefront. These challenges have prompted significant research and development in the areas of digital watermarking, steganography, data hiding, forensics, deepfakes, media identification, biometrics, and encryption to protect owners' rights, establish provenance and veracity of content, and to preserve privacy. Research results in these areas has been translated into new paradigms and applications for monetizing media while maintaining ownership rights, and new biometric and forensic identification techniques for novel methods for ensuring privacy.

The Media Watermarking, Security, and Forensics Conference is a premier destination for disseminating high-quality, cutting-edge research in these areas. The conference provides an excellent venue for researchers and practitioners to present their innovative work as well as to keep abreast of the latest developments in watermarking, security, and forensics. Early results and fresh ideas are particularly encouraged and supported by the conference review format: only a structured abstract describing the work in progress and preliminary results is initially required and the full paper is requested just before the conference. A strong focus on how research results are applied by industry, in practice, also gives the conference its unique flavor.

Conference Chairs: Adnan M. Alattar, Digimarc Corporation (US), Nasir D. Memon, Tandon School of Engineering, New York University (US), and Gaurav Sharma, University of Rochester (US)

Program Committee: Sebastiano Battiato, University degli Studi di Catania (Italy); Marc Chaumont, Laboratory d'Informatique de Robotique et de Microelectronique de Montpellier (France); Scott A. Craver, Binghamton University (US); Edward J. Delp, Purdue University (US); Jana Dittmann, Otto-von-Guericke-University Magdeburg (Germany); Jean-luc Dugelay, EURECOM (France); Touradj Ebrahimi, École Polytechnique Fédérale de Lausanne (EPFL) (Switzerland); Jessica Fridrich, Binghamton University (US); Anthony T. S. Ho, University of Surrey (UK); Andrew D. Ker, University of Oxford (UK); Matthias Kirchner, Binghamton University (US); Chang-Tsun Li, Deakin University (Australia); Jennifer Newman, Iowa State University (US); William Puech, Laboratory d'Informatique de Robotique et de Microelectronique de Montpellier (France); Husrev Taha Sencar, TOBB University of Economics and Technology (Turkey); Yun-Qing Shi, New Jersey Institute of Technology (US); Claus Vielhauer, Fachhochschule Brandenburg (Germany); and Svyatoslav V. Voloshynovskiy, University de Genève (Switzerland)

Paper authors listed as of 1 January 2023; refer to manuscript for final authors. Titles that are not listed with the proceedings files were presentation-only.

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MONDAY 16 JANUARY 2023

Monday 16 January PLENARY: Neural Operators for Solving PDEs
Session Chair: Robin Jenkin, NVIDIA Corporation (United States)
2:00 PM – 3:00 PM
Cyril Magnin I/II/III

Deep learning surrogate models have shown promise in modeling complex physical phenomena such as fluid flows, molecular dynamics, and material properties. However, standard neural networks assume finite-dimensional inputs and outputs, and hence, cannot withstand a change in resolution or discretization between training and testing. We introduce Fourier neural operators that can learn operators, which are mappings between infinite dimensional spaces. They are independent of the resolution or grid of training data and allow for zero-shot generalization to higher resolution evaluations. When applied to weather forecasting, neural operators capture fine-scale phenomena and have similar skill as gold-standard numerical weather models for predictions up to a week or longer, while being 4-5 orders of magnitude faster.

Anima Anandkumar, Bren professor, California Institute of Technology, and senior director of AI Research, NVIDIA Corporation (United States)

Anima Anandkumar is a Bren Professor at Caltech and Senior Director of AI Research at NVIDIA. She is passionate about designing principled AI algorithms and applying them to interdisciplinary domains. She has received several honors such as the IEEE fellowship, Alfred. P. Sloan Fellowship, NSF Career Award, and Faculty Fellowships from Microsoft, Google, Facebook, and Adobe. She is part of the World Economic Forum's Expert Network. Anandkumar received her BTech from Indian Institute of Technology Madras, her PhD from Cornell University, and did her postdoctoral research at MIT and assistant professorship at University of California Irvine.

EI 2023 Highlights Session
Session Chair: Robin Jenkin, NVIDIA Corporation (United States)
3:30 – 5:00 PM
Cyril Magnin II

Join us for a session that celebrates the breadth of what EI has to offer with short papers selected from EI conferences.

NOTE: The EI-wide "EI 2023 Highlights" session is concurrent with Monday afternoon COIMG, COLOR, IMAGE, and IQSP conference sessions.

IQSP-309

Evaluation of image quality metrics designed for DRI tasks with automotive cameras, *Valentine Klein, Yiqi LI, Claudio Greco, Laurent Chanas, and Frédéric Guichard, DXOMARK (France)*

ISS-329

A self-powered asynchronous image sensor with independent in-pixel harvesting and sensing operations, *Ruben Gomez-Merchan, Juan Antonio Leñero-Bardallo, and Ángel Rodríguez-Vázquez, University of Seville (Spain)*

COLOR-184

Color blindness and modern board games, *Alessandro Rizzi[1] and Matteo Sassi[2]; [1]Università degli Studi di Milano and [2]consultant (Italy)*

TUESDAY 17 JANUARY 2023

Audio Attribution & Recognition (T1.1)
Session Chair: Gaurav Sharma, University of Rochester (United States)
9:00 – 9:50 AM
Mission I

9:00   MWSF-372
Synthetic speech attribution using self-supervised audio spectrogram transformer, *Amit Kumar Singh Yadav, Emily R. Bartusiak, Kratika Bhagtani, and Edward J. Delp, Purdue University (United States)*

9:25   MWSF-373
Audio captcha breaking and consequences for human users, *Martin Steinebach[1], Fabian Oberthür[2], Verena Battis[1], and York Yannikos[1]; [1]Fraunhofer SIT and [2]TU Darmstadt (Germany)*

Steganography & Fingerprinting (T1.2)
Session Chair: Jessica Fridrich, Binghamton University (United States)
9:50 – 10:15 AM
Mission I

9:50   MWSF-374
Cost polarization by dequantizing for JPEG steganography, *Edgar Kaziakhmedov, Eli Dworetzky, Yassine Yousfi, and Jessica Fridrich, Binghamton University (United States)*

Steganography & Fingerprinting (T2.1)
Session Chair: Jessica Fridrich, Binghamton University (United States)
10:55 – 11:20 AM
Mission I

10:55   MWSF-375
Predicting positions of flipped bits in robust image hashes, *Martin Steinebach[1], Niklas Bunzel[1], Marius Hammann[2], and Huajian Liu[1]; [1]Fraunhofer Institute for Secure Information Technology and [2]TU Darmstadt (Germany)*

Watermarking (T2.2)

Session Chair: Adnan Alattar, Digimarc Corporation (United States)
11:20 AM – 12:10 PM
Mission I

11:20   MWSF-376
LECA: A learned approach for efficient cover-agnostic watermarking, *Xiyang Luo, Michael Goebel, Elnaz Barshan, and Feng Yang, Google LLC (United States)*

11:45   MWSF-377
Privacy preserving leak detection in peer-to-peer communication, *Julian Heeger, Simon Bugert, Waldemar Berchtold, Alexander Gruler, and Martin Steinebach, Fraunhofer Institute for Secure Information Technology (Germany)*

Tuesday 17 January PLENARY: Embedded Gain Maps for Adaptive Display of High Dynamic Range Images
Session Chair: Robin Jenkin, NVIDIA Corporation (United States)
2:00 PM – 3:00 PM
Cyril Magnin I/II/III

Images optimized for High Dynamic Range (HDR) displays have brighter highlights and more detailed shadows, resulting in an increased sense of realism and greater impact. However, a major issue with HDR content is the lack of consistency in appearance across different devices and viewing environments. There are several reasons, including varying capabilities of HDR displays and the different tone mapping methods implemented across software and platforms. Consequently, HDR content authors can neither control nor predict how their images will appear in other apps.

We present a flexible system that provides consistent and adaptive display of HDR images. Conceptually, the method combines both SDR and HDR renditions within a single image and interpolates between the two dynamically at display time. We compute a Gain Map that represents the difference between the two renditions. In the file, we store a Base rendition (either SDR or HDR), the Gain Map, and some associated metadata. At display time, we combine the Base image with a scaled version of the Gain Map, where the scale factor depends on the image metadata, the HDR capacity of the display, and the viewing environment.

Eric Chan, Fellow, Adobe Inc. (United States)

Eric Chan is a Fellow at Adobe, where he develops software for editing photographs. Current projects include Photoshop, Lightroom, Camera Raw, and Digital Negative (DNG). When not writing software, Chan enjoys spending time at his other keyboard, the piano. He is an enthusiastic nature photographer and often combines his photo activities with travel and hiking.

Paul M. Hubel, director of Image Quality in Software Engineering, Apple Inc. (United States)

Paul M. Hubel is director of Image Quality in Software Engineering at Apple. He has worked on computational photography and image quality of photographic systems for many years on all aspects of the imaging chain, particularly for iPhone. He trained in optical engineering at University of Rochester, Oxford University, and MIT, and has more than 50 patents on color imaging and camera technology. Hubel is active on the ISO-TC42 committee Digital Photography, where this work is under discussion, and is currently a VP on the IS&T Board. Outside work he enjoys photography, travel, cycling, coffee roasting, and plays trumpet in several bay area ensembles.

Deepfake Detection (T3)
Session Chairs: Adnan Alattar, Digimarc Corporation (United States) and Gaurav Sharma, University of Rochester (United States)
3:30 – 5:15 PM
Mission I

3:30   MWSF-378
Pros and cons of comparing and combining hand-crafted and neural network based DeepFake detection based on eye blinking behavior, *Dennis Siegel, Stefan Seidlitz, Christian Krätzer, and Jana Dittmann, Otto-von-Guericke University Magdeburg (Germany)*

3:55   MWSF-379
Human-in-control and quality assurance aspects for a benchmarking framework for DeepFake detection models based on hand-crafted and learned feature spaces, *Christian Krätzer, Dennis Siegel, Stefan Seidlitz, and Jana Dittmann, Otto-von-Guericke University Magdeburg (Germany)*

4:20   MWSF-380
Detecting GAN-generated synthetic images using semantic inconsistencies, *Danial Samadi Vahdati and Matthew C. Stamm, Drexel University (United States)*

4:45   MWSF-381
Deepfake detection assisted by background matching, *Martin Steinebach[1], Stephanie Blümer[2], Niklas Bunzel[1], and Raphael A. Frick[1]; [1]Fraunhofer Institute for Secure Information Technology and [2]TU Darmstadt (Germany)*

5:10
Concluding Remarks

WEDNESDAY 18 JANUARY 2023

Wednesday 18 January PLENARY: Bringing Vision Science to Electronic Imaging: The Pyramid of Visibility
Session Chair: Andreas Savakis, Rochester Institute of Technology (United States)
2:00 PM – 3:00 PM
Cyril Magnin I/II/III

Electronic imaging depends fundamentally on the capabilities and limitations of human vision. The challenge for the vision scientist is to describe these limitations to the engineer in a comprehensive, computable, and elegant formulation. Primary among these limitations are visibility of variations in light intensity over space and time, of variations in color over space and time, and of all of these patterns with position in the visual field. Lastly, we must describe how all these sensitivities vary with adapting light level. We have recently developed a structural description of human visual sensitivity that we call the Pyramid of Visibility, that accomplishes this synthesis. This talk shows how this

structure accommodates all the dimensions described above, and how it can be used to solve a wide variety of problems in display engineering.

Andrew B. Watson, chief vision scientist, Apple Inc. (United States)

Andrew Watson is Chief Vision Scientist at Apple, where he leads the application of vision science to technologies, applications, and displays. His research focuses on computational models of early vision. He is the author of more than 100 scientific papers and 8 patents. He has 21,180 citations and an h-index of 63. Watson founded the Journal of Vision, and served as editor-in-chief 2001-2013 and 2018-2022. Watson has received numerous awards including the Presidential Rank Award from the President of the United States.

Media Watermarking, Security, and Forensics 2023 Interactive (Poster) Paper Session
5:30 – 7:00 PM
Cyril Magnin Foyer

The following work will be presented at the EI 2023 Symposium Interactive (Poster) Paper Session.

MWSF-382
Making digital cameras less attractive targets for theft, *Henry G. Dietz and Tofunmi Oyetan, University of Kentucky (United States)*