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PROCEEDINGS

Computer Vision and Image Analysis of Art 2021

Editors: **Kurt Heumiller,** Museum of Modern Art (United States);
David G. Stork, Consultant (United States)

These papers represent the program of Electronic Imaging 2021, held online 11–28 January 2021.

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Computer Vision and Image Analysis of Art 2021

Conference overview

Thhis conference on computer image analysis in the study of art presents leading research in the application of image analysis, computer vision, and pattern recognition to problems of interest to art historians, curators and conservators.

A number of recent questions and controversies have highlighted the value of rigorous image analysis in the service of the analysis of art, particularly painting. Consider these examples: the fractal image analysis for the authentication of drip paintings possibly by Jackson Pollock; sophisticated perspective, shading and form analysis to address claims that early Renaissance masters such as Jan van Eyck or Baroque masters such as Georges de la Tour traced optically projected images; automatic multi-scale analysis of brushstrokes for the attribution of portraits within a painting by Perugino; and multi-spectral, x-ray and infra-red scanning and image analysis of the Mona Lisa to reveal the painting techniques of Leonardo. The value of image analysis to these and other questions strongly suggests that current and future computer methods will play an ever larger role in the scholarship of visual arts.

The conference chairs and program committee invite high-quality submissions of papers discussing new results in the following and related topics: image analysis of perspective, brush strokes, form color and multi-spectral images for attribution and dating; color modeling and manipulation for predicting the effects of conservation treatments; image de-warping to reveal undistorted images from anamorphic art or depictions of reflections in curved mirrors. This conference will focus on analysis, rather than on image acquisition or digital archiving of artistic works. A key goal of this conference is to foster dialog and collaboration between image scientists and humanists; as such, interdisciplinary teams of authors (scientists and art specialists) are especially encouraged to submit papers.

Paper authors listed as of 1 January 2021; refer to manuscript for final authors. Titles that are not listed with the proceedings files were presentation-only.

Computer Vision and Image Analysis of Art 2021

MONDAY 18 JANUARY 2021

OPTICS AND IMAGE PROCESSING

Session Chair: Christopher Tyler, Smith-Kettlewell Eye Research Institute (United States)
11:45 – 12:45

11:45 CVAA-040
JIST-first: Did Tim paint a Vermeer?, *David Stork[1], Christopher Tyler[2], and Sara Schechner[3]; [1]Consultant, [2]Smith-Kettlewell Eye Research Institute, and [3]Harvard University (United States)*

12:05 CVAA-041
Transfer learning with style transfer between the photorealistic and artistic domain, *Nikolay Banar[1], Matthia Sabatelli[2], Pierre Geurts[2], Walter Daelemans[1], and Mike Kestemont[1]; [1]University of Antwerp and [2]University of Liege (Belgium)*

12:25 CVAA-042
Recovery of underdrawings and ghost-paintings via style transfer by deep convolutional neural networks: A digital tool for art scholars, *David Stork[1] and Anthony Bourached[2]; [1]Consultant (United States) and [2]University College London (United Kingdom)*

CONFERENCE INTERACTIVE POSTERS

CVAA-017
CVAA POSTER: Resolution enhancement in the recovery of underdrawings via style transfer by generative adversarial deep neural networks, *George Cann[1], Anthony Bourached[1], Ryan-Rhys Griffiths[2], and David Stork[3]; [1]University College London (United Kingdom), [2]Cambridge University Press (United Kingdom), and [3]Consultant (United States)*

CVAA-015
CVAA POSTER: Computational identification of significant actors in paintings through symbols and attributes, *David Stork[1], George Cann[2], Anthony Bourached[2], and Ryan-Rhys Griffiths[3]; [1]Consultant (United States), [2]University College London (United Kingdom), and [3]University of Cambridge (United Kingdom)*

COMPUTATIONAL TOOLS FOR ART SCHOLARSHIP

Session Chair: Kurt Heumiller, Museum of Modern Art (United States)
19:45 – 20:25

19:45 CVAA-013
JIST-first: Exploring the facial color representative regions using the Humanae images, *Yuchun Yan[1], Hayan Choi[2], and Hyeon-Jeong Suk[1]; [1]Korea Advanced Institute of Science and Technology and [2]DeepScent (Republic of Korea)*

20:05 CVAA-014
A web-based visualization tool for multispectral images, *Snehal Padhye, David Messinger, and James Ferwerda, Rochester Institute of Technology (United States)*

TUESDAY 19 JANUARY 2021

PLENARY: DEEP INTERNAL LEARNING—DEEP LEARNING WITH ZERO EXAMPLES

Session Chair: Charles Bouman, Purdue University (United States)
10:00 – 11:10

Deep internal learning—Deep learning with zero examples
Michal Irani, *professor, Department of Computer Science and Applied Mathematics, Weizmann Institute of Science (Israel)*

Michal Irani is a professor at the Weizmann Institute of Science. Her research interests include computer vision, AI, and deep learning. Irani's prizes and honors include the Maria Petrou Prize (2016), the Helmholtz "Test of Time Award" (2017), the Landau Prize in AI (2019), and the Rothschild Prize in Mathematics and Computer Science (2020). She also received the ECCV Best Paper Awards (2000 and 2002), and the Marr Prize Honorable Mention (2001 and 2005).

THURSDAY 21 JANUARY 2021

PLENARY: THE DEVELOPMENT OF INTEGRAL COLOR IMAGE SENSORS AND CAMERAS

Session Chair: Jonathan B. Phillips, Google Inc. (United States)
10:00 – 11:10

The development of integral color image sensors and cameras
Kenneth A. Parulski, *expert consultant: mobile imaging (United States)*

Kenneth Parulski is an expert consultant to mobile imaging companies and leads the development of ISO standards for digital photography. He joined Kodak in 1980 after graduating from MIT and retired in 2012 as research fellow and chief scientist in Kodak's digital photography division. His work has been recognized with a Technical Emmy and other major awards. Parulski is a SMPTE fellow and an inventor on more than 225 US patents.

MONDAY 25 JANUARY 2021

PLENARY: MAKING INVISIBLE VISIBLE

Session Chair: Jonathan B. Phillips, Google Inc. (United States)
10:00 – 11:10

Making invisible visible
Ramesh Raskar, *associate professor, MIT Media Lab (United States)*

Ramesh Raskar is an associate professor at MIT Media Lab and directs the Camera Culture research group. His focus is on AI and imaging for health and sustainability. They span research in physical (e.g., sensors, health-tech), digital (e.g., automated and privacy-aware machine learning), and global (e.g., geomaps, autonomous mobility) domains. He received the Lemelson Award (2016), ACM SIGGRAPH Achievement Award (2017), DARPA Young Faculty Award (2009), Alfred P. Sloan Research Fellowship (2009), TR100 Award from MIT Technology Review (2004), and Global Indus Technovator Award (2003). He has worked on special research projects at Google [X] and Facebook and co-founded/advised several companies.

WEDNESDAY 27 JANUARY 2021

PLENARY: REVEALING THE INVISIBLE TO MACHINES WITH NEUROMORPHIC VISION SYSTEMS: TECHNOLOGY AND APPLICATIONS OVERVIEW

Session Chair: Radka Tezaur, Intel Corporation (United States)
10:00 – 11:10

Revealing the invisible to machines with neuromorphic vision systems: Technology and applications overview
Luca Verre, *CEO and cc-founder, Prophesee (France)*

Luca Verre is cc-founder and CEO of Prophesee, the inventor of the world's most advanced neuromorphic vision systems. Verre is a World Economic Forum technology pioneer. His experience includes project and product management, marketing, and business development roles at Schneider Electric. Prior to Schneider Electric, Verre worked as a research assistant in photonics at the Imperial College of London. Verre holds a MSc in physics, electronic and industrial engineering from Politecnico di Milano and Ecole Centrale and an MBA from Institut Européen d'Administration des Affaires, INSEAD.