

A REPORT FROM THE

RIJKSMUSEUM BIENNIAL WORKSHOP ON

FUTURE DIRECTIONS IN

COMPUTATIONAL ART HISTORY

THEME IN 2015: UTILIZING IMAGE PROCESSING IN THE STUDY OF
PAINTINGS, PRINTS, DRAWINGS, AND PHOTOGRAPHS

Rijksmuseum Ateliergebouw, Amsterdam, the Netherlands

June 21-23, 2015

Sponsored by AKZO-Nobel

The application of image processing to problems in art investigation has expanded rapidly since the workshop held at the Van Gogh Museum in 2007, which was devoted to the discrimination of fakes from autograph paintings by Vincent van Gogh. Since then, computational approaches to automated stitching of overlapping x-radiographs into a composite covering the full painting, the registration of multispectral images, simulation of color fading and in-filling, the matching of canvas weave patterns among rollmates, the textural classification of photographic papers from raking light images, and the matching of screen patterns for identifying laid papers made on the same mold have all contributed to advances in issues in art history and conservation.

The target of this workshop - the first in a series of three - is to gather representatives from the various specializations - art historians, curators, conservators, conservation scientists, engineers, materials scientists, and computer scientists - participating in these multidisciplinary efforts to address the question of where this emerging field should be headed over the next decade. The ultimate target is a guide to new participants assembled as a list of problems of art historical interest, associated promising image processing tools for each, instructions for gaining access to an image dataset required for development of prototype solutions, and a list of art

historians ready to collaborate with image processors on specific instances of these problems.

The workshop has 4 components: (i) paired talks by an art expert and a collaborating image processing expert, (ii) talks on advances in computational techniques that show promise for transfer to art investigation, (iii) poster presentations by image processors and art experts on active projects involving computational art history, and (iv) working groups charged with composing bits of a blueprint for future action.

In the presentations by curators, conservators, and conservation scientists, who have recently collaborated with digital image processors, they will describe their reasons for collaborating on particular problems of some generic interest, anticipated and realized gains in advancing their scholarship, advice for future collaborators, and potential unresolved problems that could be assisted by computer-based image processing. A collaborating image processor will provide an overview of the results obtained on one of the topics covered by each of the art specialists. The paired talks are drawn from two of the most active camps in utilizing computational tools from signal/image processing in addressing issues in art history and conservation: (i) characterizing and comparing manufactured patterns in art supports and (ii) imaging technology for noninvasive materials investigation. These paired talks along with the invited talks on “adjacent” subjects of significance and the poster presentations on a variety of ongoing projects are primarily intended to prepare the attendees for the last segment of the workshop.

In the last segment of the workshop attendees will first be assigned to working groups containing representatives from each of the constituencies at the workshop with the task of suggesting (at least) two interesting tasks in computational art history. Then six of these topics will be selected by the program committee for further discussion and the attendees are invited to participate in whichever of these groups they wish. Each of the six groups has the charge of creating for their topic a list of (a)

recommended computational expertise for tackling the problem, (b) an available database of images required for algorithm development, and (c) a list of art experts ready to collaborate on specific instances of the problem of interest.

The remainder of this report on the First Rijksmuseum Biennial Workshop on Future Directions in Computational Art History (FDCAH2015) provides the program for the workshop (including the subjects/titles of all talks and poster presentations), a list of the topics suggested for discussion by the assigned working groups, the six future directions proposed by the self-selected working groups, and a list of workshop attendees.

The current plan is for the second edition of this workshop to be held in 2017 to further address the central issue motivating this series of workshops: Which paths should be taken in applying computational techniques, such as image processing, to cultural heritage?

Rick Johnson, FDCAH2015 Program Chair

Some suggested reading

- J. Drucker, “Is There a ‘Digital’ Art History?”, *Visual Resources: An International Journal of Documentation*, 29:1-2, 5-13, 2013.
(<http://dx.doi.org/10.1080/01973762.2013.761106>)
- P. Fletcher, “Reflections on Digital Art History”, Re-Views: Field Editors’ Reflections, *caa.reviews*, College Art Association, June 18, 2015. (<http://www.caareviews.org/reviews/2726>)
- Inaugural issue in June 2015 of the *International Journal for Digital Art History* (<http://www.dah-journal.org>)
- Special issue on signal processing for art investigation of *IEEE Signal Processing Magazine*, July 2015.
(<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=79>)

Program

Sunday June 21

- 17:00 – 18:00 :: Tour of Rijksmuseum Gallery of Honour
- 18:00 – 19:30 :: Drinks and snacks in the Café in Rijksmuseum Atrium Oost

Monday June 22

- 09:00 – 09:30 :: Registration and Coffee
- 09:30 – 09:45 :: Introduction
- 09:45 – 10:45 :: Louis van Tilborgh (Van Gogh Museum and University of Amsterdam) and Rick Johnson (Cornell University and Rijksmuseum) / Canvas thread counting and roll layout
- 10:45 – 11:15 :: Coffee
- 11:15 – 12:15 :: Paul Messier (Yale University) and Andy Klein (Western Washington University) / Computational assessment of artist material references: black and white photographic paper, inkjet paper, and wove paper
- 12:15 – 13:30 :: Lunch
- 13:30 – 14:30 :: Margaret Holben Ellis (New York University and the Morgan Library & Museum) and William Sethares (University of Wisconsin and Rijksmuseum) / Laid paper chain line pattern matching and moldmate identification
- 14:30 – 15:00 :: Coffee
- 15:00 – 16:00 :: David Picard (ETIS-ENSEA) / Indexing and searching a cultural heritage image collection with computational tools
- 16:00 – 16:30 :: Poster pitch

- 16:30 – 18:30 :: Poster session with drinks and snacks on the Vide in the Ateliergebouw

Poster Presentations

- ⊗ “Multiscale Anisotropic Texture Analysis and Classification of Photographic Prints” / S. G. Roux, P. Abry, H. Wendt, P. Messier, A. G. Klein, N. Tremblay, P. Borgnat, S. Jaffard, B. Vedel, J. Coddington, and L. Daffner
- ⊗ “A Statistical Model of the Motion of Pastels under Vibration” / Leila Sauvage, Arash Sangari, William Sethares, William Wei, and Marcias Martinez
- ⊗ “Multispectral Imaging and Analysis of Historical Manuscripts” / Fabian Hollaus and Robert Sablatnig
- ⊗ “Quantitative Surface-Shape Studies of Gauguin’s Monotypes, Prints, and Drawings” / Marc Walton, Oliver Cossairt, Xiang Huang, and Harriet Stratis
- ⊗ “Towards Discovery of the Artist’s Style: Learning to Recognise Artists by their Artworks” / Nanne van Noord, Eric Postma, and Ella Hendriks
- ⊗ “Digital Image Processing of the Ghent Altarpiece: Supporting the Painting’s Study and Conservation Treatment” / Aleksandra Pizurica, Ljiljana Platisa, Tijana Ruzic, Bruno Cornelis, Ann Doods, Maximiliaan Martens, Helene Dubois, Bart Devolder, Marc De Mey, and Ingrid Daubechies
- ⊗ “Ongoing Projects to Improve the Readability of X-Rays of Paintings on Wood Panel” / Gabor Fodor, Rachel Yin, Bruno Cornelis, Attila Fesus, Aleksandra Pizurica, Ann Doods, and Ingrid Daubechies
- ⊗ “Automatic Thread-Level Canvas Analysis” / Laurens van der Maaten and Rob Erdmann

- ⊗ “Painting Grapes and Quantifying Polarities” / Rosaleena Murthy, William Sethares, Gregor Weber, Margriet van Eikema Hommes, and Joris Dik
- ⊗ “Detail Extraction from Point Cloud Data for the Japanned Decoration of a Baroque Gabinetto” / John Twilley, Kathleen Garland, and Catherine Futter
- ⊗ “thINKback - Virtually Restoring Readability of Double-Sided Ink Corroded Manuscripts” / Frank Ligterink, Birgit Reissland, and Marco Roling
- ⊗ “Computational Art History at the Macro Level” / Ahmed Elgammal and Babak Saleh
- ⊗ “When Van Gogh meets Mandelbrot: Multifractal Classification of Painting’s Texture” / P. Abry, H. Wendt, and S. Jaffard
- ⊗ “Data Integration for Conservation Science (DISCO): Linking data through new software” / Catherine Patterson, Karen Trentelman, and Alison Dalgity
- ⊗ “Automatic Registration and Mosaicking of Technical Images of Old Master Paintings” / Damon Conover, John Delaney, and Murray Loew
- ⊗ “In situ Characterization of the Surface Roughness of Paintings and Photographs before and after Treatment using White Light Confocal Profilometry” / Bill Wei

Tuesday June 23

- 09:00 – 09:30 :: Coffee
- 09:30 – 10:30 :: Rob Erdmann (Rijksmuseum, University of Amsterdam and Radboud University) / Computational art history and art conservation: examples from emerging disciplines

- 10:30 – 11:00 :: Coffee
- 11:00 – 12:00 :: Ella Hendriks (Van Gogh Museum and University of Amsterdam) and John Delaney (National Gallery of Art) / Imaging spectroscopy of paintings
- 12:00 – 13:00 :: Lunch
- 13:00 – 14:00 :: Jim Coddington (Museum of Modern Art) and Roy Berns (Rochester Institute of Technology) / Color and spectral archiving using a dual-RGB imaging system
- 14:00 – 15:00 :: Petria Noble (Rijksmuseum) and Geert van der Snickt (University of Antwerp) / Macro-XRF elemental analysis of painting materials
- 15:00 – 15:30 :: Coffee
- 15:30 – 16:15 :: Assigned working groups for topic proposal
- 16:20 – 18:00 :: Topical working groups
- 18:00 – 18:30 :: Conclusion
- 18:30 – ... :: Party

Program Committee:

R. Johnson (chair), R. van Langh, R. Erdmann, and W. Sethares

Topics suggested by assigned working groups

- Dendrochronology: automated grain/wood analysis as a pattern recognition problem
- Formal analysis across media: image making strategies across media
- Paper fiber identification
- Identify and discriminate between optical brighteners

- Deconvolution of illegible text, e.g. 2-sided
- Determine if an artist is left or right handed
- Develop technical tools to detect the use by artists of mechanical tools/stamps/punches
- Extended in-painting algorithms to help restoration
- Tools for panel wood grain counting from x-ray images
- Creation of tools to make imitation art works that can be destroyed
- Judging paper quality from transmitted light images
- Large image collections related/connected to historically relevant texts
- Collecting images with semantic similarity
- Open wiki structures to capture soft and hard data for a given object
 - integrating data from all sources and allowing evaluation over time
- How to assess and improve readability of archives
- Image and data management
- Working with legacy databases
- Lack of technicians to collect data/images
- Preserving endangered conservation documentation
- Creating a physical/material model of paint to test the effect of museum climate, solvents/cleaning, and vibration/travel
- Tool for iconographic pattern/motif recognition
- Surface topography on macro scale to complement micro scale

Six Future Directions Proposed

- Topic: Separation of overlapping images from double-sided written manuscript texts and/or double-sided painted panels, as the result of an optical and/or x-ray scanning process
 - Useful Technical Tools: Computational algorithms for source separation, tools for real-time visualization of the combined and separated images
 - Dataset: More than 300,000 manuscript images (300 dpi, jpg) available, dozens of x-rays available on double-painted panels at various museums Potential Art Expert Collaborators: Marco Roling (manuscripts), Aleksandra Pizurica (paintings)
- Topic: Stamp/tool identification from artwork – Artists sometimes use mechanical means to create many copies of a particular shape. Can we automatically detect these copies? Can we automatically detect the shape of the tool?
 - Useful Technical Tools: Algorithms such as digital image correlation or object identification methods (SIFT, SURF, etc), need rotation invariance but not scale invariance, registration for merging photo and raking light images, dictionary learning techniques
 - Dataset: Raking light images useful because stamped shapes typically on top/surface; examples: tree leaves by Jan Hachert, ink sketches by Jan van der Heyden
 - Potential Art Expert Collaborators: Erma, Hermens, Gregor Weber
- Topic: Semantic tagging and semantic similarity
 - Useful Technical Tools: for joint embedding of concepts and images
 - Dataset: Rijksmuseum database and the rest of the internet

- Potential Art Expert Collaborators: E. Hinterding
- Topic: Physical paint model
 - Useful Technical Tools: Motion detection microscope algorithms, laser speckle, ptychography, accurate surface shape imaging over a wide field, stress deformation imaging using nano and macro indenters
 - Dataset: images and data sufficient to create and test predictive models regarding impact of climate, cleaning, vibration, crack propagation; using a single model paint system placed into different stress environments (humidity, heat, light) at different labs around the world; keep identical system in a single location to chart relative changes
 - Potential Art Expert Collaborators: Dale Kronkright (Georgia O'Keefe Museum), Tom Learner (Getty), Alan Phenix (Getty), Jim Druzik (Getty)
- Topic: Automate dendrochronology: re-examine existing numerical data and refine extraction of ring width patterns, including provisions for the elimination of growth anomalies that perturb the fit/ranking of individual trees with regional chronologies
 - Useful Technical Tools: similarity assessment, hypothesis testing
 - Dataset: manual and semi-automated measurements from dendrochronologists
 - Potential Art Expert Collaborators: S. Weidema
- Topic: Texts \Leftrightarrow images: focus on existing, often historical collections of texts where identifiable works of art are mentioned/described. Such text collections could be designated as proto-databases. The project would try and turn these into actual, preferably linked, databases.
 - Useful Technical Tools: robotic digitalization, automated coupling of relevant texts and images, collaborative, dynamic database

- Dataset: Vasari, Baldinucci, Van Mander and other classical collections of artist’s biographies; catalogues collections of auctions, or the various Salons de Paris; letters of van Gogh e.a.; proto-databases from pre-digital art historical research (Index of Christian Art, Iconclass e.a.)
- Potential Art Expert Collaborators: R. van Leeuwen (RKD), J. Reynaerts (Rijksmuseum)

Working Group Reporters:

E. Hinterding, M. Roling, W. Sethares, J. Stumpel, J. Twilley, M. Walton

Attendees

1. Patrice Abry (ENS Lyon)
2. Roy Berns (Rochester Institute of Technology)
3. Jonathan Bikker (Rijksmuseum)
4. Maarten van Bommel (University of Amsterdam)
5. Jim Coddington (Museum of Modern Art)
6. Oliver Cossairt (Northwestern University)
7. John Delaney (National Gallery of Art)
8. Georg Dietz (independent paper conservator)
9. Park Doing (Cornell University)
10. Ann Doms (Vrije Universiteit Brussel)
11. Wietske Donkersloot (RKD)
12. Margaret Holben Ellis (New York University and the Morgan Library & Museum)

13. Ahmed Elgammal (Rutgers University)
14. Rob Erdmann (Rijksmuseum, University of Amsterdam and Radboud University)
15. Atilla Fesus (Ghent University)
16. Gabor Fodor (Vrije Universiteit Brussel)
17. Michiel Franken (RKD)
18. Ella Hendriks (Van Gogh Museum and University of Amsterdam)
19. Erma Hermens (University of Glasgow)
20. Erik Hinterding (Rijksmuseum)
21. Fabian Hollaus (TU Wien)
22. Koen Janssens (University of Antwerp)
23. Rick Johnson (Cornell University and Rijksmuseum)
24. Andy Klein (Western Washington University)
25. Robert van Langh (Rijksmuseum)
26. Frank Ligterink (RCE)
27. Laurens van der Maaten (TU Delft)
28. Max Marmor (Kress Foundation)
29. Marcias Martinez (TU Delft)
30. Teio Meedendorp (Van Gogh Museum)
31. Paul Messier (Paul Messier LLC and Yale University)
32. Petria Noble (Rijksmuseum)
33. Nanne van Noord (Tilburg University)
34. Catherine Patterson (Getty Conservation Institute)

35. David Picard (ETIS/ENSEA)
36. Aleksandra Pizurica (Ghent University)
37. Ljiljana Platisa (Ghent University)
38. Eric Postma (Tilburg University)
39. Elisabeth Ravaud (C2RMF)
40. Birgit Reissland (RCE)
41. Marco Roling (University of Leiden)
42. Stephane Roux (ENS Lyon)
43. Leila Sauvage (Rijksmuseum)
44. Travis Sawyer (University of Arizona)
45. Manfred Schreiner (Academy of Fine Arts Vienna)
46. William Sethares (University of Wisconsin and Rijksmuseum)
47. Gert Jan van der Sman (NIKI)
48. Geert van der Snickt (University of Antwerp)
49. David Strivay (Universite de Liege)
50. Jeroen Stumpel (Utrecht University)
51. Louis van Tilborgh (Van Gogh Museum and University of Amsterdam)
52. John Twilley (Independent Conservation Scientist)
53. Bas van Velzen (University of Amsterdam)
54. Marc Walton (NU-ACCESS)
55. Gregor Weber (Rijksmuseum)
56. William Wei (RCE)
57. Sytske Weidema (RKD)