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Multimodal imaging spectroscopy of works of art: registration, analysis, and interpretation

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Venue: Room 408.2038:CS
Curtin University

This seminar is open to the public and admission is free to all IEEE members and non-members.

Abstract:
Conservation of paintings requires knowledge of the artist's materials used, such as pigments, binders, and preparatory layers. Ideally, the entire painting would be characterized, but historically, identification of those materials has been made by microscopic examination and removal of small samples from a limited number of sites on the painting. The samples are examined using a variety of analytical chemical methods to identify their components. Such analytical techniques, while powerful, cannot be used to survey an entire painting; there is great interest therefore in developing in situ methods that are capable of scanning an entire painting. Such methods would offer not only a comprehensive examination of the artwork but also allow the generation of images, or maps, of the pigments used. We describe a new instrument that is capable of standing-off from and scanning an entire painting, at low light levels and with high spatial resolution in the infrared. The scans (hyperspectral infrared, x-ray fluorescence, visible) then are analyzed to provide maps of the composition of the binding materials used in the paints. That knowledge will help historians to better understand, and conservators to better restore, important works of art.

We describe the registration methods that allow highly accurate alignment of multimodality images, which then permits spectroscopy to identify and map the vibrational overtone bands associated with paint binders. Those vibrational

features act as chemical "fingerprints" that can be used to separate, map, and help identify the binders present. The project is building a novel hyperspectral imaging camera system having high sensitivity in the 1000- to 2500-nm infrared spectral range. New analysis software has been developed based on image processing techniques derived from medical imaging and remote sensing, along with a spectral library of the vibrational bands of binders generated in the study. Analyses of a number of Old Masters and impressionist works are provided.

Biography:

Murray Loew is a professor and director of the Biomedical Engineering Program in the Department of Electrical and Computer Engineering at George Washington University (Washington, D.C. USA). He is the inaugural recipient of the Fulbright Distinguished Chair in Advanced Science and Technology, sponsored by the Defence Science and Technology Organisation (DSTO). His research is in the area of medical imaging and image analysis, image registration, and image compression. Through his Fulbright, Prof. Loew will come to the DSTO laboratories in Adelaide for five months to work on object tracking and image and data fusion. He is a Fellow of the IEEE and of AIMBE.