International Conference on Surface Metrology, Worcester Polytechnic University, Worcester, MA, USA, October 2009

Query and Retrieval Systems for a Texture Library of Photographic Papers

Paul Messier[1], Mark Messier[2], Charles Parker[3]

The surface texture of a photographic print governs many of its key visual properties. Texture impacts tonal range, rendering of detail, reflectance and conveys subtle qualitative information about the discernment and aesthetic intent of a photographer. The result of a deliberate and competitive manufacturing process, textures applied to photographic paper also can provide valuable clues into the origin of prints of unknown or questioned provenance. Recent authenticity scandals in the fine art photography market, involving prints attributed to photographers Man Ray (1998) and Lewis Hine (1999) have brought a sense of urgency to the characterization of texture along with other attributes.

Catalyzed by this new imperative, a large reference collection of photographic papers, all identified by manufacturer, brand, and date, was assembled over the past decade for the purposes of characterization. Photomicrographs of the surfaces of over 2,000 papers from this collection were gathered using a simple, but highly repeatable, system of lighting and digital image capture. Though a unique and valuable asset, this surface texture library alone has limited utility for the identification of unknown textures due to an inability to effectively query the collection and retrieve best matches. However, within the past three years, two distinct signal processing methodologies have been developed by collaborators at the University of Indiana and the Eastman Kodak Company.

One method is based on rendering a Fourier transform from the texture images followed by the computation of a vector of average power per unit feature size. This procedure reduces each 2 MB grayscale image in the library to a list of 44 numbers that are easily stored, quickly recalled and compared. Developed independently, another technique relies on wavelet decomposition of the texture images coupled with metric learning techniques. Both methodologies show great promise for retrieving matches for unknowns from the library of texture images. A methodical evaluation of the techniques is ongoing and preliminary results are encouraging.

Assuming a positive outcome, the techniques used in this study may have application for rapidly and inexpensively assembling and analyzing lookup and retrieval techniques for other textured materials such as textiles, painted surfaces and paper. In addition the large library of images at the base of this work can be used to develop and test new algorithms for querying large texture databases.

---

[1] Conservator of Photographs, Paul Messier LLC, Boston, MA 02135, USA, 617 782 7110, pm@paulmessier.com

[2] Associate Professor, Department of Physics, University of Indiana, Bloomington, IN, USA

[3] Research Scientist, Eastman Kodak Corporation, Rochester, New York, USA