Multi-spectral Analysis of the Oriental Watercolor Painting on Rice Paper

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Abstract

There are two kinds of rice paper commonly used in Oriental watercolor painting. One kind made by tree cortex and rice straw is called "raw rice paper". The other one made not only by tree cortex and rice straw but also coating with alum and glue is called "developed rice paper". This raw rice paper can smooth the color when pigments or dyes paint on the paper, which is similar to uncoated paper. The developed rice paper can prevent the color interpenetrate into paper, which is similar to coated paper. Therefore, there shall be different mathematical models to describe these two kinds of watercolor-on-rice-paper effect.

Multi-spectral approach is used to analyze the oriental watercolor painting on these two kinds of rice paper. Special attention is on the interaction of the "paper white" of the rice paper with the pigments for oriental water color. Color ramps were made with pigments and dyes taken from active artist. Two Macbeth D65 solar lights were used as the illumination. Minolta CS-1000 spectral-radiometer was used to measure the spectral information (380nm to 780nm in 1 nm increment) on both the color ramps and a reference white standard. The spectral reflectance of each sample was derived from the reference white standard.

Base-vectors of the solid color blocks and both types of the rice paper are measured. Color modeling is performed to find the right transformation to achieve linearity when reconstructing the spectral reflectance by the mixing of paper base and color primaries.

Results indicate that the simple-subtractive mixing model is not suitable for this oriental watercolor painting as shown in Fig. 1, where scalability can not be achieved after normalizing each color tint with the maximum value. It is concluded that complex subtractive mixing model is needed to reconstruct the spectral reflectance of the oriental watercolor painting. With further analysis by Kubelka-Munk model and Principal Component Analysis (PCA), it is possible to find a linear model to separate the spectral characteristics of the rice paper from the pigments or dyes painted. This will provide a first step in trying to rebuild the original look of some ancient watercolor paintings which become not very visible due to the darkening by the aging of the rice paper.

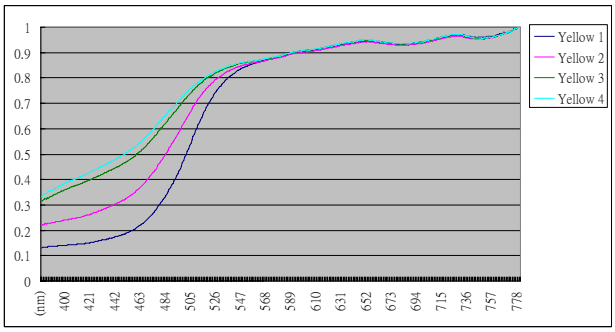

Figure. 1 Scalability is not maintained in color ramps.

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