Art Paint Pigment Concentrations

Samples contributed by:

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Objective:

Use the image data in `ArtImageDataA.mat` to predict the pigment concentrations in images `ArtImageDataB.mat`, and `ArtImageDataC.mat`. Describe any spatial variations.

Background:

This dataset contains NIR hyperspectral images of 24 samples of artist oil paints applied to canvas. The paints contain known proportions of blue pigments: Prussian blue, heliogen blue, and ultramarine blue added to an oil binder. Three sets of individual HSI images of each of the samples were acquired in random sequence (sets A, B, then C). Mosaic images (240 x 240 pixels) were created, containing 24 image sub-regions, (each 40 x 60 pixel) selected from the three imagesets. Each image contains 207 wavelengths.

These data sets may be downloaded as `ArtImageDataA.mat`, `ArtImageDataB.mat`, and `ArtImageDataC.mat`. (MATLAB format) Each data file contains two data variables, *`PaintCube`*, and *`PaintMask`*. The uint16 values (**V**) in PaintCube are proportional to reflectance (**R**):

$$V = R * 65536$$

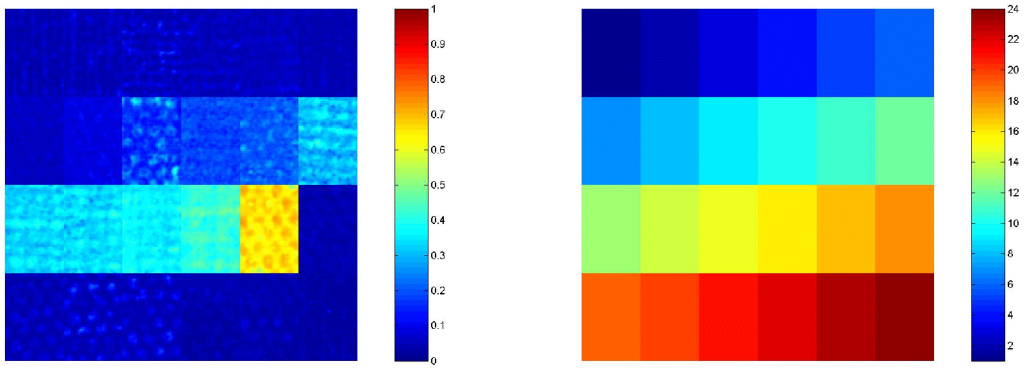

Figure 1 Average wavelength mosaic reflectance image (left) and pixel identity map (right) for 24 samples with varying amount of blue pigments.

The pigment data can be downloaded as `ArtPigmentData.mat`, which contains the variables *`ColumnNames`*, *`ActualWeights`*, *`PigmentPercent`*, and *`TotalPercent`*. There are 4 analytes, the three blue pigments and oil. The *`PigmentPercent`* data represents only the pigment contribution – i.e. the three pigments sum to 100%. The *`TotalPercent`* variable also includes the oil weight, so that the weights of the three pigments plus the oil sum to 100%. The sample weights are listed in the following table.

Sample weights:

#	Prussian	Heliogen	Ultramarine	Oil
1	9.5200	0	0	19.8300
2	9.5200	0.0950	0	18.6700
3	9.6600	0.2840	0	18.5200
4	9.5300	0.4634	0	20.2900
5	9.5300	0.7610	0	21.7800
6	9.5200	1.1400	0	22.3600
7	9.5200	2.3700	0	23.6600
8	9.5200	4.7600	0	28.7000
9	6.1600	6.1600	0	27.5500
10	3.0800	6.1600	0	20.2500
11	1.5400	6.1600	0	16.5700
12	0.4930	6.2000	0	16.5700
13	0.3000	6.1600	0	14.3600
14	0.1848	6.1600	0	14.0800
15	0.0616	6.1600	0	16.1100
16	0	6.1600	0	24.5000
17	0	0	8.6300	9.4800
18	9.5200	0	0.0952	17.6200
19	9.5200	0	0.2856	19.1800
20	9.5200	0	0.4900	20.3200
21	9.5200	0	0.7600	20.3100
22	9.5300	0	2.3800	24.0000
23	9.5200	0	4.7600	23.7800
24	9.5200	0	9.5200	25.0000

Image acquisition conditions:

Instrument: BurgerMetrics HyperPro
Wavelength range: 988.9 – 1674.7 nm (207 channels @ ~3.3 nm spacing)
Pixel resolution: 100 x 100 microns
Acquisition mode: Stepped push broom – 16 camera frames (spectral x spatial) acquired and averaged, then sample advanced 100 microns