

## **International Association for Spectral Imaging IASIM 2016: Hyperspectral Imaging Challenge Problem**

The objective of the hyperspectral image measurements was to evaluate the technology for detection of melamine particles in wheat gluten. NIR Reflectance images were measured by G. Israelson of Nestly Purina on an Opotek HySpec(TM) imaging system October 28, 2010.

For each image, material was placed in an approximately 30 mm diameter sample cup located at the center of the image. Reflectance standards are in the corners of the image and were used to convert the measurements to reflectance. Figure 1 shows an example principal components analysis (PCA) scores image. The original images were uint16 on the approximate range of 0 to 10,000 corresponding to reflectance in the range 0 to 1. The images were converted to doubles and scaled 0 to 1 for this challenge. To reduce the size, the images have been downsized and wavelength range reduced to 1120 to 1580 nm. Images were saved as DataSet objects (Eigenvector Research, Inc. freeware <http://www.eigenvector.com/software/dataset.htm>) with pixels outside the sample cup "soft excluded" and saved to MATLAB MAT files.

Six images are available for the challenge. Three images are used to characterize the measurements: Wheat\_Gluten\_Pure, Melamine\_Pure and M\_200 ppm. These images correspond to pure wheat gluten, pure melamine and a sample of wheat gluten adulterated by 200 ppm melamine by weight. Three test images are also included: Test\_1, Test\_2 and Test\_3. The test images include a sample of wheat gluten adulterated by different levels of melamine.

The challenge problem has three parts as follows.

- 1) Identify if melamine is present in the test wheat gluten samples,
- 2) If it is present, show where the melamine is located, and
- 3) To the extent possible, unequivocally show that the detection is attributable to melamine.

Solutions will be judged on accuracy and creativity. Also, given that the application is intended for quick turn-around, solutions amenable to fast detection will be judged as a better solution.

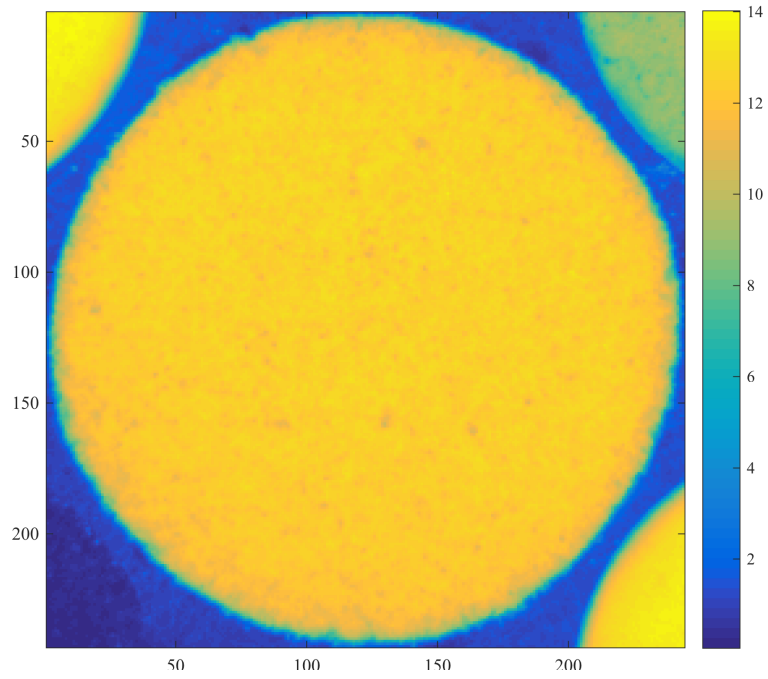


Figure 1. Scores image for principal component one for an image of pure wheat gluten (no preprocessing). Only pixels in the center of the cup were used to calibration the PCA model.