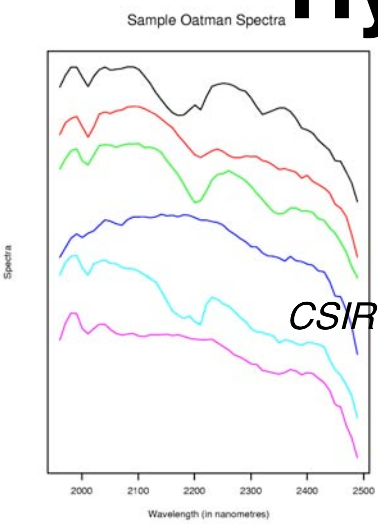
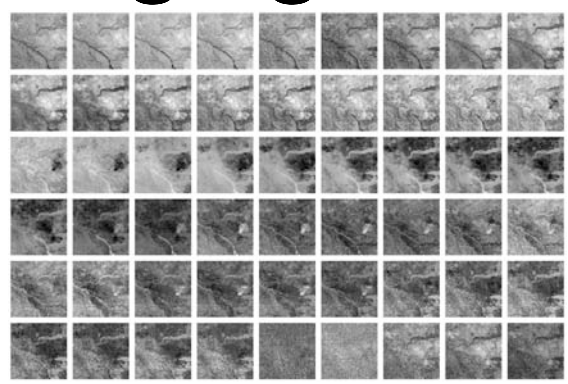
R•I•T College of Science

Chester F. Carlson Center for IMAGING SCIENCE

Seminar Series

Some Statistical Problems in Spectroscopy & Hyperspectral Imaging





Mark Berman

Chief Research Scientist

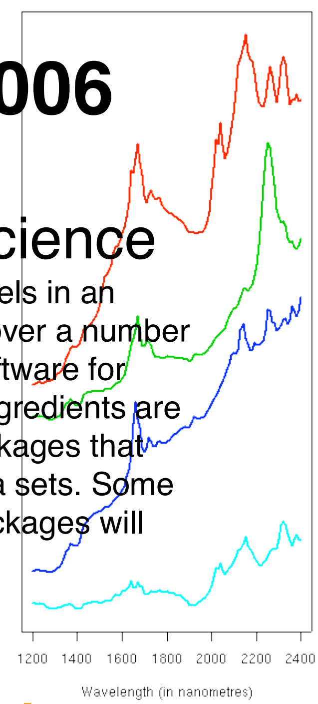
CSIRO Division of Mathematical and Information Sciences

Austrailia

4pm, Monday, Oct. 9, 2006

Auditorium of the Center for Imaging Science

A significant issue in hyperspectral imaging is that the spectra at many pixels in an image are mixtures of the spectra of the pure ingredients. My main focus over a number of years has been on developing fast and sophisticated algorithms and software for “unmixing” these spectra into their pure ingredients, both when the pure ingredients are known and when they are unknown. This has resulted in two software packages that will be introduced and demonstrated with some mineral and biological data sets. Some unsolved statistical and computational problems associated with these packages will also be discussed.



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Talk Abstract

Every material has a distinctive spectrum. The spectrum of a material tells us about its chemistry. Hyperspectral images produce a spectrum (represented as several hundred numbers) at each pixel in an image. So hyperspectral images enable us to map variations in chemistry.

The first hyperspectral scanners, built in the 1980’s and 1990’s, were designed for airborne applications, primarily for mineral, environmental and military applications.

In recent years, hyperspectral microscopes and cameras have been developed and are being used for terrestrial applications in areas such as medical diagnosis, burns analysis and skin cancer, biosecurity, pharmaceuticals, forensics and in agribusiness.

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- The Spectral Assistant (TSA), which has been incorporated into another CSIRO package, The Spectral Geologist, which itself has been sold to over 100 (mainly exploration and mining) companies around the world; and

- Iterated Constrained Endmembers (ICE), which has yet to be commercialized.

I will give an overview of the algorithms underlying TSA and ICE, and demonstrate their application to some mineral and biological data sets. Finally, I will discuss some unsolved statistical and computational problems associated with these packages.

Speaker Bio

Mark Berman received the B.Sc.(Honours) degree and University Medal in mathematical statistics from the University of New South Wales in 1974, and the Master of Statistics degree from the same institution in 1976. In 1978, he was awarded the Ph.D. and D.I.C. degrees in mathematical statistics by the Imperial College of Science and Technology, London.

He was a visiting lecturer in the Department of Statistics at the University of California, Berkeley during 1978-1979. Most of his time since then has been with the CSIRO Division of Mathematical and Information Sciences (CMIS), Sydney, where he is now a Chief Research Scientist. He led CMIS' Image Analysis Group from 1989 to 2000. He spent 1988 at the Melbourne Research Laboratories of Broken Hill Proprietary Ltd. where he established the Image Processing and Data Analysis Group. His research interests are in image analysis (especially hyperspectral), spectroscopy and spatial data analysis.