Applying predictive modeling to geology and hydrology

Dr Joshua Valder recently completed his PhD from the well-respected South Dakota School of Mines and Technology. As part of the Atmosphere and Environmental Sciences program in the Civil and Geological Engineering, he was focused on developing an approach that uses multivariate statistical methods in identifying unknown source areas and mixing proportions for geologic and hydrologic processes.

Innovative use of PCA

Josh identified there was a need for more statistical analysis of data and finding new ways of determining multivariate data analysis parameters and applying to quality data. He explains "Most of the prior research was done to identify mixing ratios or source waters where in all the current research cases one of these two parameters was known." While Principal Component Analysis (PCA) was already used in hydrology, Josh uses it primarily for predictive modeling, which was relatively new in this field at that time.

"I had heard about the Unscrambler from the Minerology Professor at the School of Mines. When I saw the capabilities of the software, I thought 'that's exactly what I need!'" In his work, he takes a very large data set then distills it down to the most relevant data possible. Josh primarily uses the Unscrambler for PCA in addition to some regression analysis to identify outliers in data sets. He then uses that information to calculate mixing ratios from the predictive model.

Intuitive and flexible

Josh had used other multivariate data analysis programs but felt they were less flexible and intuitive than The Unscrambler, in particular the graphics. "Having all the data in The Unscrambler and seeing scores plot, matrix plot and more on the same screen was fantastic. It made interpreting my data so much easier and faster" he says.

In particular, Josh appreciated The Unscrambler's ability to overlay Hotelling T2 on a PCA scores plot. He adds "It's not often you can see multivariate analysis and classical statistics on the same plot."

The powerful graphics and methods proved useful even during his Doctoral defense. "In my defense I was getting a lot of questions on interpretation of the principal components. I needed to easily show and interpret what each principal component was representing in a physical setting. Using The Unscrambler I was able to show 3D plots of the data, rotate the data cloud, and describe to my professors how to interpret more than two principal components at a time. They were impressed!" explains Josh.

Industry:

- Higher Education / Geology & Civil Engineering

Product:

- The Unscrambler®

Executive Summary:

- Conducts data analysis of multivariate statistical methods in identifying unknown source areas and mixing proportions for geologic and hydrologic processes
- Uses PCA and regression to identify outliers to calculate mixing ratios from predictive models
- Chose The Unscrambler® for its ease of use, graphical output and ability to handle large data sets
- Has found the support and assistance from the CAMO team very helpful

At a glance: South Dakota School of Mines and Technology

- Founded in 1885 in Rapid City and situated at the edge of the famous Black Hills, including Mt. Rushmore, Crazy Horse Monument and the South Dakota Badlands
- Part of a group of specialized engineering and science universities in the USA and featuring a renowned Museum of Geology
- Ranked one of America's 100 Best College Buys for eight consecutive years
- Work with organizations including Boeing, NASA, and the U.S. Department of Defense

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Dr Joshua Valder
Recent Graduate, South Dakota School of Mines and Technology

Helpful support when you need it

As someone new to multivariate analysis and applying it in an innovative way to his field, Josh has sought the advice of the CAMO Software scientific experts on several occasions. "The people at CAMO have been very helpful, I've had extensive conversations with them. The Support staff and customer service has been excellent" says Josh.

Josh believes one of the strengths of the software is being able to take a matrix of data and easily import, process, and interpret data into the Unscrambler. "The range of analysis, predictions and graphical output of the dataset is a real strength. You can have four windows showing eight different PCA. It's so easy and the user-interface is a huge advantage of the software" he adds.

SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

For more information on South Dakota School of Mines & Technology
www.sdsmt.edu

CAMO

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