Using SAS/SPECTRAVIEW™ for Data Visualization
Ali Dogrusoz, SAS Institute Inc., Cary, NC
Stuart Nisbet, SAS Institute Inc., Cary, NC

ABSTRACT

In this paper, we present some different types of data visualization that can be performed with SAS/SPECTRAVIEW software. The discussed visualization applications will explore both spatial and non-spatial data analysis and can, therefore, be useful examples in a wide variety of industries. This paper is meant to supplement a formal demonstration of the SAS/SPECTRAVIEW software.

INTRODUCTION

New for Release 6.09 of the SAS® System, SAS/SPECTRAVIEW provides real-time, multidimensional data visualization functionality with a complete menu-driven interface. This software has possible uses in a variety of applications, including environmental sciences, oil exploration, medical imaging, pharmaceutical studies, and financial analysis.

You can include up to five variables in a single analysis. The variables correspond to:

- X-axis variable
- Y-axis variable
- Z-axis variable
- BY variable
- Response variable
- BY variable

One of the strengths of this software is its ability to visualize very large data sets. Subtle patterns and changes in the data are clearly visible using custom color palettes and 3D structures viewed from any angle. The interactivity of SAS/SPECTRAVIEW allows you to rotate the model in real-time, stopping to zoom in on areas of interest. In addition, you can:

- Modify the colors while viewing the model to highlight particular densities or values.
- Make slices through the data using contour planes. Display contour planes as a block or line contour.
- Extract the peaks and valleys of a contour into 3D space much like a surface plot in G3D. The difference is that the SPECTRAVIEW surface is color-coded based on the response value.

In all, these contours and surfaces can be displayed with sixteen different variations. The entire volume of data can be viewed at once with its perimeter cut away or rendered with transparency to reveal internal structures.

The data points in a user-specified range can be subsetted and displayed in a variety of shapes and sizes. Once you find an interesting data range, you can request an iso-surface to be displayed at a given response value. The iso-surface is a 3D geometric representation of all data corresponding to the requested value. Further, you can pass a probe through the data to retrieve exact location and response value information. If the initial data contains anomalies (often present in medical images), several types of prebuilt filters can be used to process the data. The filters are a 3x3x3 matrix of values that operate on the input data set to smooth or sharpen contrasts in the data. You also have the option to define and use a custom filter on the data. Once you have performed the data analysis, you can add interactive annotations to the model. Axis labels, titles, and legends can be added to the model with the final results written to a TIFF file.

ENVIRONMENTAL SCIENCE

Multidimensional data visualization has become an increasingly important tool for scientists involved with various aspects of environmental research. As computers become more and more powerful, scientists are able to tackle larger pieces of the environmental puzzle. Unfortunately, this often results in large masses of information that can not be evaluated using traditional analysis methods. In addition, environmental data has to be continually collected since it is constantly changing. The size and dynamic nature of the data demand the type of interactive, visual analysis system that SAS/SPECTRAVIEW provides. The following example shows the variable assignments for the axes, response variable, and BY variable for a possible environmental study:

<table>
<thead>
<tr>
<th>X axis: Longitude</th>
<th>Y axis: Altitude</th>
<th>Z axis: Latitude</th>
<th>Response value: Ozone concentration</th>
<th>BY variable: Date</th>
</tr>
</thead>
</table>

The Y contour plane represents the concentration of ozone at a given altitude. Point clouds and isosurfaces can be generated at a certain ozone level to indicate dangerous or illegal conditions. The data can be animated over time using the BY variable (DATE). All of the SAS/SPECTRAVIEW tools (contour plane, isosurface, point clouds, ...) will change as you cycle through the BY variable values.

MEDICAL IMAGING

The standard X-ray has long been used in the medical industry for visualizing internal anatomy. One shortcoming of this approach is that X-rays are usually taken at an initial step in diagnosis and must be retaken from alternate positions if the pertinent information is not clear. Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) scans afford medical personnel the opportunity to gather data (ie. perform the scan) and visualize it from any angle later. The X-ray film can, in essence, be developed in real-time with an infinite number of possibilities for patient positioning. Artifacts found in the resulting image can be removed using pre-defined or custom filters. For MRI and CT scans, the contour planes of SAS/SPECTRAVIEW provide a view of the data along the pre-defined X, Y, or Z axes or along a user-defined line of sight. A probe can be passed through the volume of data to retrieve exact density readings at a location. Finally, the entire volume can be rendered with transparency values associated with different densities to produce a comprehensive picture of the data.
FINANCIAL ANALYSIS

Using SAS/SPECTRAVIEW for financial or business data analysis differs from the aforementioned applications because it traditionally deals with non-spatial data. That is, the axis variables do not represent distance in the 3D XYZ domain. For example, the axis variables may be assigned as follows:

X-AXIS: Date (01JAN94, 02JAN94, ...)
Y-AXIS: Store Location (TX, NC, SC, ...)
Z-AXIS: Department (Bakery, Dairy, Deli, ...)
Response Variable: Sales

This would allow you to analyze a large dataset of sales data based on any one, two, or three of the independent axis variables. More discrete analysis is performed by extracting a bar chart from the intersection of two contour planes. Also, the response surface can be displayed as a 3D block chart to clarify the discrete data points. In addition to these graphs, overall trends in the sales figures can be visually identified using point cloud subsetting.

CONCLUSION

These examples of 3D data visualization represent just a few of the applications for SAS/SPECTRAVIEW software. Any industry with large quantities of multidimensional data can benefit from this type of technology. SAS/SPECTRAVIEW is a new product for Release 6.09 and, as such, is an evolving product. New features and enhancements are added as their need is realized in the hope that SAS/SPECTRAVIEW will provide a comprehensive data analysis tool capable of assisting a wide variety of visualization efforts.

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