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EN 605.662 Data Visualization

Project #5

Scientific Visualization using ParaView

I. Introduction

As the data becomes more complex, visualization requires a more advanced way to illustrate the data such as volume rendering, isosurfaces and etc. In this paper, I will be using Paraview, an open source visualization application, to demonstrate the way to illustrate interactive, scientific visualizations with some scientific datasets.

II. Datasets

1. Iris Species by Kaggle.com [1]

A famous tabular dataset in machine learning domain that contains 4 features of Iris (Sepal length, sepal width, petal length, and petal width) with their species (setosa, versicolor, and virginica). 50 records for each species. Since it's a tabular dataset with multi dimensional features and 1 class, so that basic 2D plots and some 3D plots such as 3D scatter plot are feasible for the visualization.

2. 3D surface model of Honolulu by Paraview [2]

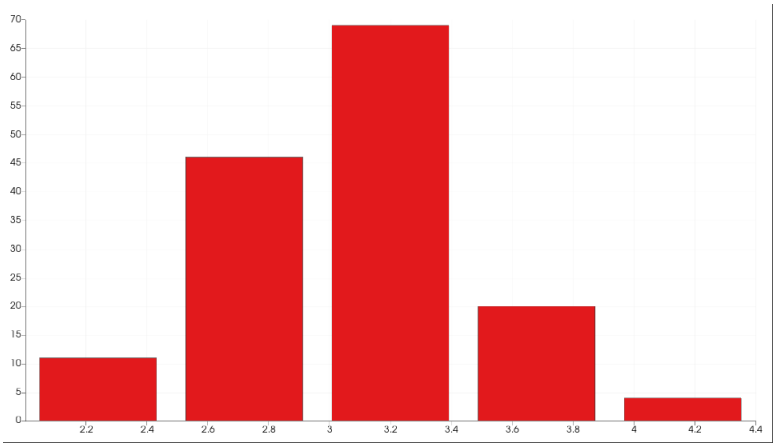
This is a 3D volume file provided by Paraview as a sample dataset, which contains the geological surface information of Honolulu city. It is an unstructured grid data with 112400 points. Possible visualizations would be volume rendering, clipping and slicing filtering.

III. Visualization

1. Iris dataset

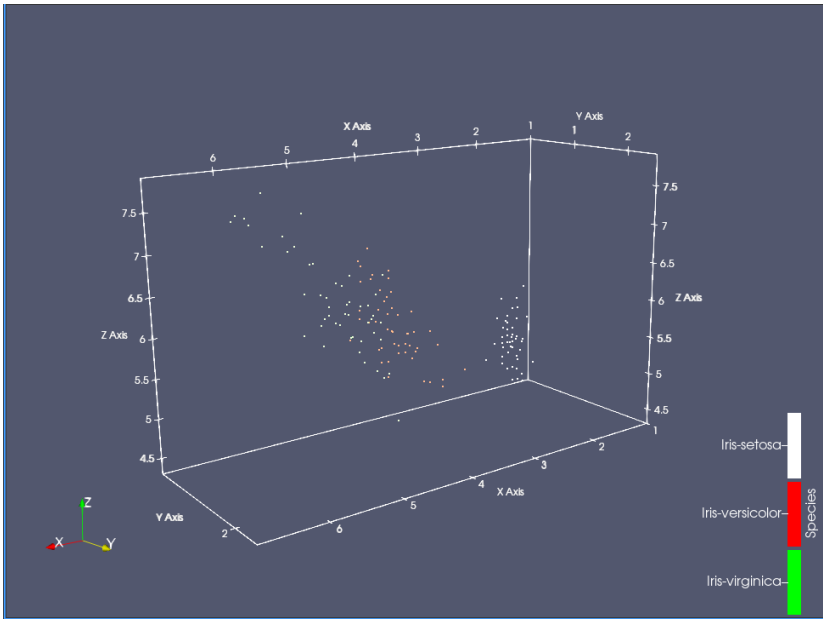
a. Histogram:

5 bin histogram for one feature (sepal length) of iris is visualized as below.



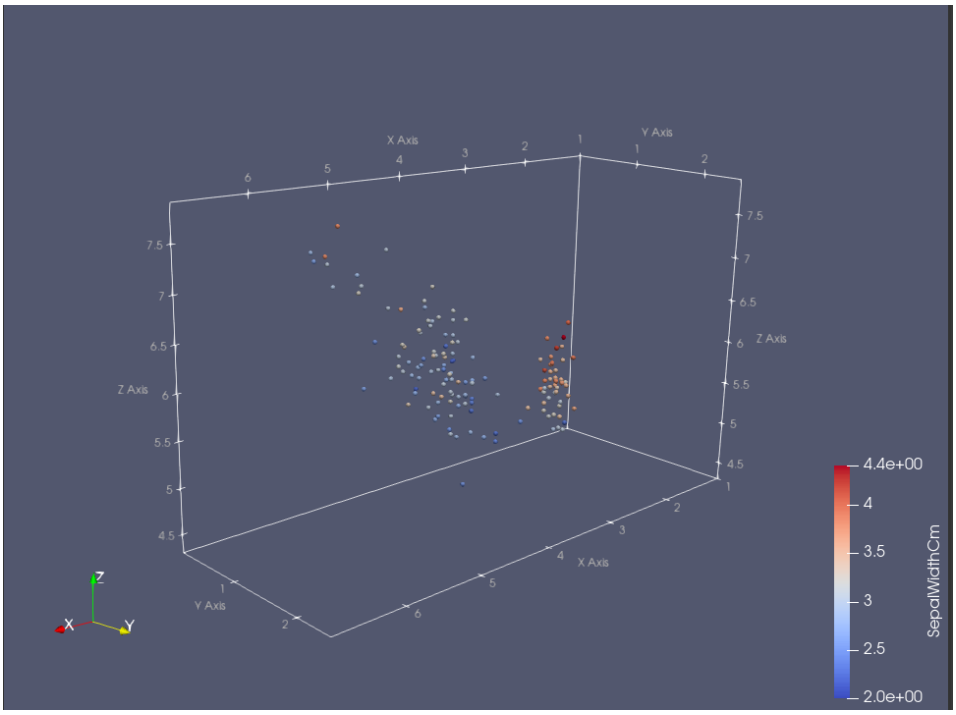
b. 3D scatter with class markers (Table to point):

Petal length, petal width and sepal length as X,Y, Z axis and species as a coloring for each point. So from the visual we can observe if there is any grouping or clustering of 3 features for 3 species.



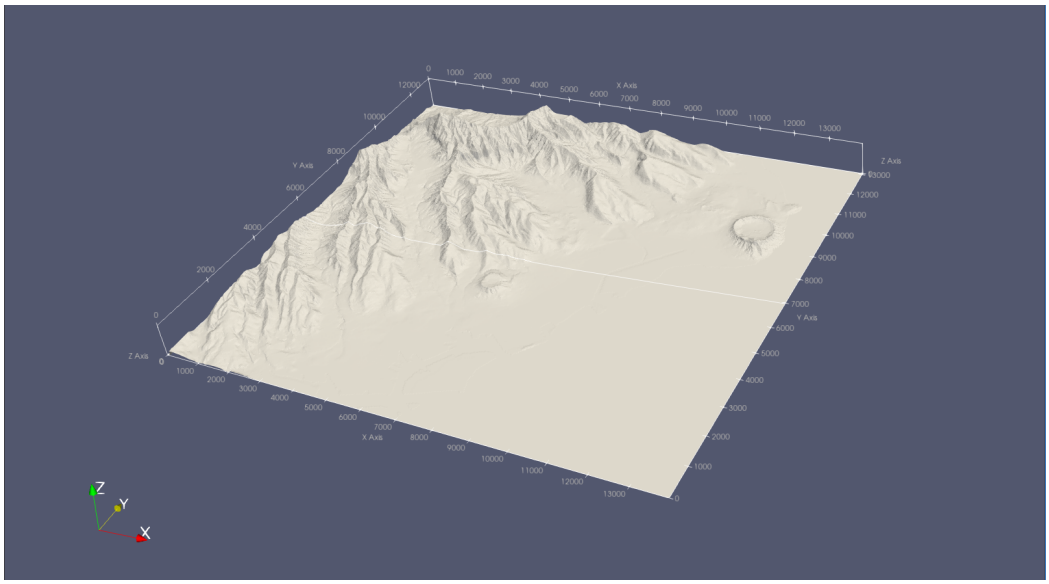
c. 3D scatter with scaler markers (Isovolume):

Petal length, petal width and sepal length as X,Y, Z axis and petal width as a marker for each point. Therefore from the visual we can see if there is any relationship between 3 features and 1 marker feature.

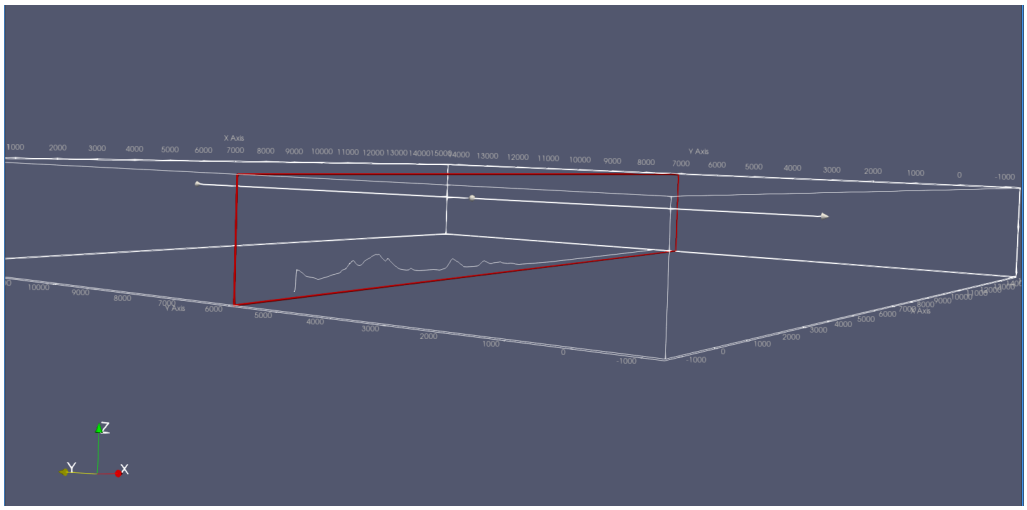


2. Honolulu.vtk

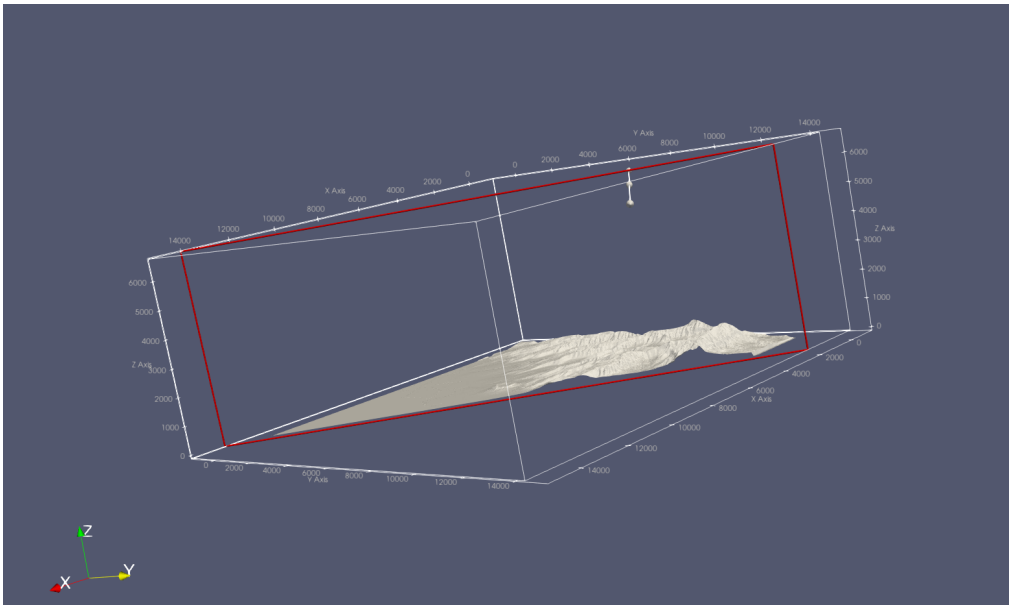
a. Volume Rendering: default output after reading honolulu.vtk data. Paraview illustrates the geological information of Honolulu.



b. Slice filter: after configuring the plane to slice the volumetric object, the cross-section is rendered.



c. Clip filter: similar to slicing, the plane and the direction to clip the 3D object can be adjusted by dragging the axis.



IV. References

1. Iris Species - Kaggle.com: https://www.kaggle.com/uciml/iris
2. Honolulu - Paraview Tutorial Data: https://www.paraview.org/Wiki/The_ParaView_Tutorial