Lecture 9: CS6250 Graphics & Visualization Algorithms

- Scalar Algorithms
- Vector Algorithms
- Tensor Algorithms
- Modeling Algorithms (misc.)

Algorithms in General

How can we characterize different visualization algorithms?

- Structure

- Type

Types of Algorithms

- Geometric Transformations

- Topological Transformations
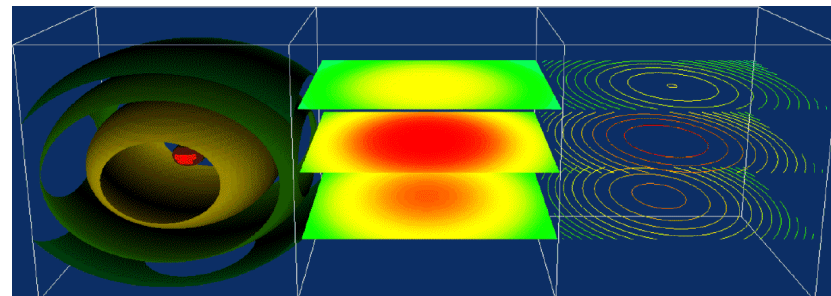
- Attribute Transformations

E.g. creating scalars from vector magnitudes.

- Combined Transformations

E.g. computing contour lines.

Scalar Algorithms

- Color Mapping
- Contouring
- Scalar Generation

Color Mapping

Map scalar data to colors.

In order to implement, we could define a color lookup table.

More General Color Mapping

We could also define a transfer function, mapping from scalar values to colors.
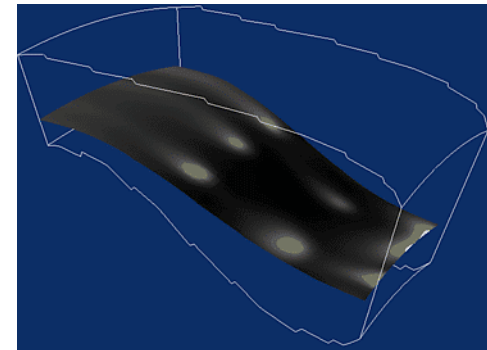
Caveats

Choosing the color map entries is the most important part of this visualization technique.
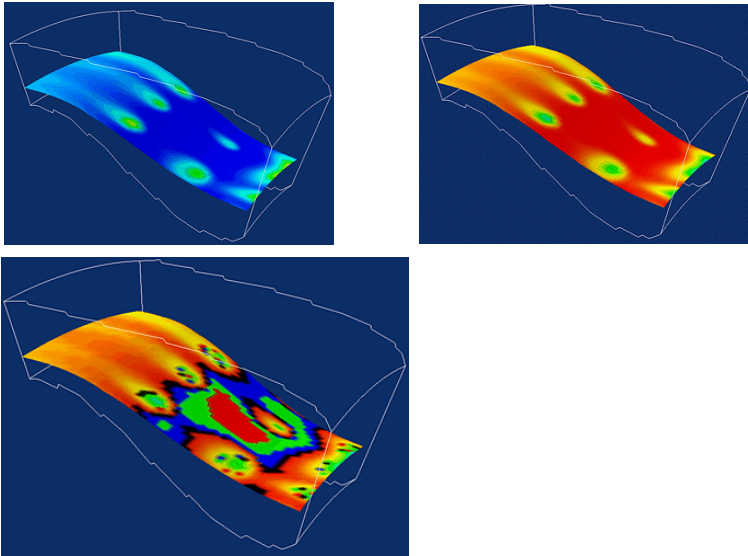
Some choices:

- Grayscale
- Hue stretch
- Contrast enhancing

Be careful! Not everything apparent is real. Also there are interactions between the data, and the human visual system.
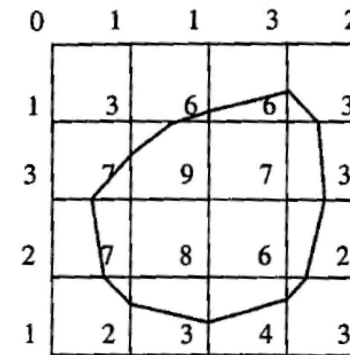
Examples

Contouring

0	1	1	3	2
1	3	6	6	3
3	7	9	7	3
2	7	8	6	2
1	2	3	4	3

Figure 6–4 Contouring a 2D structured grid with contour line value = 5.
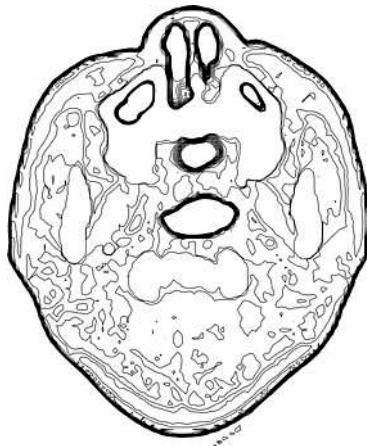
Contouring in 2D and Higher Dimensions
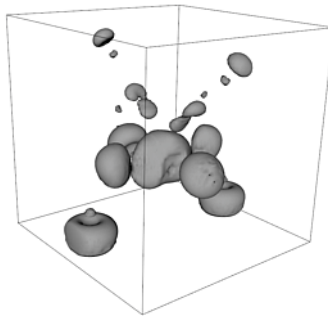
Marching squares/cubes

Problems?

Marching Cubes Continued
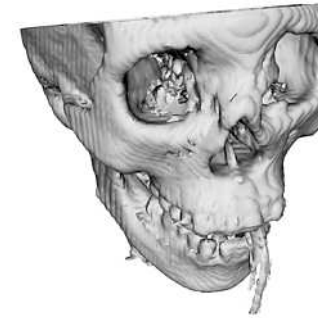
Pipeline:
`VtkVolume16Reader->vtkMarchingCubes->`
`vtkPolyDataMapper->vtkActor`

Note, we could also do smoothing, or reduction in the number of polygons in the pipeline for greater efficiency.

`vtkStructuredPointsReader->vtkCleanPolyData->`
`vtkPolyDataNormals->vtkPolyDataMapper`

What do `vtkCleanPolyData` and `vtkPolyDataNormals` do?

Example

Given a surface grid, how would you visualize the tilt of the surface, e.g. where is the surface tilted greater than a preset angle?

What are some possible pipelines?

Vector Algorithms

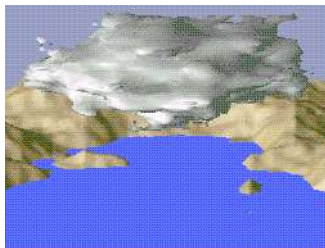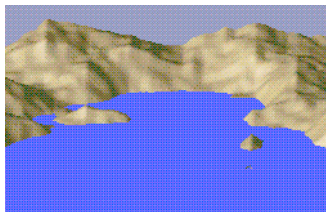What are some simple ways to visualize a field of vectors?

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If we use a 3D graphic to represent a vector, what potential problem can occur when we scale the 3D graphic to the norm of the vector?
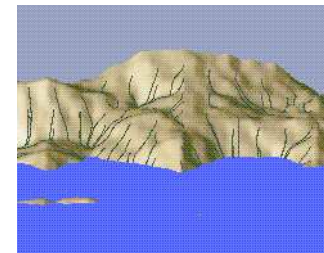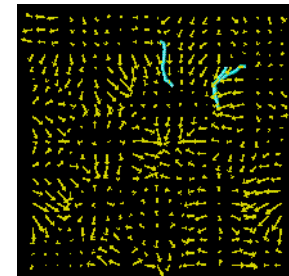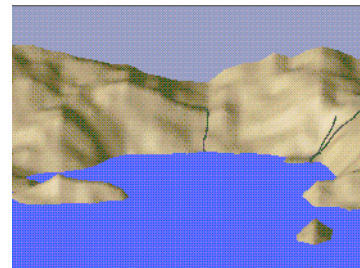
Other Vector Visualization Methods

• Warping

• Displacement Plots

• Time Animation

• Streamlines

Terrain Examples:

Rivers

A Better Color Map?

Trees?