Chapter 1: Introduction

- What is visualization?
- Why visualization?
- Difference and similarity: imaging, computer graphics, and visualization
- Topics in this course
1.1 What is visualization

- Visualization is the process or format that makes the information visible.
- Based on this definition, is printed text, or handwriting a kind of visualization? How about movies, video products?
Terminologies of visualization

Data visualization

Scientific visualization
  - Science
  - Engineering

Information visualization
  - World wide web
  - Business
  - Hyper-text documents
Examples of visualization

- Modern medicine: photographic X-ray, X-ray Computed Tomography (CT), and Magnetic Resonance Imaging (MRI)

(to reconstruct the slice-planes into a volume)
Examples of visualization

- Entertainment industry: movie and television products. Typical examples, Jurassic Park, Ice Age, Happy Feet.
- Engineering and scientific community: fluid flow, ballistic trajectories, structural mechanics, weather report.
Techniques of visualization

- Tensor field
- Vector
- Iso-surface
- Contour
- Curve
- Line segment
- Morphing: a smooth blending of one object into another object.
Data source of visualization

- Experimental measurement
- Numerical simulation
- Theoretical prediction
- Statistic data, population, transactions in stock exchanges
1.2 Why visualization

- To extract important information from a very large amount of data
- To make use of the human vision system, medical image data, weather forecast, describe a classroom
- To reduce production cost, computer simulation of moving car, flying airplane, sailing boat
1.3 Difference and similarity: imaging processing, computer graphics, and visualization

- Imaging processing: the study of 2D pictures and images
- Computer graphics: the process of creating 2D and 3D images using a computer
- Visualization: the process of visualizing data in the form of image
Visualization process

Measurement

Data acquisition

Data transformation

Data mapping

Display

Numerical simulation
1.4 What is covered in this course

- Fundamental concepts of computer graphics
- Fundamental concepts of visualization
- Program languages: C++ and Tcl/Tk
- Basic data representation: structure, cell, and data attributes
- Applications: real world visualization
What can you learn from this course

- The procedures and methods in visualization
- How to visualize scientific data using vtk
- How to visualize data of your own interest
- How to develop your GUI interface for data input and output
Graphs are one kind of visualization.

Large Scale Virtual Reality

The CAVE

Projection Wall

Immersadesk

More Examples

Surface Rendering with vTK

Volume Rendering with SGI Infinite Reality Engine

Even More Examples:
Astro Physics

Some examples

Nuclear, Quantum, and Molecular Modeling

Structures, Fluids and Fields

Advanced Imaging and Data Management