Introduction

HCI LAB　　visitlab

Who are we?

- ## Bára Kozlíková
  - Head of visitlab, research in visualization, namely in biochemistry, criminology, geology, ...

- ## Vítek Rusňák
  - HCI/Vis researcher at the MUNI Cybersecurity Team, research in user interfaces, visual analytics in cybersecurity and gamification

What to expect?

- Successor of PV251 – Visualization course
  - We are expecting that you know the basic principles of visualizations ☺

- **Visualization II** more focused on **research** in visualizations

What to expect?

- Lectures about diverse research fields and topics in visualization

  - Medical visualization, molecular visualization, visual data science, AI explainability, visualization & machine learning, user studies, …

- Many (invited) speakers

  - TU Wien

  - Wolftech Broadcast Solutions AS, Bergen

  - MU

What is expected from you?

- Attend **lectures**

  - *Mandatory* attendance (up to 2 excuses)

- Attend **seminars**

  - Select a topic of interest and work on your project for the whole semester

  - You can work individually or in groups

  - Each seminar, there will be a task for you and homework

  - Each task will be "awarded" by points. Based on these, you will get the final grade for the course.

- **Enjoy** :)

Topic for today ...

- Why is visualization important

- Why is research in visualizations exciting

https://princetonlibrary.org/event/data-visualization-with-javascript-part-3/

Motivation

- TED talk of David McCandless: Introduction to Data Visualization

  - Visualization Basics - Introduction to Data Visualization - Research Guides at Florida Institute of Technology

- Hans Rosling: GapMinder

  - Hans Rosling's 200 Countries, 200 Years, 4 Minutes - The Joy of Stats - BBC Four

Three main fields in visualization

- Scientific visualization (SciVis)

- Information visualization (InfoVis)

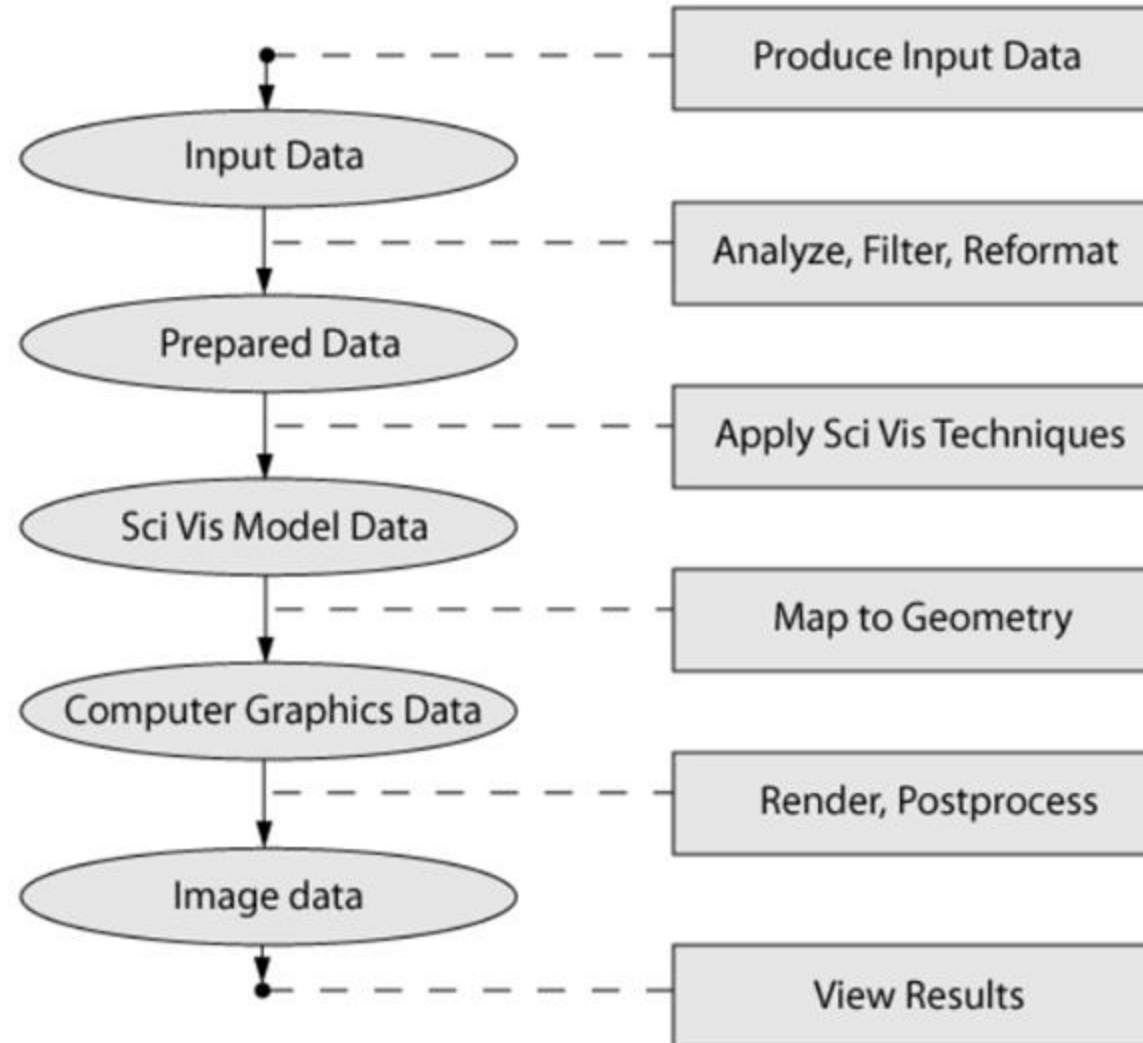- Visual analytics (VAST = Visual Analytics Science and Technology)

Scientific Visualization

- Producing graphics representations of scientific phenomena

- Graphic representation is used for understanding, interpretation.

- It may guide the direction of the research in the corresponding field.

Scientific Visualization – Areas

- Many fields:

  - Medical visualization

  - Molecular visualization

  - Flow visualization

  - Volumetric visualization

  - …

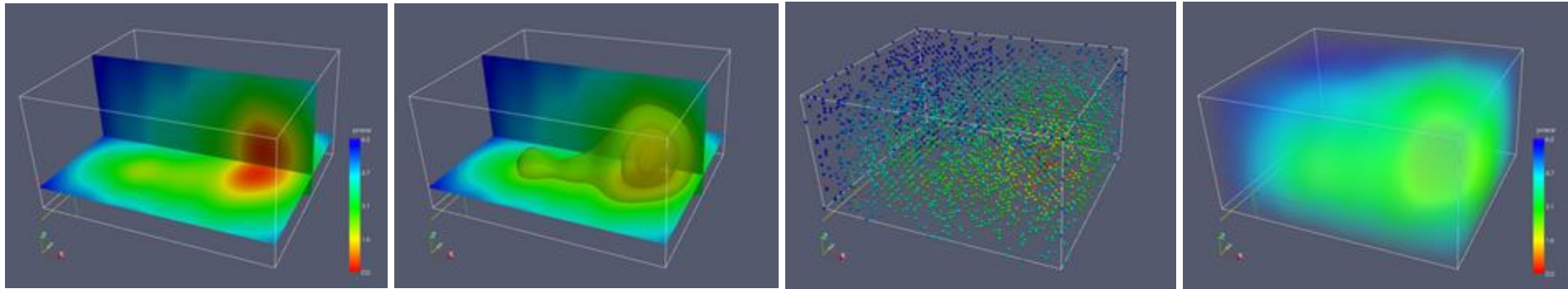# Scientific Visualization Pipeline

What is the core topic …

- The focus of the pipeline is the application of SciVis techniques to create a renderable geometric model of the data
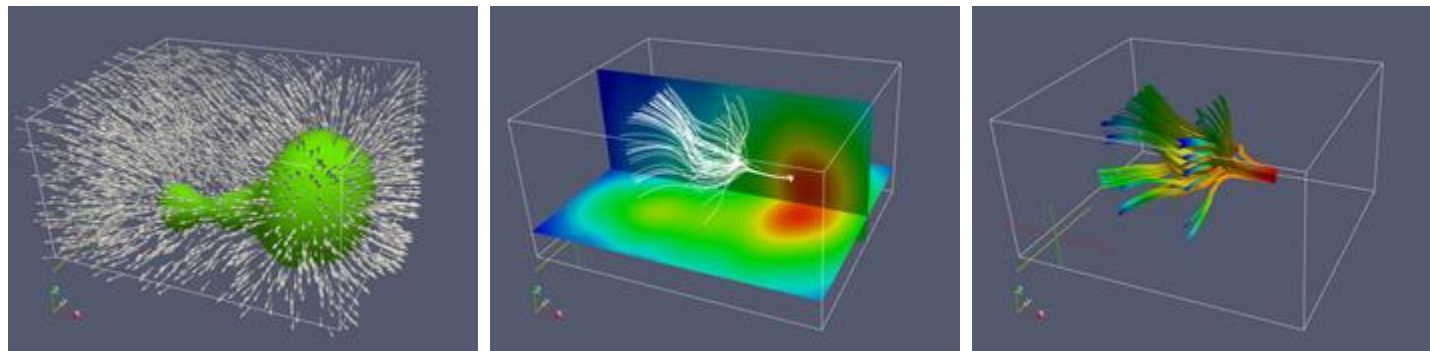
Data Representation in SciVis

- The studied phenomenon is usually modelled by measurements at a discrete set of points in space

  - Representational samples of the underlying mathematical function governing that phenomenon

  - Mesh or topology associated with the data

  - Explicit or implicit definition of points

SciVis Techniques

- ## Spatial phenomena

  - ### Scalar data – slice planes, isosurfaces, glyphs, volumes

  - ### Vector data – hedgehog, streaklines, ribbons

SciVis Software Packages

Tool	Produce Input Data	Analyze, Filter, Reformat	Apply Sci Vis Techniques	Map to Geometry	Render	Postprocess	View Results
Experiments, Simulations	Y						
Custom code	x	x	x	x	x	x	x
MATLAB	x	Y	x	x	x		x
IDL	x	Y	x	x	x		x
VTK		x	Y	x	x		x
Paraview		x	Y	x	x		x
OpenGL					Y		x
Open Scene Graph					Y		x
Maya					Y		x
Photoshop						Y	x
Gimp						Y	x
Imagemagick						Y	x
Premier						Y	x
Journals, web browsers, Projectors							Y

http://www.bu.edu/tech/support/research/training-consulting/online-tutorials/introduction-to-scientific-visualization-tutorial/software-packages/

Other Resources

- Anders Ynnerman: OpenSpace – Visualizing the Universe

  - https://vimeo.com/169967499

- Anders Ynnerman et al.: Interactive visualization of 3D scanned mummies at public venues
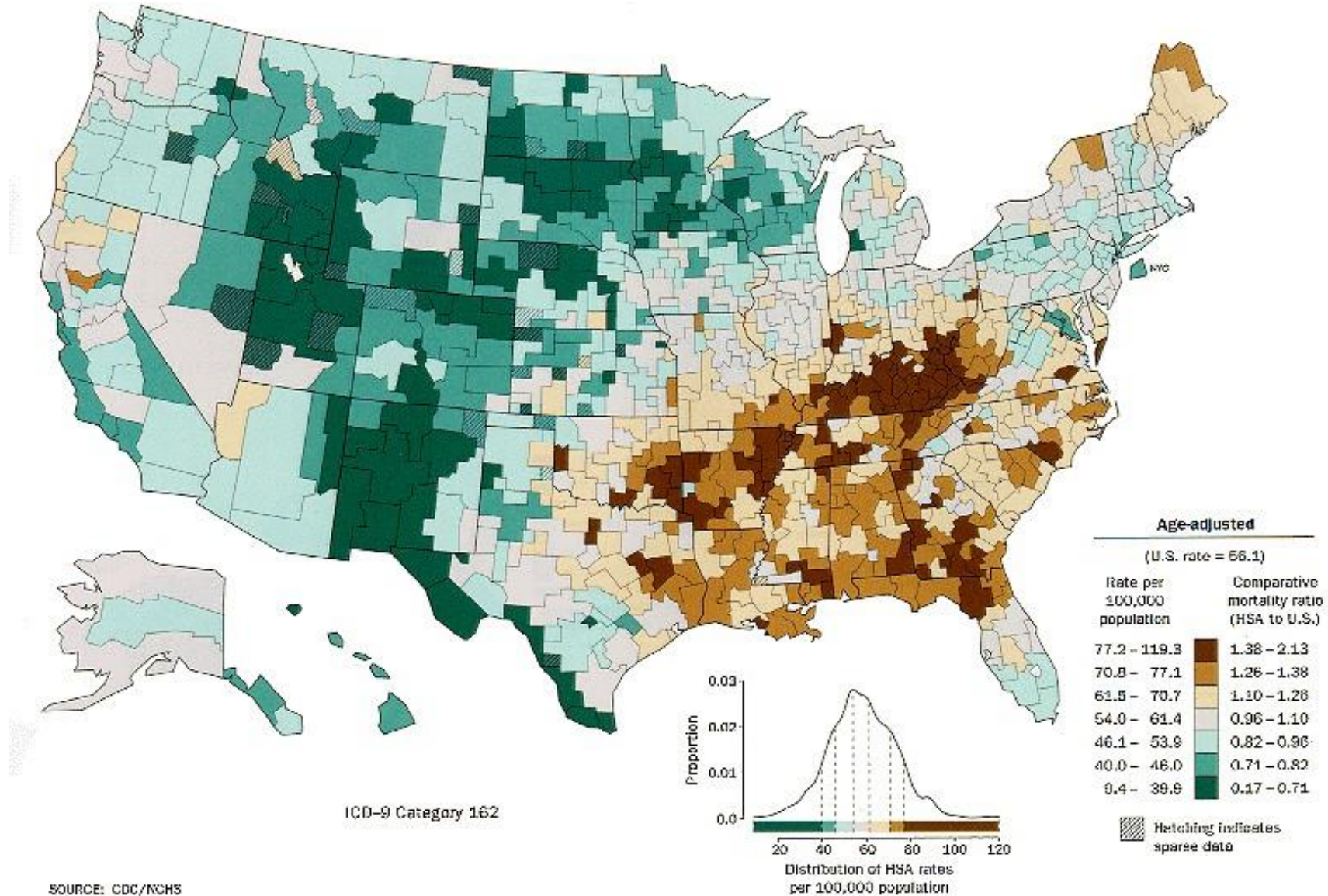 - https://dl.acm.org/doi/10.1145/2950040

Information Visualization

- Main focus on representing data in an easily understandable way, supported by intuitive interaction

- The most common uses of InfoVis are:
  - Presentation
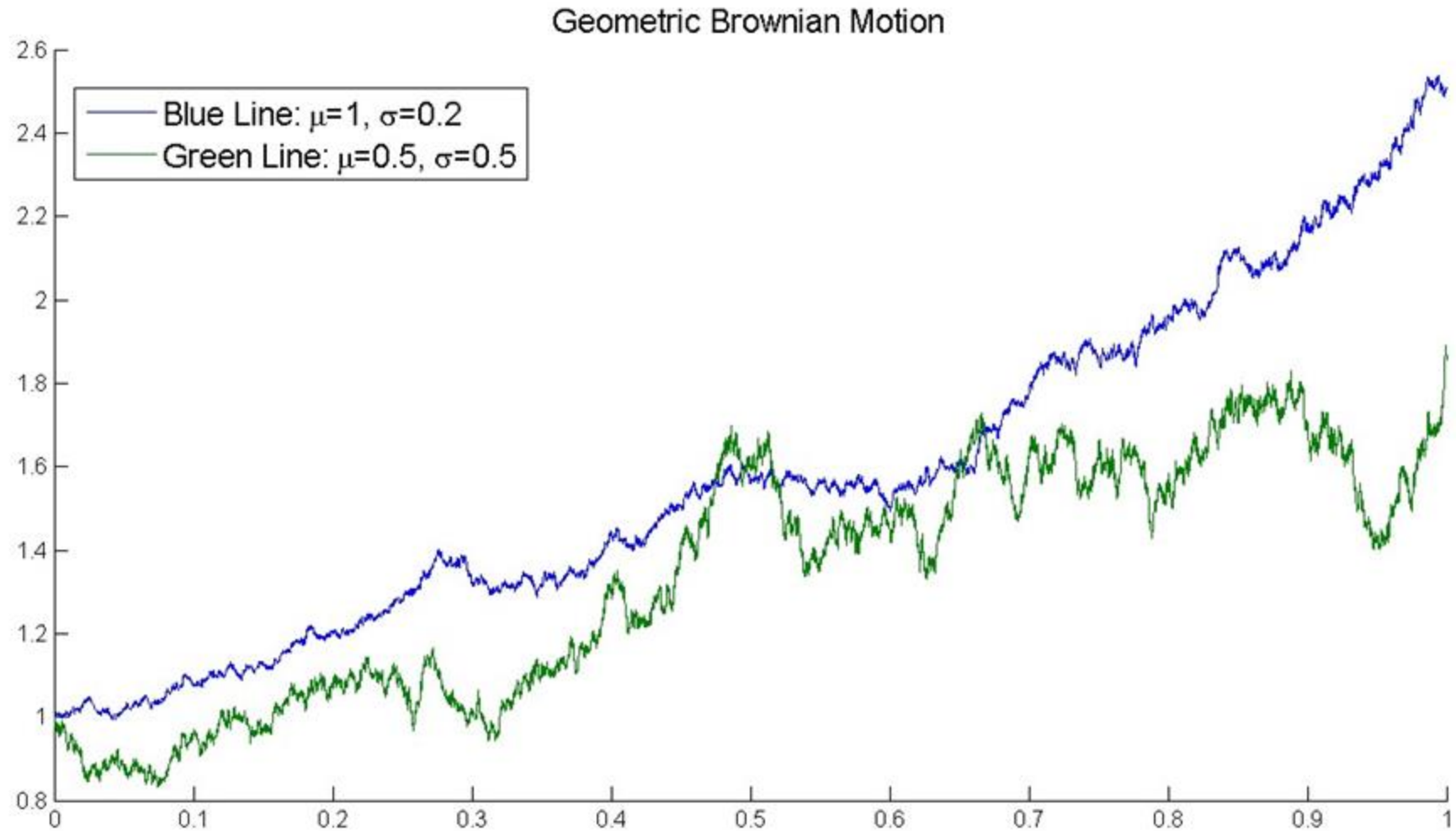 - Explorative analysis
  - Confirmation analysis

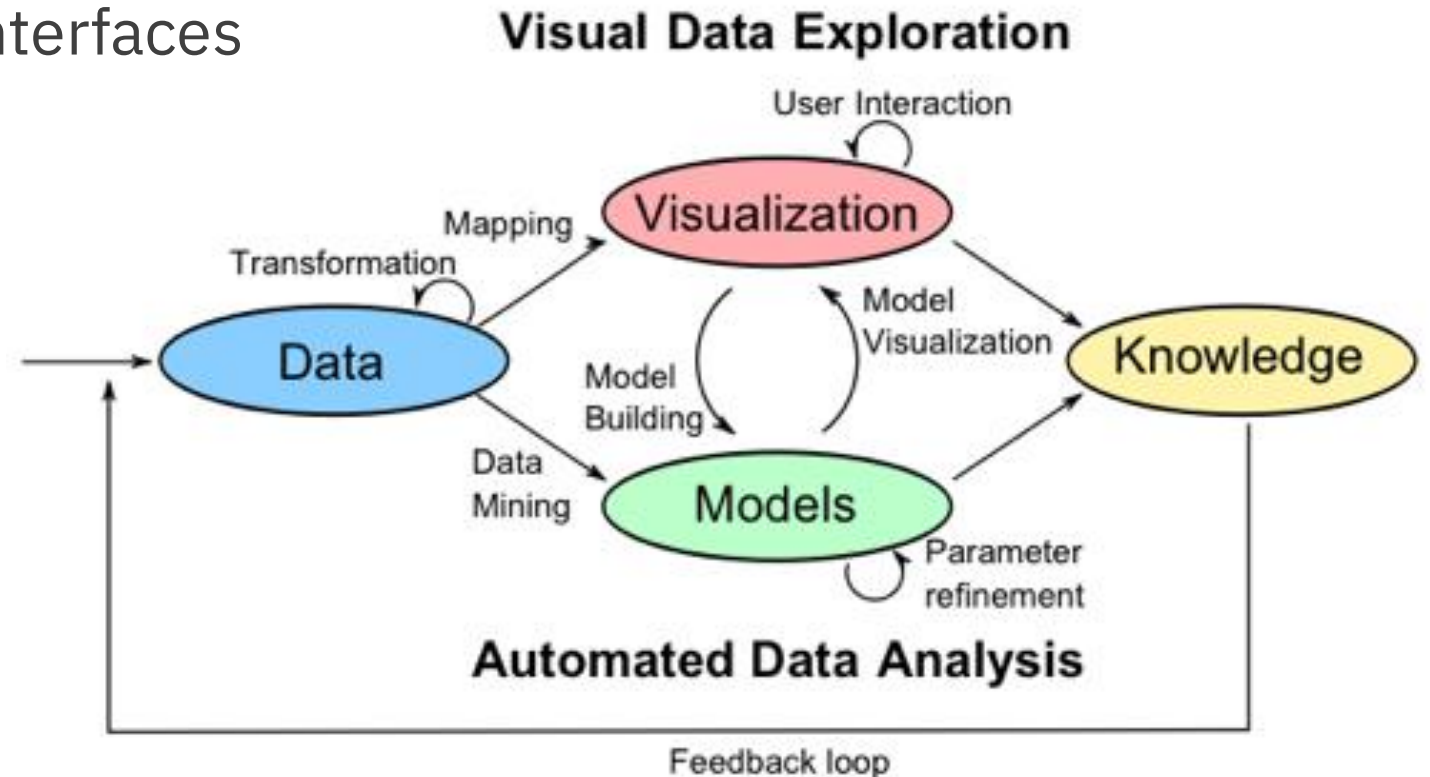# Presentation

Explorative Analysis

Confirmation Analysis

Geometric Brownian Motion
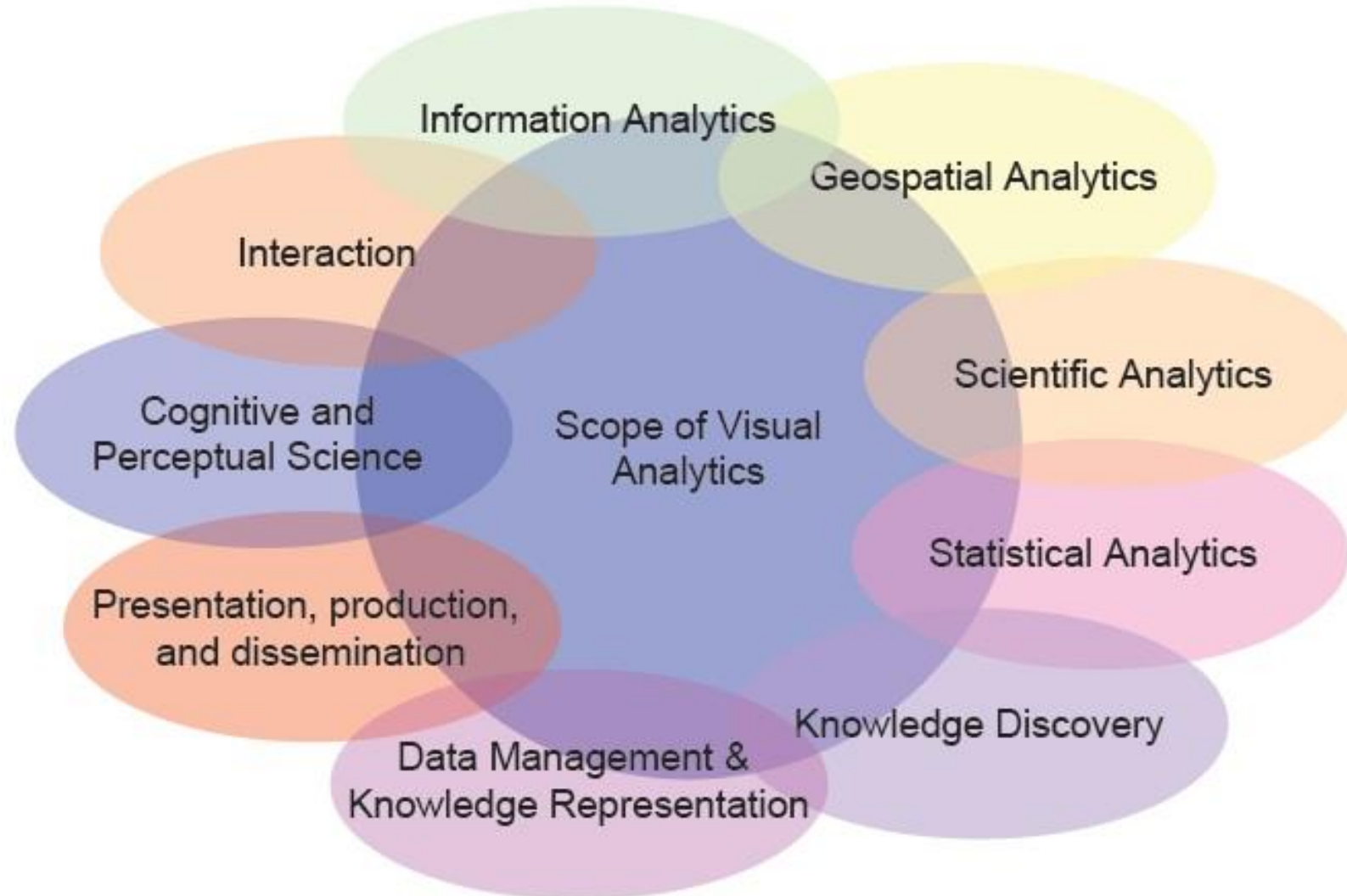
Blue Line: $\mu=1$, $\sigma=0.2$
Green Line: $\mu=0.5$, $\sigma=0.5$

Other Resources

- https://informationisbeautiful.net/

- https://informationisbeautiful.net/visualizations/what-makes-a-good-data-visualization/

- Jeffrey Heer: https://www.youtube.com/watch?v=hsfWtPH2kDg
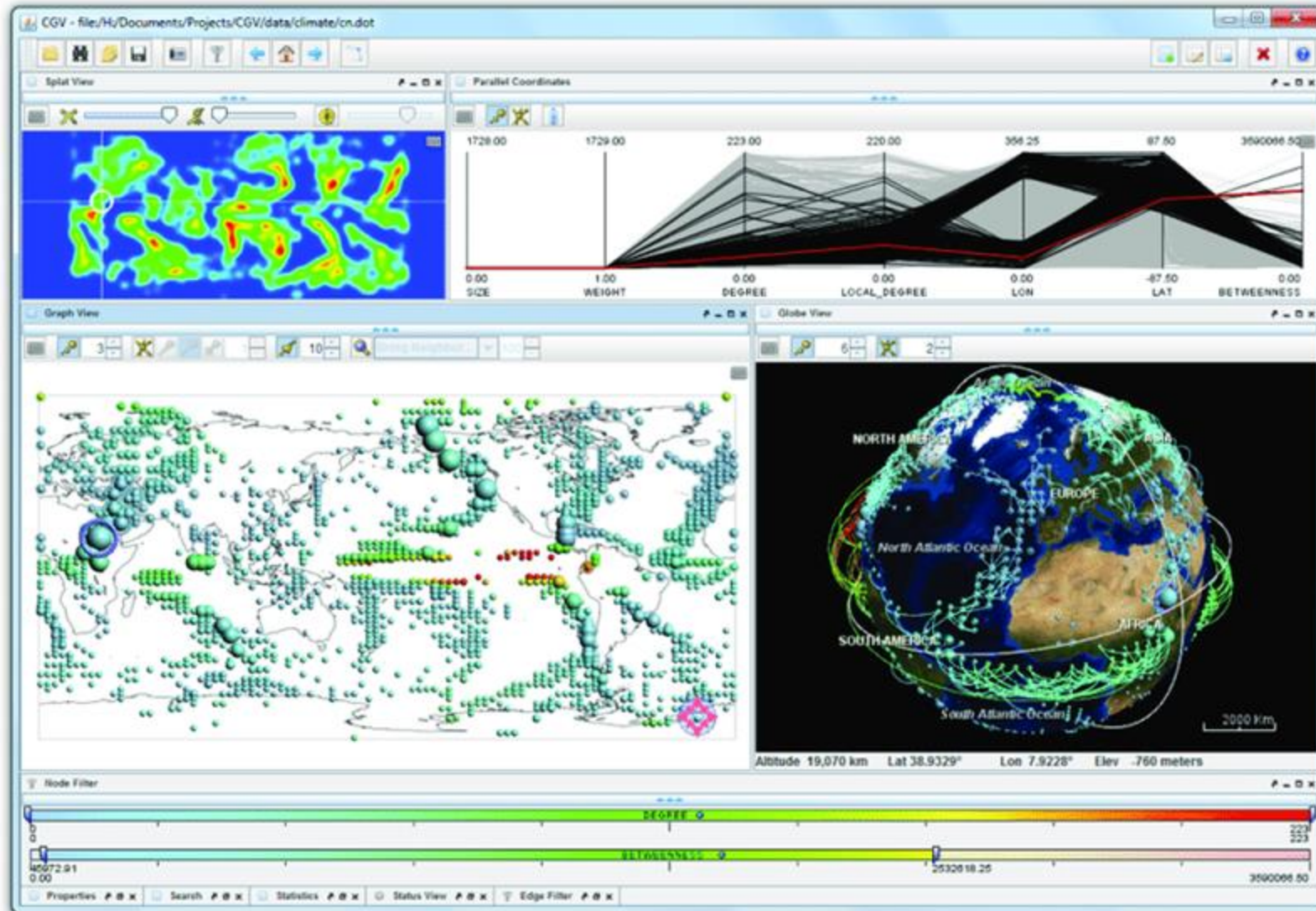
- Ben Shneiderman:
  https://www.youtube.com/watch?v=X1EPxT9EP5c

VAST

- Analytical reasoning supported by interactive visual interfaces

- Designing advanced visual interfaces

VAST Scope

Examples

24

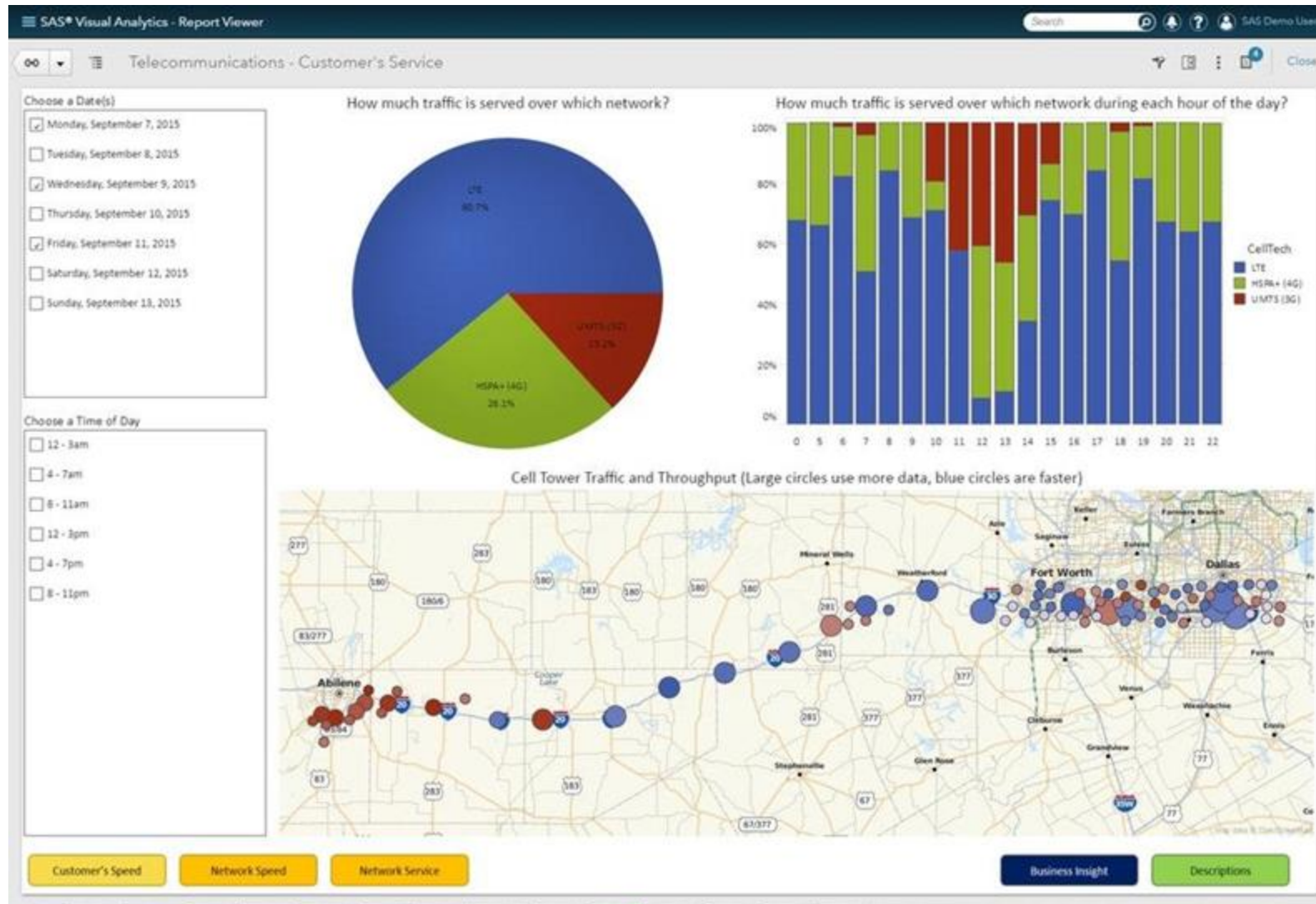# Examples

Other Resources

- Tamara Munzner:

  https://www.youtube.com/watch?v=xUbhRu2f8e4

Where to publish the visualization research outcomes ...

- International conferences: IEEE VIS, EG EuroVis, IEEE PacificVis, ...

  - Smaller specialized venues: EG VCBM

- Journals: IEEE TVCG, Computer Graphics Forum, ...

What are the possible paper types ...

- http://ieeevis.org/

Area 1: Theoretical & Empirical

This area focuses on theoretical and empirical research topics that aim to establish the foundation of VIS as a scientific subject.

Theoretical & Empirical →

Area 2: Applications

This area encompasses all forms of application-focused research.

Applications →

Area 3: Systems & Rendering

This area focuses on the themes of building systems, algorithms for rendering, and alternate input and output modalities.

Systems & Rendering →

Area 4: Representations & Interaction

This area focuses on the design of visual representations and interaction techniques for different types of data, users, and visualization tasks.

Representations & Interaction →

Area 5: Data Transformations

This area focuses on the algorithms and techniques that transform data from one form to another to enable effective and efficient visual mapping as required by the intended visual representations.

Data Transformations →

Area 6: Analytics & Decisions

This area focuses on the design and optimization of integrated workflows for visual data analysis, knowledge discovery, decision support, machine learning, and other data intelligence tasks.

Analytics & Decisions →

We hope you'll like the course …

- Questions and requests:

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