

PA214 Visualization II / Lecture #1

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Introduction

HCI^{LAB}

visiτlab

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
 - Harvard Medical School
 - 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)

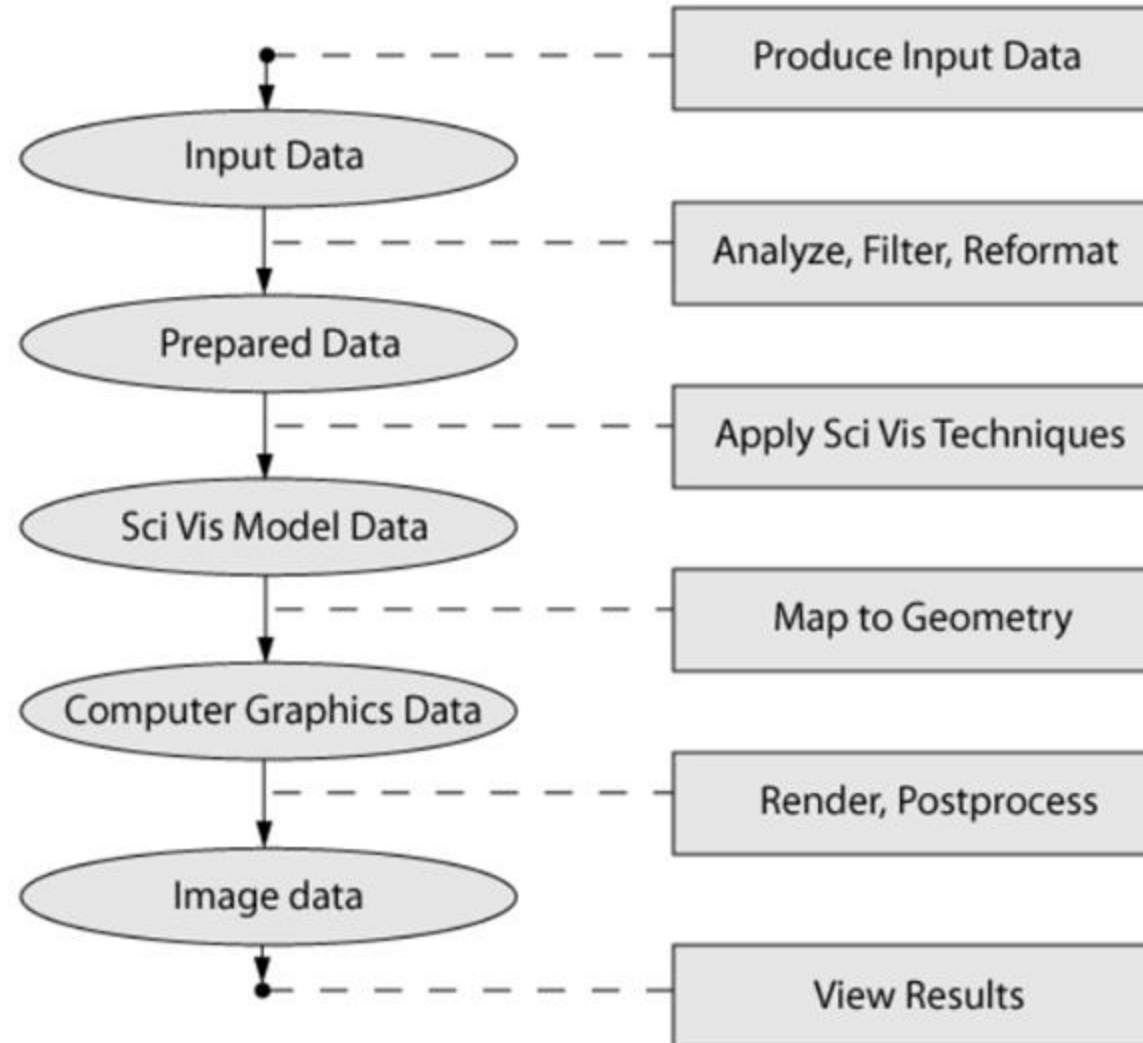
Scientific Visualization

- 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 ...

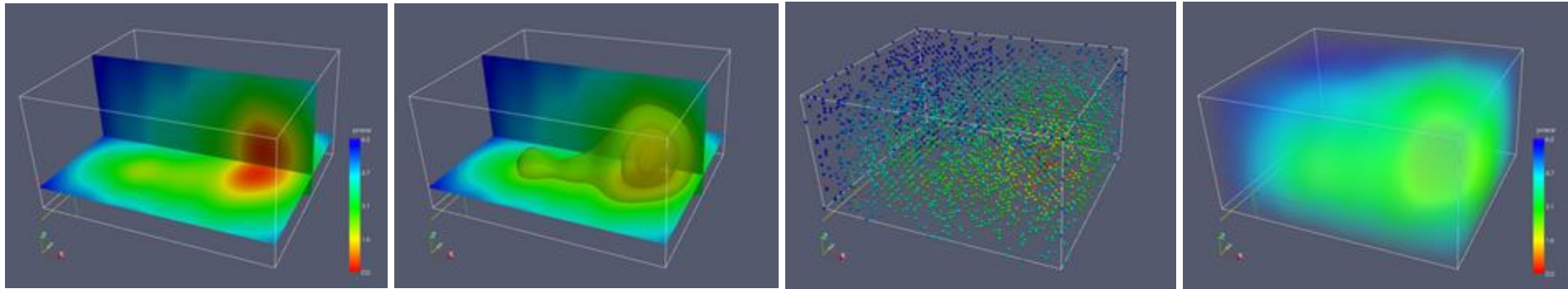
- The focus of the pipeline is the application of SciVis techniques to create a renderable geometric model of the data

Data Representation in SciVis

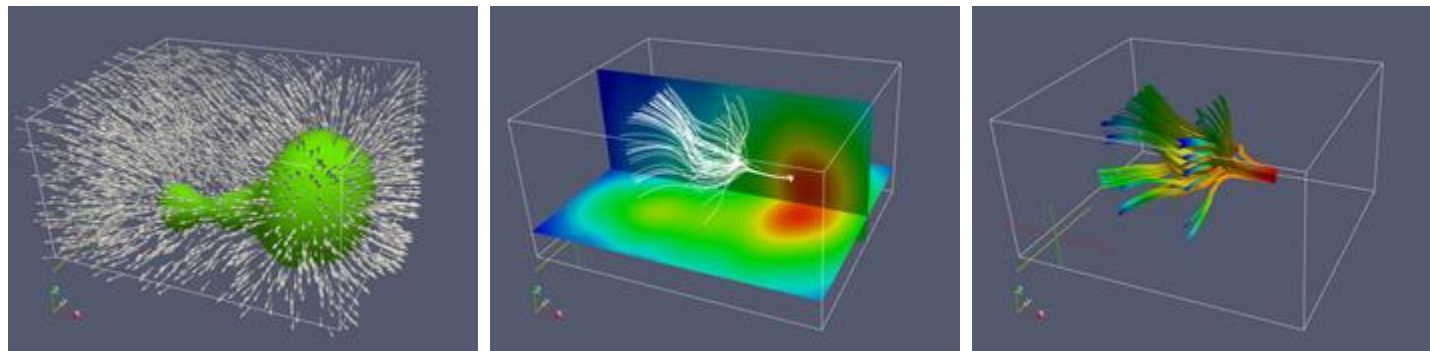
- The studied phenomenon is usually modelled by measurements at a discrete set of points in space
 - Representational samples of the underlying mathematical function governing that phenomenon
 - Mesh or topology associated with the data
 - Explicit or implicit definition of points

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>

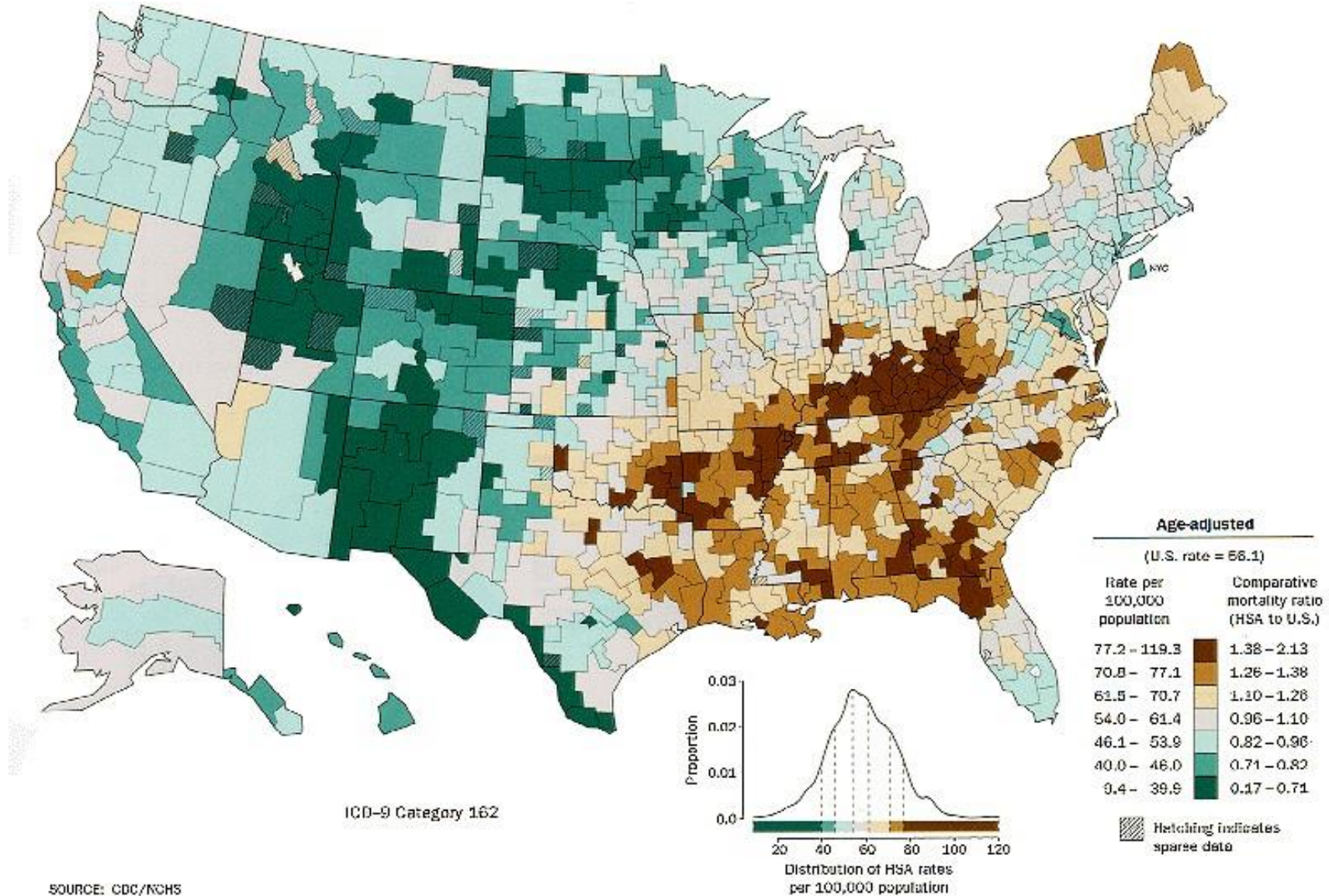
Information Visualization

- 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

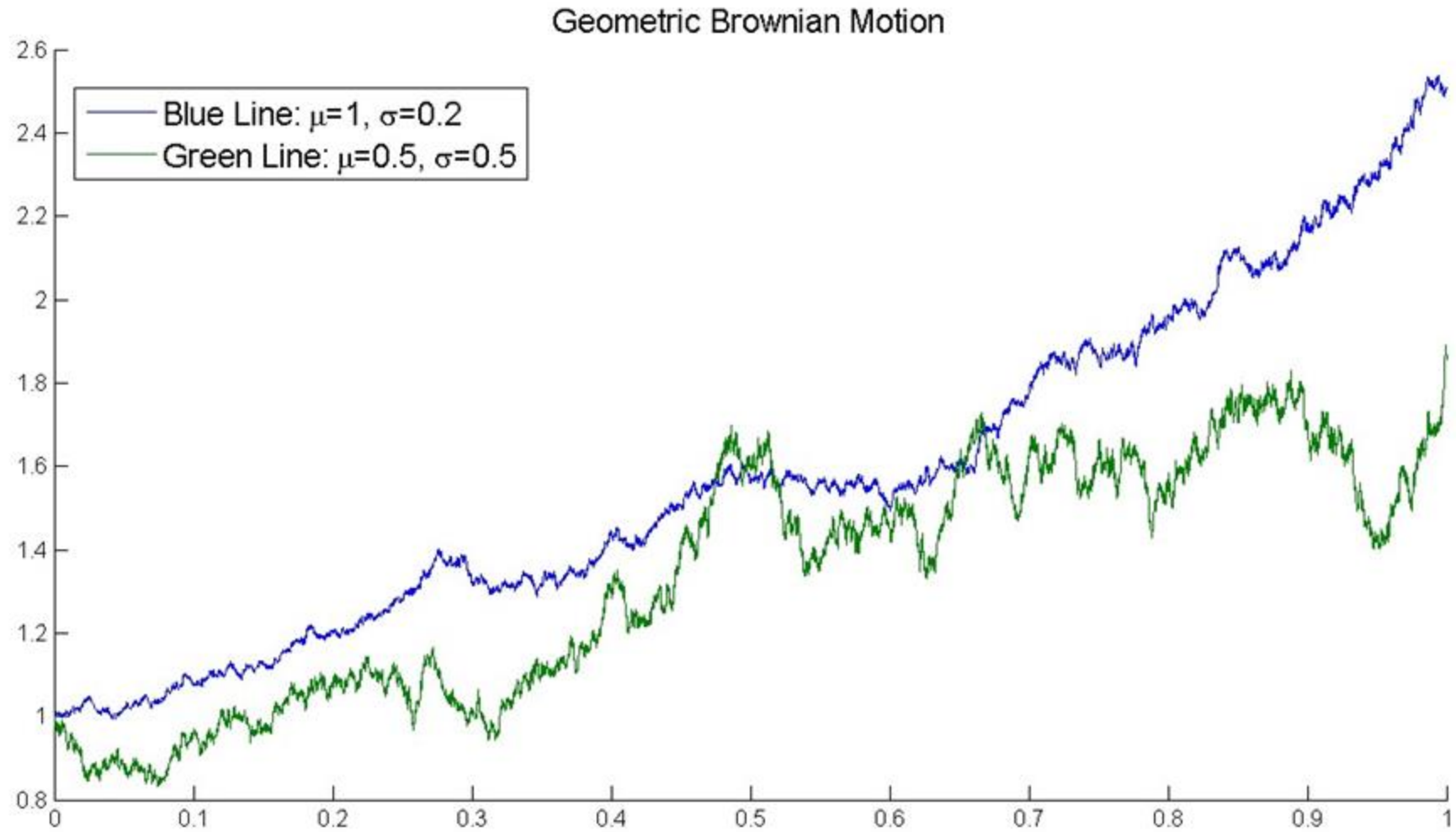


Explorative Analysis



SOURCE: CDC/NCHS

Confirmation Analysis

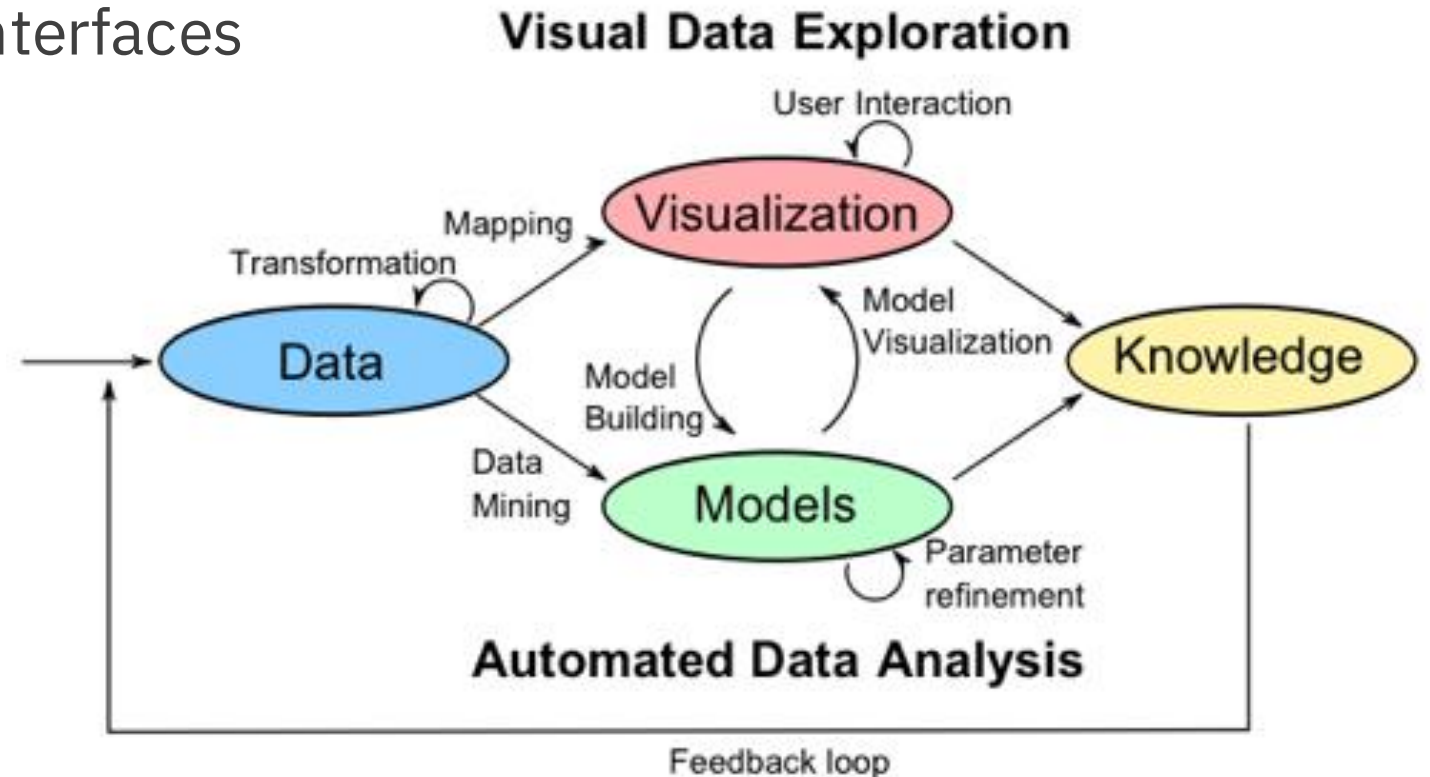


Other Resources

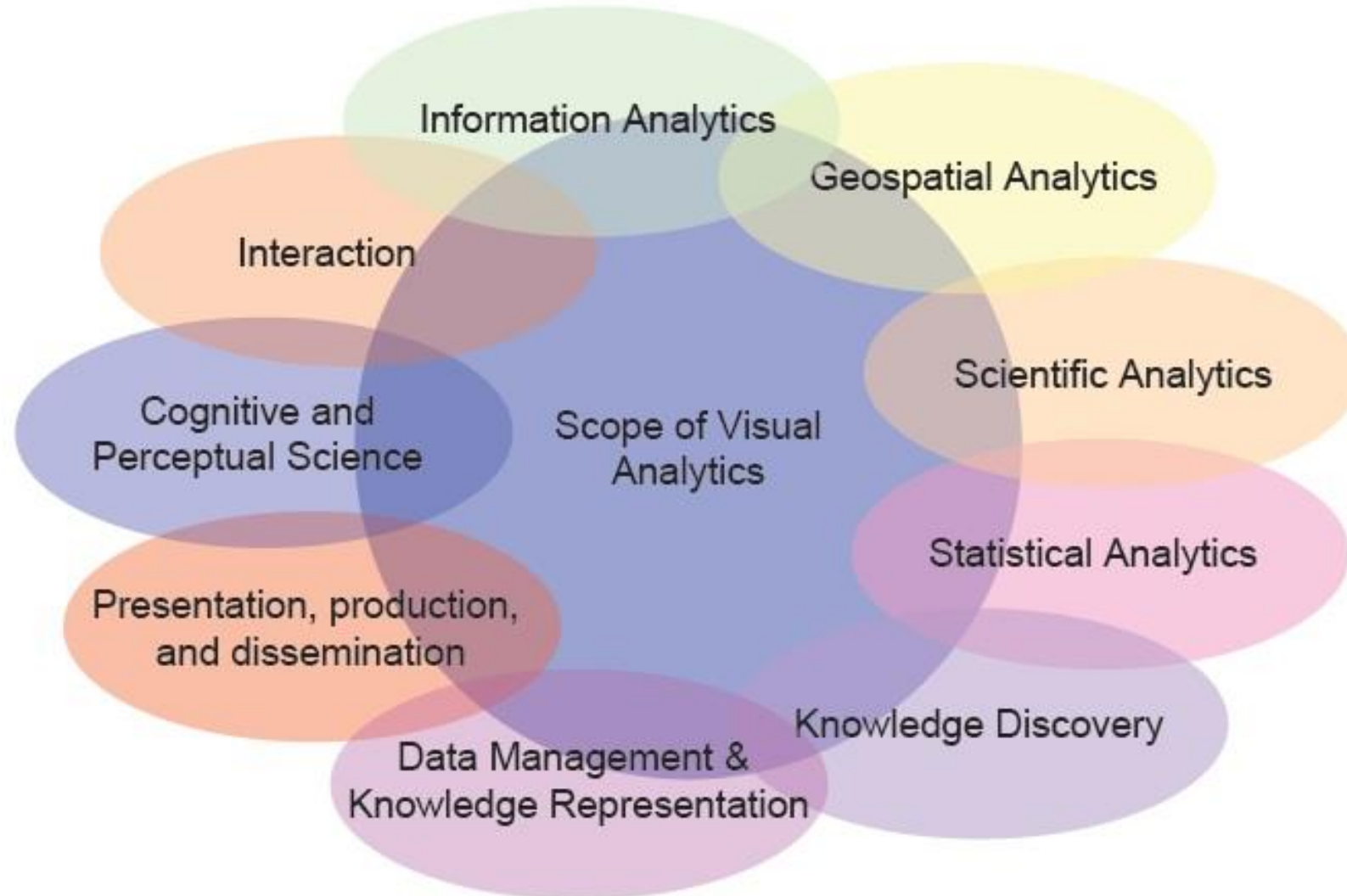
- <https://informationisbeautiful.net/>
- <https://informationisbeautiful.net/visualizations/what-makes-a-good-data-visualization/>
- Jeffrey Heer: <https://www.youtube.com/watch?v=hsfWtPH2kDg>
- Ben Shneiderman:
<https://www.youtube.com/watch?v=X1EPxT9EP5c>

VAST

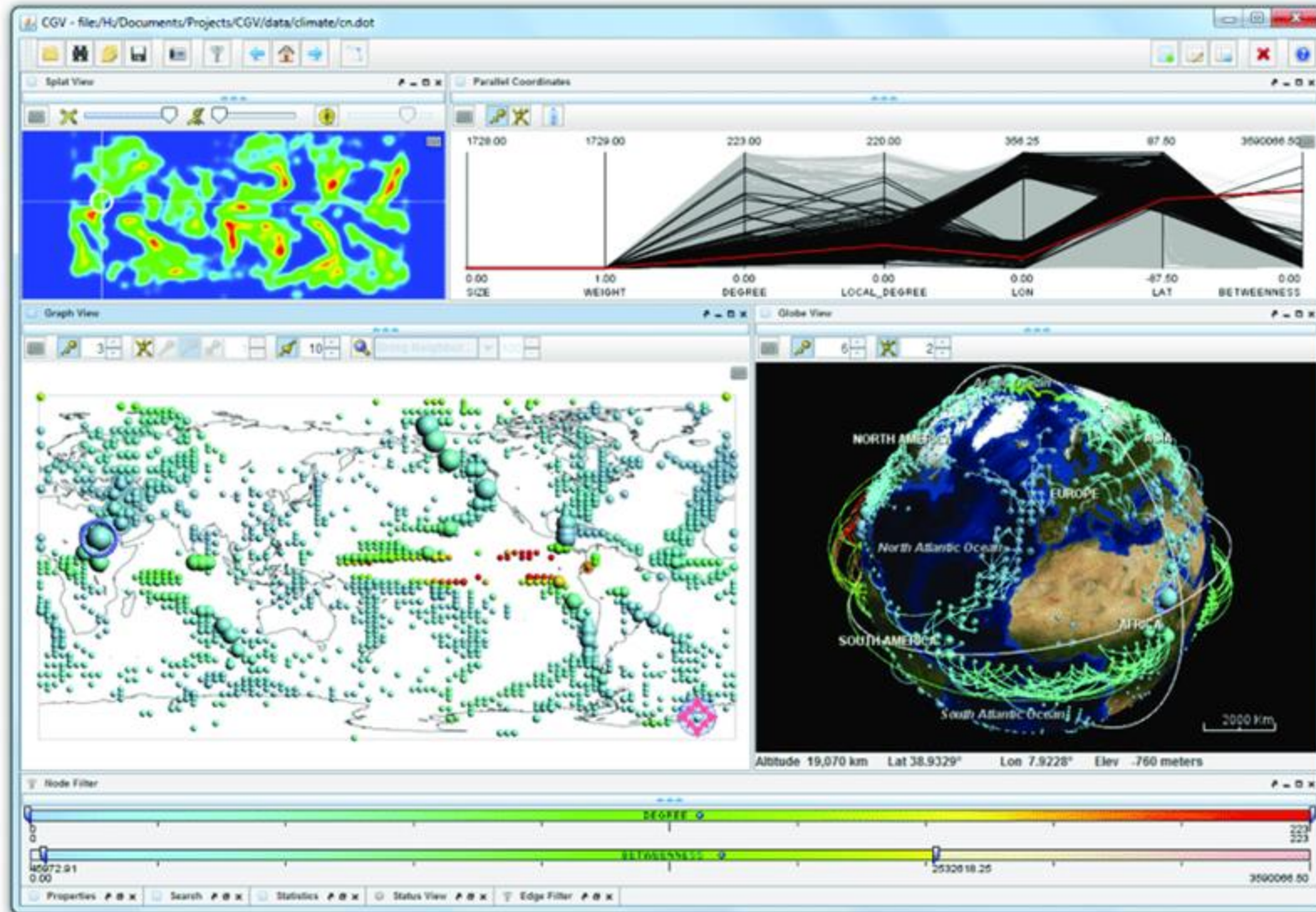
- Analytical reasoning supported by interactive visual interfaces
- Designing advanced visual interfaces



VAST Scope

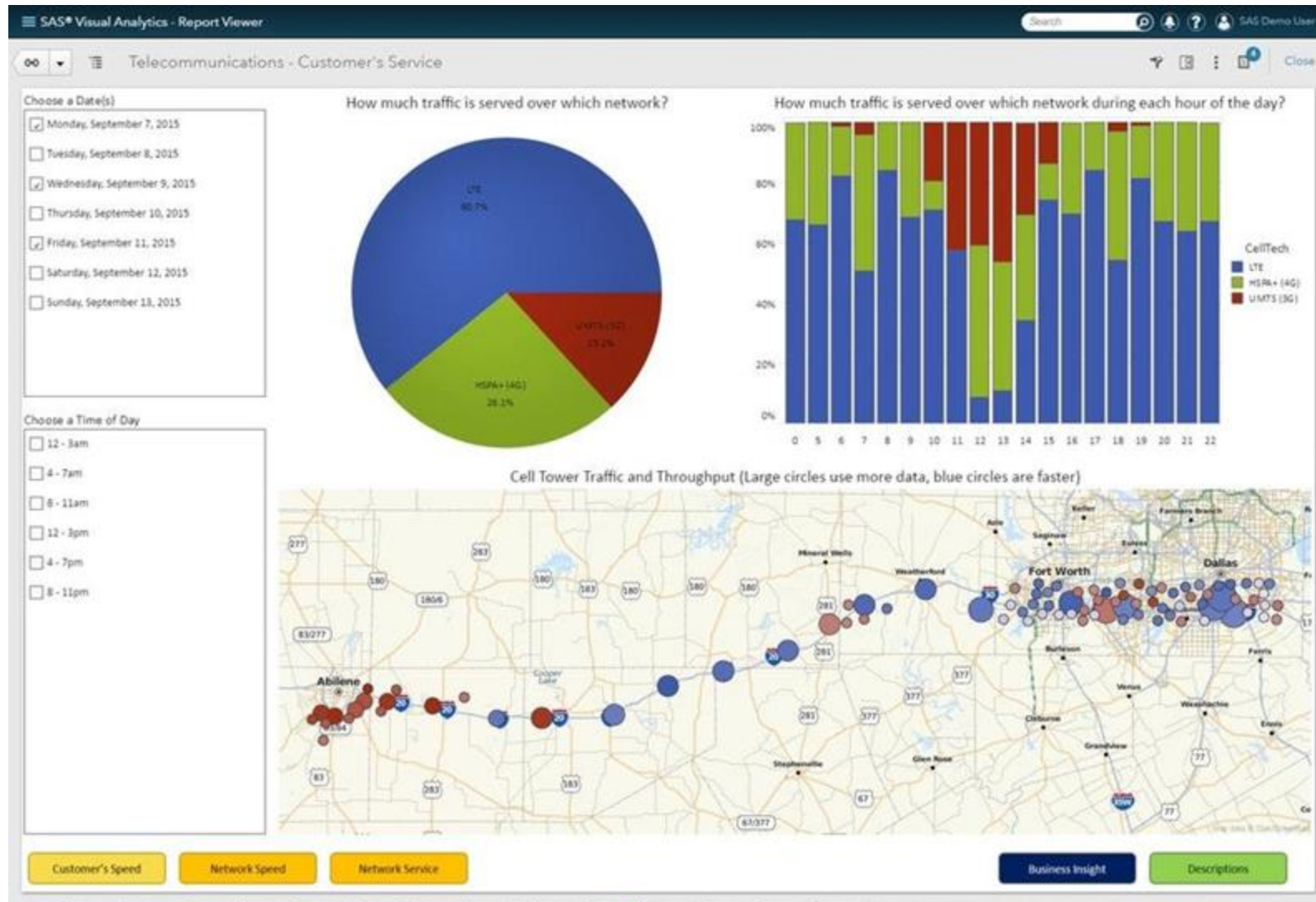


Examples



https://www.researchgate.net/figure/Visual-analytics-in-action-Visual-support-for-the-simulation-of-climate-models_fig1_277007765

Examples



<https://www.softwareadvice.com/bi/sas-visual-analytics-profile/>

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://ieevis.org/>

<p>Area 1: Theoretical & Empirical</p> <p>This area focuses on theoretical and empirical research topics that aim to establish the foundation of VIS as a scientific subject.</p> <p>Theoretical & Empirical →</p>	<p>Area 2: Applications</p> <p>This area encompasses all forms of application-focused research.</p> <p>Applications →</p>	<p>Area 3: Systems & Rendering</p> <p>This area focuses on the themes of building systems, algorithms for rendering, and alternate input and output modalities.</p> <p>Systems & Rendering →</p>
<p>Area 4: Representations & Interaction</p> <p>This area focuses on the design of visual representations and interaction techniques for different types of data, users, and visualization tasks.</p> <p>Representations & Interaction →</p>	<p>Area 5: Data Transformations</p> <p>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.</p> <p>Data Transformations →</p>	<p>Area 6: Analytics & Decisions</p> <p>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.</p> <p>Analytics & Decisions →</p>

We hope you'll like the course ...

- Questions and requests:
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