# Showcases of Visualization Research for Data Analytics and Explainable AI

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# Motivation



### Big Data

- Overwhelming size and complexity of the data
- Data is often simply stored
- $\rightarrow$  Time and money are wasted
- Questions
  - What to do with the data?
  - How can we derive insights from it?
  - What is relevant, what not?



### Motivation

 A purely automatic analysis is *not* or *only partly* possible, and in many cases *not useful*

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	8.0	6,95	8.0	8.14	8.0	6.77	8.0	5.76
	13.0	7,58	13.0	8.74	13.0	12.74	8.0	7.71
	9.0	8.81	9.0	8.77	9.0	7.11	8.0	8,84
	11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
	14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
	6.0	7.24	6.0	6.13	6.0	6.08	8.0	5,25
	4.0	4.26	4.0	3.10	4.0	5,39	19.0	12.50
	12.0	10.84	12.0	9.13	12.0	8.15	8.0	5,56
	7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
	5.0	5.68	5.0	4.74	5.0	5.73	8.0	6,89
mæn	9.0	7.5	9.0	7.5	9.0	7.5	9.0	7.5
var.	10.0	3.75	10.0	3.75	10.0	3.75	10.0	3,75
corr.	(	0.816	(	0.816	(	0.816		0.816

#### Anscombe's Quartet: Raw Data

+ identical linear regression





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# Visualization

- What is a **visualization**?
  - It is NOT a static graphics, diagram, or image
  - It IS a *cognitive process* that
    - produces a mental model of the data in our brains
    - supports a better understanding/insight
  - "The purpose of visualization is *insight*, not pictures"

8en Shneiderman (1999)

• Aims: discovery, decision making, explanation, ...

### $\rightarrow$ Interactive, exploratory data analysis



### Visualization



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# Visualization vs. Visual Analytics

### • Visualization (Vis)

- Pure interactive visualization methods do not work for billions of data records
- Not enough pixels, too much clutter, ...
- Visual Analytics (VA)
  - Science of analytical reasoning facilitated by interactive visual interfaces
  - Combines the strengths of humans (Vis) and computers (DM, ML)







Group Web Site https://liu.se/en/research/ivis

# Showcases



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# Current Research Areas @ iVis

#### **Text Visualization and Visual Text Analytics**

Interactive representations and analytical tools for raw textual data and the results of text mining algorithms.

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#### Network Visualization and Visual Network Analytics

Developing novel network layouts and interactive visual analysis tools for large and complex networks.



#### **User-centered Evaluation**

User-centered evaluation in visualization and visual analytics.



#### Human-Al/Automation Joint Control

Basic and applied research on Human-Al/Automation Joint Control for missioncritical processes. Research on visual analysis tools, on concepts for visualization of processes.



#### Explainable and Interpretable AI/ML

Providing insights from AI/ML models to make better predictions and improve the trustworthiness of the results.



#### Foundations of Visualization

General research on the foundations of visualization and visual analytics.



### Visual Analytics of Temporal Event Data

Innovative research at the intersection of temporal data mining and interactive visualization.

#### **Immersive Analytics**

Research on the utilization of immersive human-computer interfaces to support data understanding, analytical reasoning, and collaborative decision making.





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# Selected Areas

- Visual text analytics
- Visual analytics for XAI
- Network visualization









# Visual Text Analytics: StanceVis

### Visual Analysis of Sentiment and Stance in Social Media Texts





https://link.springer.com/article/10.1007/s12650-020-00684-5 - Sec21

#### [Journal of Visualization, 23(6):1015-1034, 2020]



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# Visual Text Analytics: EEVO

### Interactive optimization of embedding-based text similarity calculations



#### https://doi.org/10.1177/14738716221114372

[Information Visualization, 21(4):335-353, 2022]



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### VA for XAI: t-viSNE



https://vimeo.com/404912503

[IEEE TVCG, 26(8):2696-2714, 2020]

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### VA for XAI: StackGenVis



https://vimeo.com/449276614

[IEEE TVCG, 27(2):1547-1557, 2021]



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# Network Visualization: OnGraX



https://vimeo.com/135034649

#### [Journal of Graph Algorithms and Applications, 21(1):5-27, 2017]

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# Network Visualization: MLN-Vis

### **Multilayer Network Visualization**



https://doi.org/10.1109/TVCG.2023.3327402

[IEEE TVCG, 30(1):469-479, 2024]



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# Thank you!





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