IEEE VIS '25 notes and interesting posters

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Contents

1 Workshshops

1.1 alt.VIS (Sunday Morning)

https://altvis.github.io/

1.1.1 Data Melodification FM

1.1.2 Visualization Was Here

1.1.3 The Fuzzy Front Ends

Very interesting talks, Melodification could be part of survey for HCDA. TLX-on-TLX by Daniel was also a good throwback to the NASA-TLX, complete with a LaTeXtemplate to emulate the old typewriter-paper feel. ...

1.2 Bio+MedVIS (Sunday Morning): Redesign Challenge Introduction

- Spectral analysis of 31P-MRS output of 9 individuals
- Dashboards to show spectra/peaks with rations of metabolic ranges
- Difference between subjects focus of many works, ratios/difference

1.3 SciVis (Sunday Afternoon)

- More focus on specific solutions
- Inverse problem analysis could be interesting?
- A lot of dimensionality reduction, used PCA which could be flawed in the current setting
- Filtering on parallel coordinates/coordinates was very popular too, could be interesting to replace by target function and weight to allow fuzzy optimisation and apply Pareto front for our approach.

1.4 LDAV (Monday Morning)

1.4.1 Opening & Keynote

- Keynote: Kwan-Liu Ma
- Extract data, integrate viz in flows, integration AI/ML
- INR: implicit neural representations, for data reduction, i.e. encode dataset in model (related to PINNs, kind of as data/observations encoded in NN), new method: Gaussian Splatting, kind of related as NERF supplanted by Splatting
- Glyph-based viz, after spatial aggregation (using Voronoi patterns) [1]
- Uncertainty: 2D uncertainty: use small multiples, limitations of direct interpretation (requires understanding) [2], ClimateSOM to encode distribution of uncertainty (instead of summary)
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1.4.2 Extracting Complex Topology from Multivariate Functional Approximation: Contours, Jacobi Sets, and Ridge-Valley Graphs

Guanqun Ma, David Lenz, Hanqi Guo, Tom Peterka, **Bei Wang**

- Extract topology without having to sample from model?
- Reframe Ridge-Valley graph (complex topology) from contour graph
- Core approach: use gradient of INF to trace paths, then use these as splines, extract gradients from these, then get the Ridge-Valley graphs/Jacobi Graphs
- Very smooth lines (B-Splines...)
- Possible weakness: NN gradients non-smooth/well learned... (especially for higher dimensions!)

[1] https://arxiv.org/pdf/2506.23092v1
[2] https://arxiv.org/pdf/2012.11109

1.4.3 Extremely Scalable Distributed Computation of Contour Trees via Pre-Simplification

Mingzhe Li, Hamish Carr, Oliver Rübel, Bei Wang, Gunther H. Weber

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1.4.4 ChatVis

- Use RAG to automate viz based on prompts, evaluated on 20 examples + agentic correction flow
- RAG is quite good...

1.4.5 From Soup to Bricks: Fast Clustering of Fine-Grained AMR Hierarchies for Rendering on GPUs

Stefan Zellmann, Ingo Wald

- Optimize Kd-based rendering of flow/volumetric data.

1.4.6 Lossy Parallel Visualization of Large-Scale Volume Data with Error-Bounded Image Compositing

Yongfeng Qiu, Yuxiao Li, Xin Liang, Yafan Huang, Guanpeng Li, Sheng Di, Franck Cappello, Hanqi Guo

- Compression for image exchange between nodes
- Use cross-combinations by using cross-exchange using $O(n \log n)$
- Calculate error based on alpha-blending/compression overlaying
- Can calculate upper bound for error.

1.4.7 Managing Data for Scalable and Interactive Event Sequence Visualization

Sayef Azad Sakin, Katherine E. Isaacs

- use Kd-tree across event paths, would it be better to use binary trees to not mix non-spatially related tracks.
- SSIM as metric for visual similarity for viz

1.5 VAST Challenge 2025

1.5.1 Welcome & Introduction

- Hidden story extraction from dataset (fictional island of Oceanis)
- MC1:
- MC2: Bias detecion in a KG, conflict of Tourism/Fishing
- MC3: Last year illegal fishing, this year: secret tourism patter/atypical activities detection including deceptive/contradicting information
- DC: Design challenge, propose designs for diverse teams

1.5.2 BAIT Dashboard (MC2)

- Really cool dashboard for bias/change detection
- Scale metaphor to analize impact
- `https://bait.ava25.dbvis.de/`

1.5.3 Interactive Platform 4 VA of Suspicious patterns (MC3)

- Build KG from radio messages
- Discovering patterns/groups within networks, using topic modeling over messages

... and using similarity measures of content

1.5.4 Intuitive Support for Query Construction (DC)

- Related works: **State of the Art in Multivariate Network Visualization**
- TreeMap-based viz of node types/edges & hierarchies

2 Conference

2.1 Opening & Keynote: Visualization as a Science/The path of Viz to Science

- Early Viz: ASCII plot to a row-based line printer, very simple yet effective, next line printer (vector graphics) of MC simulations of ray scattering in clouds
- Early start in Supercomputers, "Mental Images" on the first GPUs (create every imaginable image on the computer)
- Medical planning: volume data to finite element representation using segmentation and organ rendering (surgery planning)
- Feature extraction from flow modeling
- da Vinci Studio (before Cave Viz)
- His points: serious application, entire problem, identify core functionality, cross disciplinary;
- The Science of Visual Insight
  - One dataset can tell different stories (e.g. log vs linear)
  - Visualizations to make sense of data!
  - The mental representation/model/concepts/semantic networks/language/knowledge gets updated (Tobias's "aha!", for language - viz metaphors)
  - "modern" worldview: smybolic - nature - social orders, given truths - viz is according to him in the middle, cannot capture all truths... (this seems like the Venn diagram meme), map to different "ontologies" (not in KG sense but philosophical sense...)
  - Floridi's infosphere / related viz to various philosophical arguments about truth and understandings, Foccaults power structures
  - Critical Visualization [3]
  - What makes a science a science?
    1. Epistemic clarity: measure/truths can be validated
    2. Theoretical articulation: ontology of visual objects
    3. Normative guardrails: ethics of epistemic-ness, power, fairness?
  - Visual Knowledge - definition? - transparent in provenance, reusable, uncertainty
  - Visualizing Arguments - every viz serves a claim! Make structure/provenance clear
  - Predictive Understanding - toolset to verifiably/predict Understanding
  - Power and Responsibility of Viz, Foucault's representations coupled with power.
  - two major problems: how to gain and communicate true knowledge

2.1.1 Awards

- VGTC Lifetime award: Meister
- Best short paper: Toward a Logic of Generalization about Visualization as a Decision Aid
  - How can viz be useful for decision making / epistemic framework: atomic viz parts vs. contextualized interpretation
  - Formalize decision theory in viz (state - signal - interpretation - action)

[3] https://academic.oup.com/cybersecurity/article/1/1/93/2366512?login=false

2.2 Best Paper Awards

2.2.1 "They Aren't Built For Me": An Exploratory Study of Strategies for Measurement of Graphical Primitives in Tactile Graphics

Areen Khalaila, Lane Harrison, Nam Wook Kim, Dylan Cashman

- Accessibility for Data using Physicalisation
- Tasks for BLV are exponentially harder than for sighted people
- Evaluate errors of blind people on chart reading - some measures are similar to sighted people, some are very different (i.e. area measurements)
- Expected outcomes: inclusive design, remove tactile distraction

2.3 ReVISit 2: A Full Experiment Life Cycle User Study Framework

Zach Cutler, Jack Wilburn, Hilson Shrestha, Yiren Ding, Brian Bollen, Khandaker Abrar Nadib, Tingying He, Andrew McNutt, Lane Harrison, Alexander Lex

- Really great tool!

2.3.1 Beyond Problem Solving: Framing and Problem–Solution Co-Evolution in Data Visualization Design

Parsons, Prakash Chandra Shukla

2.3.2 Causality-based Visual Analytics of Sentiment Contagion in Social Media Topics

- Interesting causality maps (by assuming time progression is not just correlation...)

2.4 Test-of-Time award

2.4.1 Vector field visualization

- Use templates for critical points (fingerprints?)

2.4.2 Uncertainty Viz

- Use bands to visualize uncertainties (see master thesis?)

2.4.3 Compression algorithm for 4D vector compression

- Compression on block-level, with simple Mutiply-Add
- Widely used, Open-Source (funding for porting!)

2.4.4 Graph-Theoretic Scagnostics

2.4.5 Voyager

Well-known viz browsers

2.4.6 Reducing Snapshots to Points

- Analyze dynamic network by flattening them and performing dimensionality reduction and drawing them as time curves.
- Kind of similar to GNN (according to author)

2.5 Maps & Spatial Vis

2.5.1 "Mapping What I Feel": Understanding Affective Geovisualization Design Through the Lens of People-Place Relationships

- Emotional Mapping/Geography
- Identifying Emotional Visualization through survey (remove image/historical viz) - Affective Visualization
- Situated and personalized compared to other emotional viz.
- For Jesú : social/humanistic viz.
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2.5.2 Unveiling the Visual Rhetoric of Persuasive Cartography: A Case Study of the Design of Octopus Maps

- Octopus: literally?, historically famous (they creep into the data, rhetorically speaking)
- Survey of maps containing octopus with deep coding of maps, propaganda/misinformation maps deeply connected!

Fig. 5: Examples of octopus maps in our corpus.

Figure 1: From Lin et al. [1]

2.5.3 How do Data Journalists Design Maps to Tell Stories?

- Explore design space of these specifc maps
- Article sourrounding maps, accompying viz/supporting media
- Interactivity/Overlays...
- Interactive more challenging, less common (expensive!)
- Tight deadlines force less map inclusion, AI enables more inclusion (but at what cost)?
- A lot of users require locator maps, data literacy often a problem/readers often lost, require well-versed audience
- Limitations: biased towards Brazilian journalists, no mobile maps

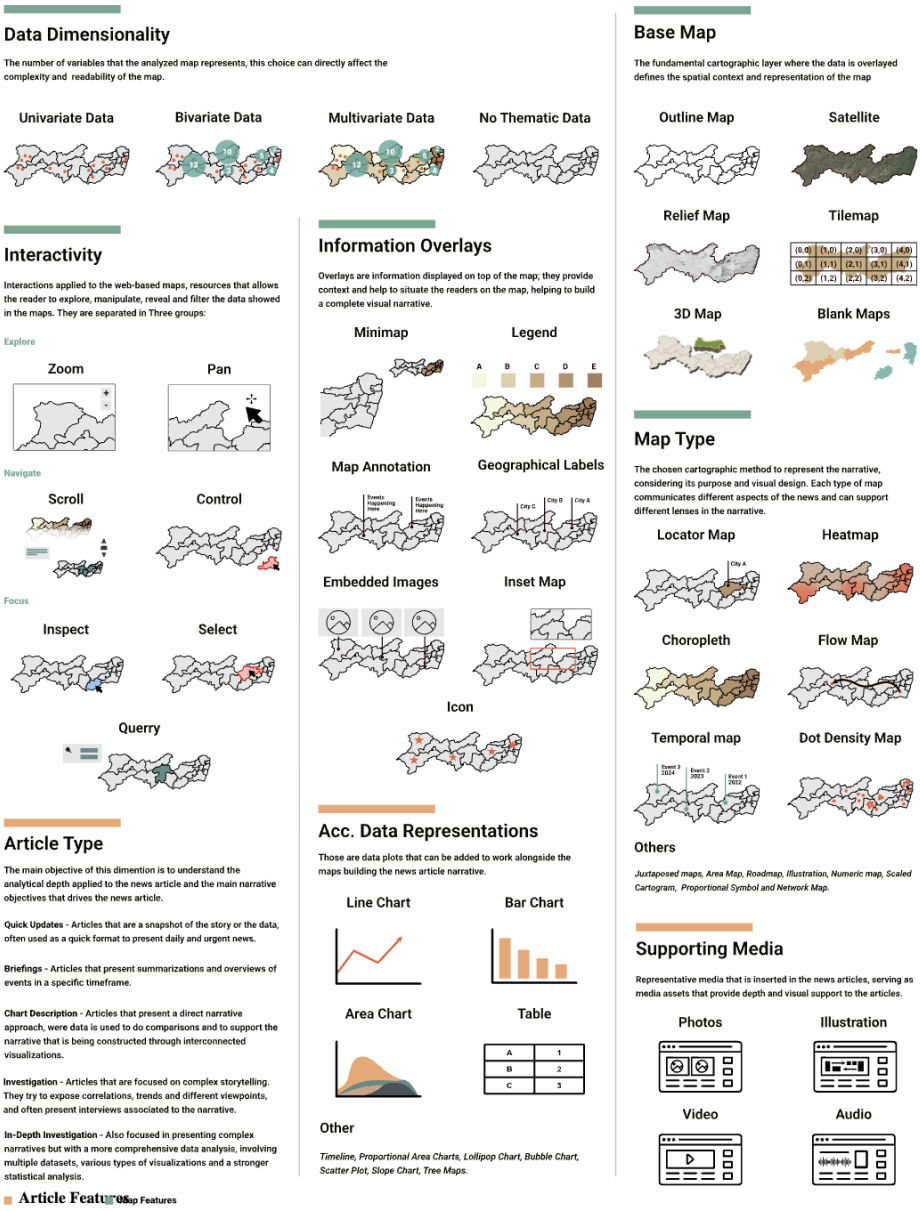

Figure 2: From Gomes et al. [2]

2.5.4 Algorithmically-Assisted Schematic Transit Map Design: A System and Algorithmic Core for Fast Layout Iteration

- Their major contribution: interactive design, compared to Hannah Bast's greedy construction!
- Fast/Global algorithms survey
- Kind of limited user study (but only a few people)

2.5.5 Algorithms for Consistent Dynamic Labeling of Maps With a Time-Slider Interface

- Time-Based labeling of images with time/geospatial info
- Use maximal information metric for labeling
- Query by adjusted slider
- Optimal + Valid Activity diagram - define constriants to display optimal viz! Using ILP for optimal labeling
- @Julian: could be interesting to display your optimal display of progressive viz on time series

2.5.6 Volume-Based Space-Time Cube for Large-Scale Continuous Spatial Time Series

- Space-Time Cube/linked views/overlay for displaying time-based data on maps
- Does not work on large-scale data!
- Slicing of volume (effectively volume atop map)

2.6 Vis 4 Science

2.6.1 Paraview-MCP: An Autonomous Visualization Agent with Direct Tool Use

- AI agents for Para View
- Reduce Barrier of Entry
- No user study, but present strong use case with Blender MCP

2.6.2 Uncertain Mode Surfaces in 3D Symmetric Second-Order Tensor Field Ensembles

- Prior work: Topological Tensor field
- Tensor Mode → can be extracted to get contours/limits/extremes
- Uncertainty in Tensor Ensemble: Calculate Mean - then Mode (removes information), therefore - mode of each field, then calculate variance/... over these, viz these
- Current limitations: only for 1D-lines, current work: add more extension

2.6.3 Virtual Ray Sampling for Direct Volume Rendering using Hermite Interpolation

2.6.4 SEG-RobustEye: Understanding medical image segmentation models

2.6.5 Scope Meets Screen: Lessons Learned in Designing Composite Visualizations for Marksmanship Training Across Skill Levels

2.6.6 Interactive Visual Analytics of Carbon Cycle Science

- Usually: box-flow diagrams (boxes represent storage, arrows movement)
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2.6.7 Analyzing Time-Varying Scalar Fields using Piecewise-Linear Morse-Cerf Theory

2.7 Abstract Physical Spaces

2.7.1 Don't Stop Me Now: Visualizing Disruptions in Railroad Networks

- Goal: exploring train disruption dataset
- Disrupted segments/temporal heatmap
- Use Case: Spreading of weather related delays and repair "cooldown"
- `https://trainviz.github.io/`

2.7.2 Posterity: Balancing historical context and visual dynamism while visualizing a collection of American labor posters

- Nice demo with dimensionality reduction/embedding similarity to custom posters/clustering

2.7.3 Chronotome: Real-Time Topic Modeling for Streaming Embedding Spaces

- Progressive Viz of Clusters
- Could be interesting for the RIS time viz of topics in laws?
- Cluster evolution over time in 3D!, time constant cluster by doing 2D clustering first then expanding to 3D
- Applied to 3 different models, and has the progressive aspects which sets it apart...

2.7.4 Data-Driven Compute Overlays for Interactive Geographic Simulation and Visualization

- Montain viz of avalanche risk
- Web-based compute for dynamic overlay using LoD system + webGPU
- `https://webigeo.alpinemaps.org/`

2.7.5 Embedding Atlas: Low-Friction, Interactive Embedding Visualization

- Main selling point: easy setup/sane defaults/fast
- Uses webGPU for fast rendering
- Easy viz config, reducing friction

2.7.6 CFTree: Exploring Paths Through Counterfactuals

- Uses DECE for Counterfactuals
- Parallel coordinates over nodes

2.7.7 Visualizing Climate Model Outputs with CliMAScope

- Full-On Design study with experts

2.7.8 MC-INR: Efficient Encoding of Multivariate Scientific Simulation Data using Meta-Learning and Clustered Implicit Neural Representations

- Usually/Related: INR for compression
- Their approach: not only use a single INR, globally, but use multiple INRs clustered by k-Means

2.8 Graphs and Networks

2.8.1 Envisage: Towards Expressive Visual Graph Querying

2.9 Dimensionality Reduction and Parameter Space Analysis

2.9.1 ClimateSOM: A Visual Analysis Workflow for Climate Ensemble Datasets

- Partition SOM into clusters
- Study with experts (this seems to be the deciding factor for many accepted papers!)

2.10 SEAL: Spatially-resolved Embedding Analysis with Linked Imaging Data

- Gigapixel size with 100+ channels, millions of cells!
- Bridge spatial image / embedding
- Cells extracted and rearranged in embedding view - hybrid embedding view, render cells progressively
- Linked view dashboard, with lasso tools to select embedding view and show in overview.
- Calculate SHAP features based on model learned on dimensionality reduction (similar to our SciVis submission - we just use SG and use it as guidance)
- Eval: Use Case Study with three experts in three domain
- `http://sealvis.org/` using anywidet

2.10.1 A Critical Analysis of the Usage of Dimensionality Reduction in Four Domains

- Survey of DR usage in domains

2.10.2 Interactive Visual Analysis of Spatial Sensitivities

2.10.3 RSVP for VPSA : A Meta Design Study on Rapid Suggestive Visualization Prototyping for Visual Parameter Space Analysis

2.11 IEEE VIS Reviewing — On a Path to Self-Destruction?

Petra Isenberg, Gunther Weber, Narge Mahyar, Niklas Elmqvist, Han-Wei Shen, Michael Sedlmair, Melanie Tory, Helwig Hauser, Bei Wang, Tamara Munzner

- Reviews are on a bumpy path - LMs, virtual conference, good (?): student reviews
- What we [should] value in reviews (related to psychology panel)
- Survey results
  - Gatekeeping in Viz – less novelty, subjective quality, career systems; efficiency is going down (hundreds of review cycles) – beer garden theory (spend your time effectively)
  - Intransparent discussion – reviewers change score, but not underlying review; one person (critical one) leads discussion,
  - Perceived randomness – because it is a noisy sampling process; be in a good mood for reviewing ;), one (very convinced) person could lead discussion; recommendation: noise - a flaw in the human judgement
  - Unqualified reviewers – student reviewers (no weigh in review scores - that makes it feel valued for me. . .), unqualified PCS reviewers (how did that happen?), do not just average; also look for the good in the work, do not expect everything
  - Unnecessarily negative reviews – review fatigue, harsh gatekeeping, self-check expertise - positive framing (e.g. lacks justification instead of missing parameters)
  - Low range – people do not use the full range, update review after being convinced!
- Discussion

2.12 From data to meaning

2.12.1 Stitching Meaning: Practices of Data Textile Creators

- Survey of Creators
- Looking at (meta-)structure, meaning, data, color, motivation

2.12.2 Story Ribbons: Reimagining Storyline Visualizations with Large Language Models

- Structural timelines from text(-stories)
- Character arcs . . .
- Using LMs and correction loops, interactive explanations and provenance to the texts
- Added a lot more fine-grained characters and themes compared to other methods

2.12.3 F^2Stories: A Modular Framework for Multi-Objective Optimization of Storylines with a Focus on Fairness

- Fairness in *Viz*?
- Tradeoffs between global and local fairness (minorities)
- Networks: MILP used instead of global layouting
- Optimize crossings in story lines

2.13 Transportation, Buildings, and Urban Vis

2.13.1 StressDiffVis: Visual Analytics for Multi-Model Stress Comparison

- Alternative Visualization for stress visualization for construction views

2.13.2 StreetWeave: A Declarative Grammar for Street-Overlaid Visualization of Multivariate Data

- Maps, Urban analysis - Walkability score
- Design space survey of walkable/accesible neighbourhood street analysis.

2.13.3 TraSculptor: Visual Analytics for Enhanced Decision-Making in Road Traffic Planning

- Model traffic demand on graph, explore options on graph

3 Best Paper Awards according to me

- Smoothest Maps: Algorithmically-Assisted Schematic Transit Map Design: A System and Algorithmic Core for Fast Layout Iteration
- Longest Tentacles: Unveiling the Visual Rhetoric of Persuasive Cartography: A Case Study of the Design of Octopus Maps
- Fastest Avalanche: Data-Driven Compute Overlays for Interactive Geographic Simulation and Visualization

4 Posters

References

[1] D. Lin, Y. Wang, Y. Yang, and X. Lan, "Unveiling the visual rhetoric of persuasive cartography: A case study of the design of octopus map," in *2025 IEEE Visualization Conference (VIS)*, 2025.

[2] A. Gomes, E. Brito, L. Morais, and N. Ferreira, "How do data journalists design maps to tell stories?" In *2025 IEEE Visualization Conference (VIS)*, 2025.