Information Visualization

Writing Visualization Papers

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Paper Structure

- Title & Author List
- Abstract
- Introduction
- Related Work
- [Background/Preliminaries]
- Contribution (Approach/Theory/Specification/Implementation)
- Evaluation (Experiments, case studies)
- [Discussion]
- Conclusion [& Future Work]
- [Appendices]

Contribution

- Theoretical or experimental
- May be broken into multiple sections
- For computer science techniques, often broken into a framework/ specification, and the implementation
  - Framework describes the main contribution at a conceptual level,
  - Implementation is secondary but gives readers an idea of the actual code (code can be made available on the Web)
  - Pseudocode is usually used for specific algorithms.
- Should provide details that allow other computer scientists to recreate the proofs or technique
- Not a daily journal—tell a story that argues for the importance of the results

Important Pieces to Extract from a Vis Paper

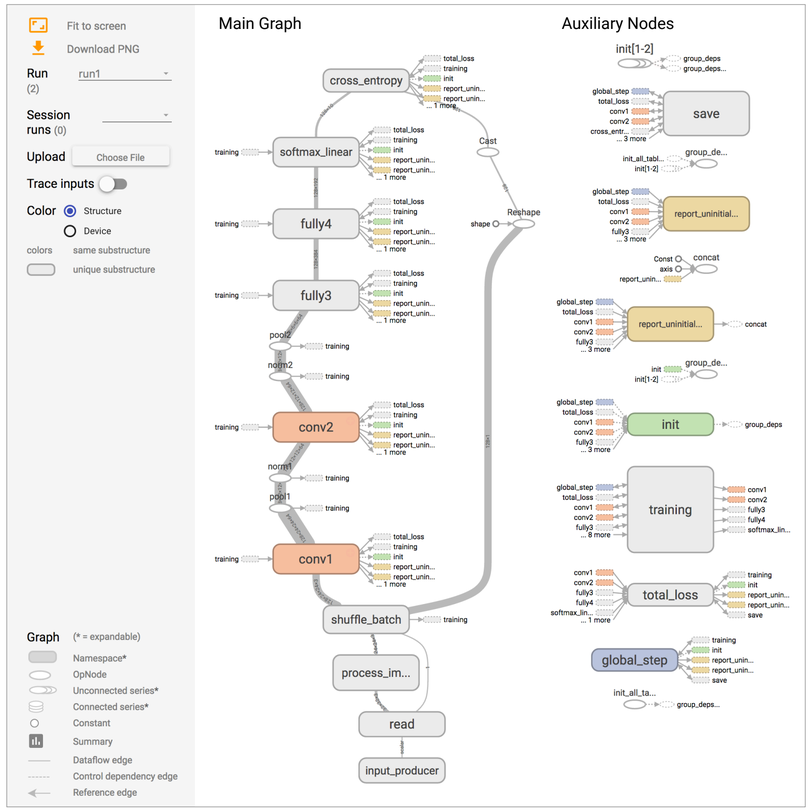
- Concept: what is the main goal/idea?
- Implementation: how is this realized?
- Related Work: what previous work does this build on or relate to?
- Data Characteristics: what is the type of data (items & attributes)?
- Visualization Techniques: what classes of techniques are used?
- Application Domain: where can this research be applied?

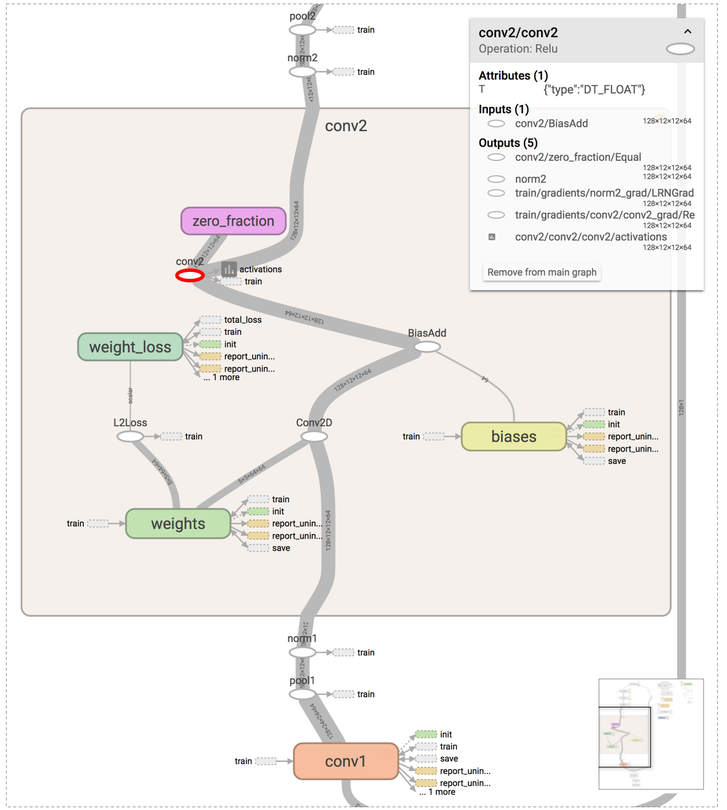
[R. S. Laramee, 2009]

Example: TensorGraph Visualization

Visualizing Dataflow Graphs of Deep Learning Models in TensorFlow

Kanit Wongsuphasawat, Daniel Smilkov, James Wexler, Jimbo Wilson,
Dandelion Mané, Doug Fritz, Dilip Krishnan, Fernanda B. Viégas, and Martin Wattenberg



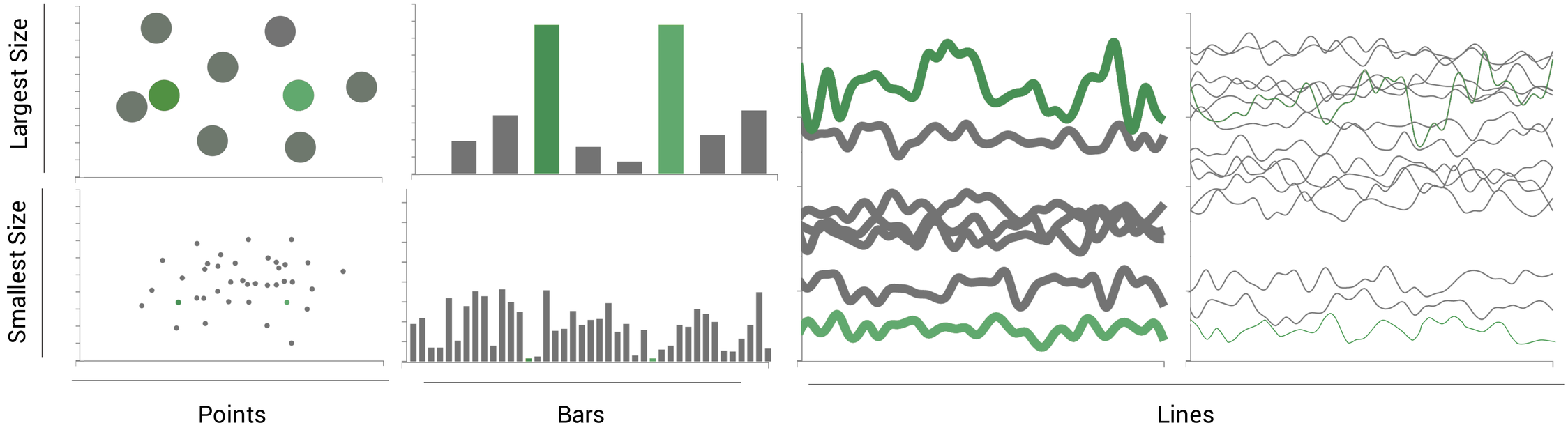


[Link]

Example: Color Difference

Modeling Color Difference for Visualization Design

Danielle Albers Szafir, *Member, IEEE*



[Link]

Project Proposal

- Due **Thursday:** September 16
- Turn in via Blackboard
- Write up your ideas as they currently stand
- Things can change, that's ok!
- Focus on motivation (why should we care?) and the core idea (how does your work improve on existing techniques?)

Critiques of Papers

Critical Response to Reading

1. Describe, in your own words, what the problem addressed is and what the key contributions are
2. Respond to the paper
   - How would you add to the work that was presented?
   - What evaluation was not done that should have been?
   - No vague statements like "The paper is well-written"
   - Does the direction of the work make sense?
   - Questions are fine, but they should be specific & show your understanding
   - Keep track of points in favor, points against
   - Should focus on specific parts of the paper, make sure you understand everything about that part of the technique/system

Responding to a Paper [Griswold]

- What is your analysis of the identified problem, idea and evaluation?
  - Is this a good idea?
  - What flaws do you perceive in the work?
  - What are the most interesting points made?
  - What are the most controversial ideas or points made?
  - For work that has practical implications, you also want to ask: Is this really going to work, who would want it, what it will take to give it to them, and when might it become a reality?
- What questions are you left with?
  - What questions would you like to raise in an open discussion of the work?
  - What do you find confusing or difficult to understand?

Evaluating Responses

- Can I see that you understood the paper?
- Can I see that you thought critically about the paper?
- Style and grammar are important
  - Writing with spelling and grammar mistakes is of lower value
  - Use spelling and grammar checkers…
  - …but also read your own writing

Citations in Presentations

- Applies to presentations as well
- Put citations inline [“CSCI 628 Lecture 7", D. Koop, 2021]
- Cite figures and images taken from elsewhere

Quoting References

- In general, do not copy even a sentence from another source even if it is properly cited.
- Direct quotes are used to emphasize the **specific terminology** the author has used
  - Example: state an exact definition from another source
  - Surround all copied text by quotation marks
- Using a thesaurus to change words is **not** allowed either
- Your writing should reflect **your own thinking**
  - Read the paper, take notes of key points
  - Put the paper away
  - Write a response

Writing Visualization Papers

Different Types of Visualization Papers

- Techniques (Algorithms)
- Applications (Design Studies)
- Systems (Toolkits)
- Evaluation (Summative User Studies)
- Model (Taxonomy, Formalism, Commentary)
- +Surveys

- and Combinations of the above

[T. Munzner, 2008]

Paper Type Pitfalls

- Design in Technique's Clothing
- Application Bingo versus Design Study
  - Narrowly-defined problem of unknown relevance + random technique
  - Justify why the technique is appropriate, compare/contrast
- All That Coding Means I Deserve A Systems Paper: think about what contributions others will want to read about
- Neither Fish Nor Fowl
  - Hard to straddle techniques
  - Try to identify the **primary** contribution

[T. Munzner, 2008]

General Pitfalls

- What I Did Over My Summer Vacation: a diary is not a paper
  - Should not be chronological
  - Should not dwell on implementation details (which may have taken a long time)
- Least Publishable Unit: Don't try to squeeze too many papers out of the same project
- Dense As Plutonium (Inverse of LPU): too dense, and can often miss important details of the work due to space
- Bad Slice and Dice: Dividing papers leads to too much overlap or neither paper being standalone

[T. Munzner, 2008]

Laramee's Suggested Structure

- Introduction (Motivation)
- Related Work
- Method (Computational Model)
- Enhancements/Extensions
- Implementation
- Results & Performance
- Conclusions & Future Work

[R. S. Laramee, 2009]

Introduction

- AKA motivation
- “What is this research…good for?”
- Why is this a good addition?
  - a novel visualization or interaction technique
  - faster performance (e.g. using GPUs)
  - facilitates new insights

[R. S. Laramee, 2009]

Tactical Pitfall: Stealth Contributions

- “Do not leave your contributions implicit or unsaid”
- Reviewers shouldn’t have to figure this out
- Add a sentence that starts “The contributions of this work are…”
- Often a bullet list
- This can be very hard
  - How do you know your approach is better?
  - How does this go beyond existing work?
  - What hasn’t been clear until now?

[T. Munzner, 2008]

Related Work

- Have to determine scope: what is actually related and what isn't
- Also, try to figure out which papers are required and which are optional
  - Choice of "optional" papers can influence who reviews the paper…
  - …and potentially a reviewer's mood about a particular paper
- Sometimes citations are a list of key references [1,4,6,12]
- Other citations are specific and there should be a sentence or two that explains the contribution as it relates to your paper's work

[R. S. Laramee, 2009]

Related Work Pitfalls

- I Am So Unique
  - “Proposing new names for old techniques or ideas may sneak your work past some reviewers, but will infuriate those who know of that previous work”
  - Don’t lose credibility with your readers
  - Discuss work on similar problems but also work with similar **solutions** in other domains
- Enumeration Without Justification
  - Don’t just cite other work, explain why your work is different
  - Tell a story in the related work section

[T. Munzner, 2008]

Method

- **Concept** not implementation
- Provide an overview first
- Overview diagram can be helpful for a complex technique
- Subsections break out parts or stages
  - Stages of an algorithm
  - Parts of the experiments
  - Parameters
- Enhancements can be an addition section (or rolled into Method)
  - Concepts that extend the core idea that aren't significant enough for another paper

[R. S. Laramee, 2009]

Implementation

- Laramee states this is optional, but there are generally some details here
  - Not just programming language, libraries used
  - Include aspects of implementation that are perhaps **unexpected**
- Link to the method section helps
- Will be useful to those who wish to experiment or extend your work
- Should not be full technical documentation

[R. S. Laramee, 2009]

Results & Performance

- Show nicest results
- Describe datasets:
  - Can be synthetic or real-world
  - Details about size, domain, dimensions, etc.
- Provide details about hardware and software stack
- Performance:
  - Timing of algorithms and comparison with other approaches
  - Quality
  - User studies
- There are other means of evaluation, too (Laramee focuses on timing/quality)

[R. S. Laramee, 2009]

Results Pitfalls

- Unfettered By Time: Include performance details
  - Level of detail depends on paper type
  - Often means tables or charts
- Fear and Loathing of Complexity: Discuss algorithmic complexity if you're accelerating something
- Straw Man Comparison
  - Don't compare against outdated work
  - Rerun algorithms on the same hardware

[T. Munzner, 2008]

Results Pitfalls

- Tiny Toy Datasets
  - Ok for examples, but not ok for evaluation
  - Use datasets that match other approaches, target applications
- But My Friends Liked It
  - Informal evidence from colleagues is not compelling
  - Use representative subjects and/or more formal evaluation
- Unjustified Tasks
  - If no one will ever do a particular task, don't include it (even if results good)
- Tasks should mirror real-world tasks related to technique

[T. Munzner, 2008]

Conclusion & Future Work

- Remind reader of contributions
- Stake claims to next potential directions

General Writing Pitfalls

- Deadly Detail Dump:
  - What and why before how
  - Provide an overview
- Grammar is Optional: use correct syntax and grammar
- Mistakes Were Made:
  - No passive voice
  - Ambiguous who has done something otherwise
- Jargon Attack: Define terms, including for acronyms
- Nonspecific Use Of Large: Every author has a different idea of what large is (gigabytes, terabytes, petabytes)

[T. Munzner, 2008]

Other: Titles

- Title should be **memorable** (2-3 words)…
- …and long enough to be **descriptive**
- Sometimes authors make both explicit using `<title>: <subtitle>`
- “Marching Cubes: A High Resolution 3D Surface Construction Algorithm” is the “Marching Cubes” paper
- “Visual Analysis and Exploration of Fluid Flow in a Cooling Jacket” is the “cooling jacket” paper

[R. S. Laramee, 2009]

Other: Figures

- Show off your work
- Figures should be self-contained
  - Reader should be able to understand what is going on in the figure without reading the paper
  - Captions must be descriptive
- Not just results: also diagrams about how things work, potential issues

- Use **vector** images when possible
- When using raster images, make sure the **resolution** is good

[R. S. Laramee, 2009]

Figure Pitfalls

- Story-Free Captions
  - Words in captions are not limited
  - Embrace the flip-through reader
- My Picture Speaks For Itself:
  - Often need to get all readers on the same page with a visualization
  - Guided side-by-side comparisons are useful

[T. Munzner, 2008]

Other: Supplemental Materials

- In VIS, a video is usually submitted with the paper
  - Anything that is time dependent or has interaction is much easier to understand in a video
  - Can also show many more parameter settings
  - Often includes captions and voiceover
- Other supplemental materials:
  - User study materials
  - Raw experimental results
  - Code/results (more often posted to a website)

[R. S. Laramee, 2009]

Visual Encoding Pitfalls

- Color Cacophony: color distinguishability, # of categorical colors, colorblindness, oversaturated colors
- Rainbows Just Like In The Sky: no unjustified rainbow colormaps
- Unjustified Visual Encoding: pre-attentive processing, separability
- Hammer In Search Of Nail: start with of test with real data
- 2D Good, 3D Better: occlusion, foreshortening, other 2D options

[T. Munzner, 2008]