Information Visualization

Intro, *Time Series Exercise*

Tamara Munzner
Department of Computer Science
University of British Columbia

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http://www.cs.ubc.ca/~tmm/courses/547-19

Visualization (vis) defined & motivated

Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

Visualization is suitable when there is a need to augment human capabilities rather than replace people with computational decision-making methods.

- human in the loop needs the details
  - –doesn't know exactly what questions to ask in advance
  - –longterm exploratory analysis
    - ***speed up*** through human-in-the-loop visual data analysis
  - –presentation of known results
  - –stepping stone towards automation: refining, trustbuilding
- intended task, measurable definitions of effectiveness

Logistics

Finding me

- email is the best way to reach me: tmm@cs.ubc.ca
- office hours Tue right after class (5-6pm)
  - –or by appointment
  - –unlikely to catch me by dropping by, usually either in meeting or elsewhere
- X661 (X-Wing of ICICS/CS bldg)

- course page is font of all information
  - –don't forget to refresh, frequent updates
  - –http://www.cs.ubc.ca/~tmm/courses/547-19

Audience

- no formal prerequisites
  - –many areas helpful but not required
    - human-computer interaction (HCI), eg CPSC 544 this term or equivalent
    - computer graphics, cognitive psychology, machine learning, statistics, algorithms, <application domain>...
  - –programming skills required for most project types
- open to non-CS people
  - –if no programming background, can do analysis or survey project
- communication skills in English important for success
  - –substantial reading, writing, discussion, presentations
- need strength in *at least* one of these 3: programming, English, HCI
  - –**unsuccessful combination:** weak ESL, weak programming, no HCI background

- open to informal auditors
  - –some or all days of readings/discussion/exercises, you'll get out of it what you put into it...

Intros

- say your full name, program, year
- also sign up on paper sheet so I see who's here vs who's registered

Schedule, big picture

- once/week, 2-5pm Tuesdays, 12 sessions
- *Sep 3, no class: no CS grad classes, orientation events only*
- Sep 10, first class: today!
- Oct 22, no class: annual VIS conference
- Dec 3, last class: one week past usual time

- Dec 10, final presentations: afternoon, exact time TBD (1-5pm?)
- Dec 13, final reports due

Marking

- 50% Project
  - – 15% Intermediate Milestones (pass/fail)
    - – extensive feedback along the way
    - – but formative not summative
      - – goal: help you make projects the best they can be!
  - – 15% Final Presentation
  - – 20% Final Report
  - – 50% Content
- 20% Presentations (*probably, depending on final enrolment*)
  - – 75% Content: Summary 50%, Analysis 25%, Critique 25%
  - – 25% Delivery: Presentation Style 50%, Slide Quality 50%
- 30% Participation
  - – 60% Written Comments
  - – 25% In-Class Work/Exercises (pass/fail)
  - – 15% Discussion

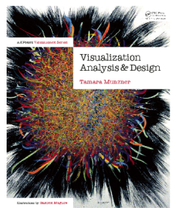
- marking by buckets
  - – great 100%
  - – good 89%
  - – ok 78%
  - – poor 67%
  - – zero 0%

Class sessions

- first part: read & participate [30%]
  - –before class:
    - you do readings (~4, mix of chapters & papers)
    - you submit comments before class
    - you respond to at least ~~two~~ one comment from classmates
  - –during class:
    - sometimes I lecture (briefly) and we discuss
    - frequent in-class work/exercises/critique
- highly likely: presentations [20%]
  - –before one of the classes: you read paper I assign on topic of your choice
  - –during that class: you present it to everybody else (~10-15 min)
  - –*TBD depending on final enrollment*

Readings

- textbook
  - –Tamara Munzner. Visualization Analysis and Design. AK Peters Visualization Series. CRC Press, 2014.
    - http://www.cs.ubc.ca/~tmm/vadbook/
  - –library has multiple free ebook copies
  - –to buy yourself, cheapest is amazon.com
    - hardcover bundled with ebook
- papers
  - –links posted on course page
  - –if DL links, use library EZproxy from off campus
- readings posted by 6 days before class
- ~4 each session: mix of chapters & papers



Comments submission & marking

- written comments on reading in advance, in two rounds
- round 1 due 10am (4 hrs before class), 90% of comment mark
  - – 1 for each reading
  - –bring printout or laptop with you, springboard for discussion
  - –post to Canvas discussion group
- round 2 due 1:30pm (30 min before class), 10% of comment mark
  - –written responses to at least 2 comments per session/week
  - –you can only read comments from others after you post your own
- start as pass/fail marking, see how it goes
  - –switch to explicit marking if quality concerns

Comments content

- comments or questions
- fine to be less formal than written report
  - –correct grammar and spelling still expected
  - –be concise: one paragraph is good
- should be thoughtful, show you've read and reflected
  - –poor to ask something trivial to look up
  - –ok to ask for clarification of genuinely confusing section
  - –good to show that you're thinking carefully about what you read
  - –great to point out something that I haven't seen before
- examples on http://www.cs.ubc.ca/~tmm/courses/infovis/structure.html

Class participation

- in-class group/individual exercises
- workshopping/critique for projects
- crucial part of course, attendance expected
  - –tell me in advance if you'll miss class (and why)
  - –tell me when you recover if you were ill
  - –(written comments credit still possible if submitted in advance)

Projects [50%]

- groups of 2, 3, or 4
  - –amount of work commensurate with group size
  - –permission for solo project granted in exceptional circumstances, by petition
- stages
  - –milestones along the way, mix of written & in-class
    - new last few years: formative feedback only
    - pitches (data/task), proposals, peer project reviews
  - –final versions
    - final presentations (oral): Tue Dec 10, afternoon
      - –whole dept invited, refreshments served
    - final reports (written): Fri Dec 13, 11:59pm
    - summative written feedback for both
- resources
  - –more on datasets and tools later

Projects

- programming
  - –common case *(I will only consider supervising students who do these)*
  - –four types
    - problem-driven design studies (target specific task/data)
    - technique-driven (explore design choice space for encoding or interaction idiom)
    - algorithm implementation (as described in previous paper)
    - interactive explainer (like distill articles)
- analysis
  - –use existing tools on dataset
  - –detailed domain survey
  - –particularly suitable for non-CS students
- survey
  - –very detailed domain survey
  - –particularly suitable for non-CS students

Projects: Design studies

- BYOD (Bring Your Own Data)
  - –you (or your teammates) have your own data to analyze
    - thesis/research topic
    - personal interest
    - dovetail with another course (sometimes works, but timing may be tricky)
- FDOI (Find Data Of Interest)
  - –many existing datasets, see resource page to get started
    - http://www.cs.ubc.ca/group/infovis/resources.shtml
  - –can be tricky to determine reasonable task

Project examples

- http://www.cs.ubc.ca/~tmm/courses/547-17F/projectdesc.html#examp

Presentations [20%]

- probably - *depends on final enrollment! TBD*
- present, analyze, and critique one paper
  - –send me topic choices, I will assign papers accordingly
- expectations
  - –slides required
  - –summary/description important, but also your own thoughts
    - analysis according to book framework
    - critique of strengths and weaknesses
- timing
  - –exact times TBD depending on enrollment
  - –likely around 15 +/- 5 minutes each
- topics at http://www.cs.ubc.ca/~tmm/courses/infovis/presentations.html

Enrollment

- don't worry if you're not registered yet, just attend and keep up
  - –major churn is normal the first few weeks
  - –spaces will definitely open up
- do make sure you've signed up on paper sheet going around!
- registered students currently have fob access to FSC 2330 door
  - –will update after final enrollment settles (after Sep 17)
  - –you can work in this room when not otherwise in use
    - other classes: Tue/Thu 9:30-11am, Tue 5-8pm, Fri 1-4pm
    - DFP Seminar: 2nd & 4th Wed 12-1pm

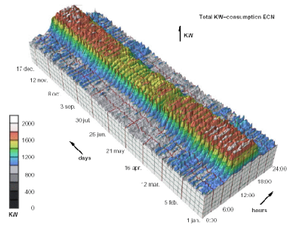
Break

Now: In-class design exercise, in small groups

- Five time-series scenarios
  - –A: every 5 min, duration 1 year, 1 thing: building occupancy rates
  - –B: every 5 min, 1 year, 2 things: currency values (exchange rate)
  - –C: several years and several things: every 5 min, 5 years, 10 currencies
  - –D: many things: every 5 min, 1 year, CPU load across 1000 machines
  - –E: several parameters, many things: every 5 min, 1 year, 10 params on 1000 machines
- Small-group exercise: 15-20 min
  - –one group per table (4 people/group)
  - –discuss/sketch possible visual encodings appropriate for your assigned scenario
- Reportback: 30-40 min
  - –3 min from each group
- Design space examples/discussion: 20-30 min

Case A: 3D Approach (Not Recommended)

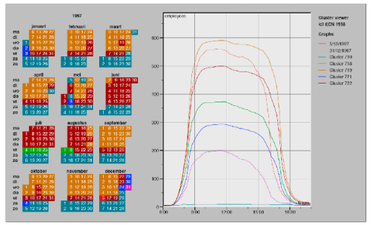
- extruded curves: detailed comparisons impossible



[Cluster and Calendar based Visualization of Time Series Data. van Wijk and van Selow, Proc. InfoVis 99.]

Case A: Cluster-Calendar Solution

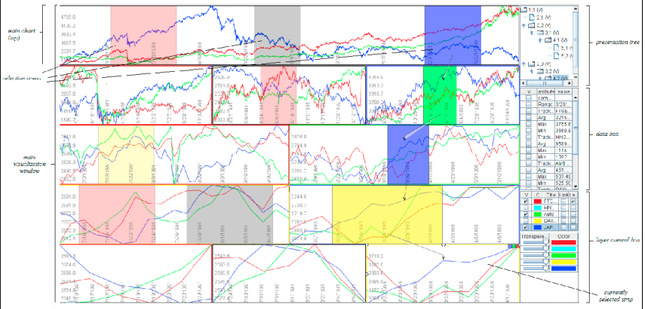
- derived data: cluster hierarchy
- juxtapose multiple views: calendar, superimposed 2D curves



[Cluster and Calendar based Visualization of Time Series Data. van Wijk and van Selow, Proc. InfoVis 99.]

Case B: Stack Zooming

https://youtu.be/dK0De4XPm5Y



[Stack Zooming for Multi-Focus Interaction in Time-Series Data Visualization. Javed and Elmqvist. Proc PacificVis 2010, p 33-40.]

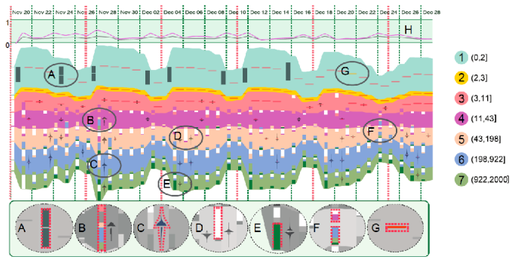
Case C: ChronoLenses

https://youtu.be/k7pl8ikczqk

[Exploratory Analysis of Time-Series with ChronoLenses. Zhao, Chevalier, Pietriga, and Balakrishnan. IEEE TVCG 17(12):2422-2431 (Proc. InfoVis 2011).]

Case D: RankExplorer

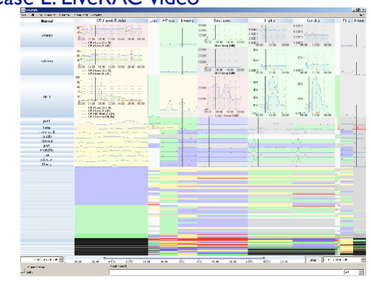
https://youtu.be/rdgn1qcZ2A4



[RankExplorer: Visualization of Ranking Changes in Large Time Series Data. Shi, Cui, Liu, Xu, Chen and Qu. IEEE TVCG 12(18):2669-2678 (Proc. InfoVis 2012)]

Case E: LiveRAC video

http://youtu.be/ld0c3H0VSkw



[LiveRAC - Interactive Visual Exploration of System Management Time-Series Data. McLachlan, Munzner, Koutsofios, and North. Proc. Conf. on Human Factors in Computing Systems (CHI) 2008, pp 1483-1492.]

Next Time

- to read
  - –VAD book, Ch 1: What's Vis, and Why Do It?
  - –VAD book, Ch 2: What: Data Abstraction
  - –VAD book, Ch 3: Why: Task Abstraction
  - –paper: Design Study Methodology