Wrapup: Research Papers and Process

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

Final presentations timing

- final presentations timing
  - Original plan: 1-5 Tue (26)
    - ML final: 12-2?? 12:30-3:30??
  - Best availability: 3-7 Tue (28)
  - Worse: Mon (21), Wed (24), Thu (20)

- reminder
  - we do have class next time (Tue Dec 3), since started a week late
  - peer reviews 2
    - do remember to submit your peer review slides
    - for this one, also upload notes as comments

Today

- finalize final presentation slot: Tue Dec 10 3-7pm
- presentations
- final papers and final presentations
  - course paper vs research paper expectations
- writing infovis papers: pitfalls to avoid
  - Process and Pitfalls in Writing Information Visualization Research Papers.
    Tamara Munzner. In: Information Visualization: Human-Centered Issues and Perspectives.
    Andreas Kerren, John T. Stasko, Jean-Daniel Fekete, Chris North, eds.
    Springer LNCS Volume 4950, p 134-153, 2008.
- other research pitfalls and process
  - review reading, review writing, conference talks
- reproducible and replicable research

Final Papers & Presentations

Final reports

- PDF, use InfoVis templates http://junctionpublishing.org/vgtc/Tasks/camera_tvcg.html
  - your choice to use Latex/Word/whatever
- no length cap: illustrate freely with screenshots!
  - design study / technique: aim for at least 6-8 pages
  - analysis / survey: aim for at least 15-20 pages
- ok to re-use text from proposal, interim writeup
- encourage looking at my writing correctness and style guidelines
  - http://www.cs.ubc.ca/~tmm/writing.html
- strongly encourage looking at previous examples
  - www.cs.ubc.ca/~tmm/courses/547-19/projectdesc.html#examp
  - Example Past Projects
  - browse 2015, 2014,… reports

Course requirements vs research paper standards

- research novelty **not** required
- mid-level discussion of implementation **is** required
  - part of my judgement is about how much work you did
  - high level: what toolkits etc did you use
  - medium level: what pre-existing features did you use/adapt
  - low level **not** required: manual of how to use, data structure details
- design justification **is** required
  - (unless analysis/survey project)
  - different in flavour between design study projects and technique projects
  - technique explanation alone is not enough
- publication-level validation **not** required
  - user studies, extensive computational benchmarks, utility to target audience

Report structure: General

- low level: necessary but not sufficient
  - correct grammar/spelling
  - sentence flow
- medium level: order of explanations
  - build up ideas
- high through low level: why/what before how
  - paper level
    - motivation: why should I care
    - overview: what did you do
    - details: how did you do it
  - section level
    - overview then details
  - sometimes subsection or paragraph level

Sample outlines: Design study

- www.cs.ubc.ca/~tmm/courses/547-17F/projectdesc.html#examp
- abstract
  - concise summary of your project
  - do not include citations
- introduction
  - give big picture, establish scope, some background material might be appropriate
- related work
  - include both work aimed at similar problems and similar solutions
  - no requirement for research novelty, but still frame how your work relates to it
  - cover both academic and relevant non-academic work
  - you might reorder to have this section later

Sample outlines: Design study II

- data and task abstractions
  - analyze your domain problem according to book framework (what/why)
  - include both domain-language descriptions and abstract versions
  - could split into data vs task, then domain vs abstract - or vice versa!
  - typically data first then task, so that can refer to data abstr within task abstr
- solution
  - describe your solution idiom (visual encoding and interaction)
  - analyze it according to book framework (how)
  - justify your design choices with respect to alternatives
  - if significant algorithm work, discuss algorithm and data structures

Sample outlines: Design study III

- implementation
  - medium-level implementation description
    - specifics of what you wrote vs what existing libraries/toolkits/components do
  - breakdown of who did what work
- results
  - include scenarios of use illustrated with multiple screenshots of your software
    - walk reader through how your interface succeeds (or falls short) of solving intended problem
    - report on evaluation you did (eg deployment to target users, computational benchmarks)
    - screenshots should be png (lossless compression) not jpg (lossy compression)!
- discussion and future work
  - reflect on your approach: strengths, weaknesses, limitations
  - lessons learned: what do you know now that you didn't when you started?
  - future work: what would you do if you had more time?

Sample outlines: Design study IV

- conclusions
  - summarize what you've done
  - different than abstract since reader has seen all the details
- bibliography
  - make sure to use real references for work that's been published academically
    - not just URL
    - check arxiv papers, many have forward link to final publication venue - use that too!
  - be consistent! most online sources require cleanup including IEEE/ACM DLs
    - do pay attention to my instructions for checking reference consistency
      - http://www.cs.ubc.ca/~tmm/writing.html#refs

Sample outlines: Technique (diffs)

- *Abstract, Introduction (same as above)*
- Related Work
  - big focus on similar solutions, some discussion of similar problems (same task/data combo)
- Data and Task Abstractions
  - much shorter than the corresponding one for design studies, framing context not core contrib
- Solution
  - describing proposed idiom exactly, not justifying its use for particular domain problem
  - as above, analyze in terms of design choices, justify why appropriate vs alternatives
- *Implementation (same as above)*
- Results
  - less emphasis on scenarios with particular target users
  - more emphasis on characterizing the breadth of possible uses
  - still definitely include screenshots of the system in action
- *Discussion / Future Work, Conclusions, Bibliography (same as above)*

Sample outlines: Survey (diffs)

- *Abstract (same as above)*
- Introduction
  - discuss the scope of what you're covering, why it's interesting/reasonable partition compared to visualization as a whole
- Related Work
  - **only** previous surveys
    - focus on how your work is similar to or different from them, especially wrt coverage
- Main
  - break up into sections based on your own synthesis of themes of work covered
  - you might want a Background section at the start if domain-focused survey
    - where there's important vocabulary/ideas to establish before diving into main discussion
  - analyze visualizations proposed in these papers in terms of what/why/how framework
    - include images from papers
- *Discussion / Future Work, Conclusions, Bibliography (same as above)*

Sample outlines: Analysis (diffs)

- *Abstract, Intro (same as above)*
- Domain Background
  - relevant vocabulary/ideas, your own background/connection
- Data/Task Abstraction, Related Work (same as above)
- Methods and Tools
  - how has it previously/normally been analyzed
  - explain what idioms you chose and justify those choices; same for tools
- Analysis
  - present results of your visual data analysis, including screenshots of tools in action
  - specifics of what you learned in terms of the domain problem
  - your reflection on how visualization choices helped you understand it
  - strengths/weaknesses of your approach (idioms and tools)
    - can be interleaved or in separate section at end
- *Discussion / Future Work, Conclusions, Bibliography (same as above)*

Sample outlines: Other types

- see page for implementation project types
  - implementation
    www.cs.ubc.ca/~tmm/courses/547-19/projectdesc.html#outlines
- interactive explanations
  - meet with me in advance to discuss

Report marking

- required: at least material I've listed
  - you may include more material, you may choose alternate orderings
- probable marking scheme (may change!)
  - design study & technique: 12.5% each for
    - intro, related work, abstractions, solution, implementation, results, discussion, style
    - style: 10% main, 2.5% bibliography
  - survey: intro (10%), relwork (10%), main (60%), style (20%)
  - analysis: intro/domain (8%), abstr (8%), relwork (8%), methods/tools (8%), analysis (52%), discussion (8%), style (8%)
- reminder: project content is 60% of entire project mark
  - report is 25%, presentation is 15%

Code / Video

- required: submit your code
  - so I can see what you've done, but I will not post
  - include README file at root with brief roadmap/overview of organization
    - which parts are your code vs libraries
    - how to compile and run
    - I do not necessarily expect your code compiles on my machine
- encouraged but not required
  - submit live demo URL
  - open-source your code (if so, fine to just send me that URL)
  - submit supporting video
    - with or without voiceover
    - very nice to have later, software bitrot makes demos not last forever!
  - can be same or different from what you show in final presentation

Showcase image

- showcase image for projects page
  - 300x300 image
  - call it showcase.png or showcase.jpg

Logistics

- Assignments: Final Presentations on Canvas
  - upload due Tue Dec 10 6pm
  - (upload due 1 hr before presentations if using my laptop)
- Assignments: Final Report on Canvas
  - upload due Fri Dec 13 11:59pm
    - required & posted: report, showcase image
    - required but not posted: code including README
    - encouraged: live demo URL, video

Final presentations

- context
  - CS department will be invited, also feel free to invite others
  - refreshments will be served, two short breaks
  - order: alphabetical by first name
- code freeze
  - no additional work on project after presentation deadline
  - additional three days to get it all written down coherently for final report

Final presentations: Tue Dec 13 3-7 (!) FSC 2300A

- length (19 projects)
  - 14 min for 3-person teams, 12 min for 2-person teams, 10 min for 1-person teams
  - includes questions: aim for 1 min (brief questions only)
- session structure
  - order alphabetical by first name, as on project page [shift if conflicts]
  - 2 breaks, between each set of 6 presentations
  - dept invited, friends welcome, refreshments served
- presentation structure
  - slides required *(remember slide numbers!)*
  - demo or video encouraged
    - if plan is for demo, screenshots and/or video for backup strongly encouraged
      - but do practice, demos eat up time!
  - should be standalone
    - don't assume audience has read proposal or updates (or remembers your pitch)
- slide upload
  - upload to Canvas Assignments: Final Presentations
  - post your slides by 6pm if using your laptops (best), or by 11am if using mine

Final presentations marking

- last year's template
  - Intro/Framing:
  - Main:
  - Limitations/Critique/Lessons:
  - Slides:
  - Style:
  - Demo/Video:
  - Timing:
  - Question Handling:

Marking: Course overall

- 50% Project, summative assessment at end
  - 15% Final Presentation
  - 25% Final Report
  - 60% Content
  - (penalty to 20% for missed Milestones, pass/fail)
    - pitch, proposal, peer review 1, peer review 2
- 20% Presentations
  - 75% Content:
    - Summary 50%, Analysis 25%, Critique 25%
  - 25% Delivery:
    - Presentation Style 50%, Slide Quality 50%
- 30% Participation
  - 60% Written Questions
    - 6 weeks, 10% each
  - 40% In-Class Discussion & Group Work (pass/fail)
    - 4 weeks, 10% each
- marking by buckets
  - great 100%
  - good 89%
  - ok 78%
  - poor 67%
  - zero 0%

Come talk!

- encourage meeting with me to get advice/feedback before final present
  - chance to get feedback while you can still act on it
  - optional, not mandatory
  - do send email to schedule, can't meet with all 19 teams in last few days!

Process & Pitfalls for InfoVis Papers

Idiom pitfalls

- Unjustified Visual Encoding
  - should justify why visual encoding design choices appropriate for problem
  - prerequisite: clear statement of problem and encoding!
- Hammer In Search of Nail
  - should characterize capabilities of new technique if proposed in paper
- Color Cacophony
  - avoid blatant disregard for basic color perception issues
    - huge areas of highly saturated color
    - categorical color coding for 15+ category levels
    - red/green without luminance differences
    - encoding 3 separate attributes with RGB
- Rainbows Just Like In The Sky
  - avoid hue for ordered attribs, perceptual nonlinearity along rainbow gradient

Later pitfalls: Strategy

- What I Did Over My Summer Vacation
  - don't focus on effort rather than contribution
  - don't be too low level, it's not a manual
- Least Publishable Unit
  - avoid tiny increment beyond (your own) previous work
  - bonus points: new name for old technique
- Dense As Plutonium
  - don't cram in so much content that can't explain why/what/how
    - fails reproducibility test
- Bad Slice and Dice
  - two papers split up wrong
  - neither is standalone, yet both repeat

Later pitfalls: Tactics

- Stealth Contributions
  - don't leave them implicit, it's your job to tell reader explicitly!
  - consider carefully, often different from original project goals

Contributions in research papers

- what are your research contributions?
  - what can we do that wasn't possible before?
  - how can we do something better than before?
  - what do we know that was unknown or unclear before?
- determines everything
  - from high-level message to which details worth including
- often not obvious
  - diverged from original goals, in retrospect
- state them explicitly and clearly in the introduction
  - don't hope reviewer or reader will fill them in for you
  - don't leave unsaid should be obvious after close reading of previous work
  - goal is clarity, not overselling (limitations typically later, in discussion section)

Later pitfalls: Tactics

- Stealth Contributions
  - don't leave them implicit, it's your job to tell reader explicitly!
  - consider carefully, often different from original project goals
- I Am So Unique
  - don't ignore previous work
  - both on similar problems and with similar solutions
- Enumeration Without Justification
  - "X did Y" not enough
  - must say why previous work doesn't solve your problem
  - what limitations of their does your approach fix?
- I Am Utterly Perfect
  - no you're not; discussion of limitations makes paper stronger!

Later pitfalls: Results

- Unfettered By Time
  - choose level of detail for performance numbers
  - detailed graphs for technique papers, high-level for design & eval papers
- Straw Man Comparison
  - compare appropriately against state-of-the-art algorithms
  - head-to-head hardware is best (re-run benchmarks yourself, all on same machine)
- Tiny Toy Datasets
  - compare against state-of-the-art dataset sizes for technique (small ok for eval)
- But My Friends Liked It
  - asking labmates not convincing if target audience is domain experts
- Unjustified Tasks
  - use ecologically valid user study tasks: convincing abstraction of real-world use

Final pitfalls: Style

- Deadly Detail Dump
  - explain *how* only **after** *what* and *why;* provide high-level framing before low-level detail
- Story-Free Captions
  - optimize for flip-through-pictures skimming
- My Picture Speaks For Itself
  - explicitly walk them through images with discussion
- Grammar Is Optional
  - good low-level flow is necessary (but not sufficient), native speaker check good if ESL
- Mistakes Were Made
  - don't use passive voice, leaves ambiguity about actor
    - your research contribution or done by others?

Final pitfalls: Style 2

- Jargon Attack
  - avoid where you can, define on first use
    - all acronyms should be defined
- Nonspecific Use Of Large
  - quantify! hundreds? 10K? 100K? millions? billions?…

Final pitfalls: Submission

- Slimy Simultaneous Submission
  - often detected when same reviewer for both
  - instant dual rejection, often multi-conference blacklist
- Resubmit Unchanged
  - respond to previous reviews: often get reviewer overlap, irritated if ignored

Generality

- encoding: visualization specific
- strategy: all research
- tactics: all research
- results: visualization specific
- style: all research, except
  - Story-Free Captions, My Picture Speaks For Itself

Research Process & Pitfalls

Review reading pitfalls

- Reviewers Were Idiots
  - rare: insufficient background to judge worth
  - if reviewer didn't get your point, many readers won't
  - your job: rewrite so clearly that nobody can misunderstand
- Reviewers Were Threatened By My Brilliance
  - seldom: unduly harsh since intimately familiar with area
- I Just Know Person X Wrote This Review
  - sometimes true, sometimes false
  - don't get fixated, try not to take it personally
- It's The Writing Not The Work
  - sometimes true: bad writing can doom good work (good writing may save borderline)
  - sometimes false: weak work common! reinvent the wheel worse than previous one

Review writing pitfalls

- Uncalibrated Dismay
  - remember you've only read the best of the best!
  - most new reviewers are overly harsh
- It's Been Done, Full Stop
  - you must say who did it in which paper, full citation is best
- You Didn't Cite Me
  - stop and think whether it's appropriate
  - be calm, not petulant
- You Didn't Channel Me
  - don't compare against paper you would have written
    - review the paper they submitted

Conference talk pitfalls

- Results As Dessert
  - don't save until the end as a reward for the stalwart!
  - showcase early to motivate
- A Thousand Words, No Pictures
  - aggressively replace words with illustrations
  - most slides should have a picture
- Full Coverage Or Bust
  - cannot fit all details from paper
  - communicate big picture
  - talk as advertising: convince them it's worth their time to read paper!

Paper writing process suggestions

- pre-paper talk
  - write and give talk first, as if presenting at conference
  - iterate on talk slides to get structure, ordering, arguments right
  - then create paper outline from final draft of slides
    - encourages concise explanations of critical ideas, creation of key diagrams
    - avoids wordsmithing digressions and ratholes
    - easier to cut slides than prose you agonized over
- pre-paper/practice talk feedback session: at least 2-3x talk length
  - global comments, then slide by slide detailed discussion
  - nurture culture of internal critique (build your own critique group if necessary)
- have non-authors read paper before submitting
  - internal review can catch many problems
  - ideally group feedback session as above

Reproducible and Replicable Research

Reproducible research

- 5: 15 minutes with free tools
- 4: 15 minutes with proprietary tools
- 3: considerable effort
- 2: extreme effort
- 1: cannot seem to be reproduced
- 0: cannot be reproduced

[Vandewalle, Kovacevic and Vetterli.
Reproducible Research in Signal Processing - What, why, and how.
IEEE Signal Processing Magazine, 26(3):37-47, May 2009.]

Why bother with reproducibility

- moral high ground
  - for Science!
- enlightened self-interest
  - make your own life easier
  - you'll be cited more often by academics
  - your work is more likely to be used by industry

Reproducibility: Levels to consider

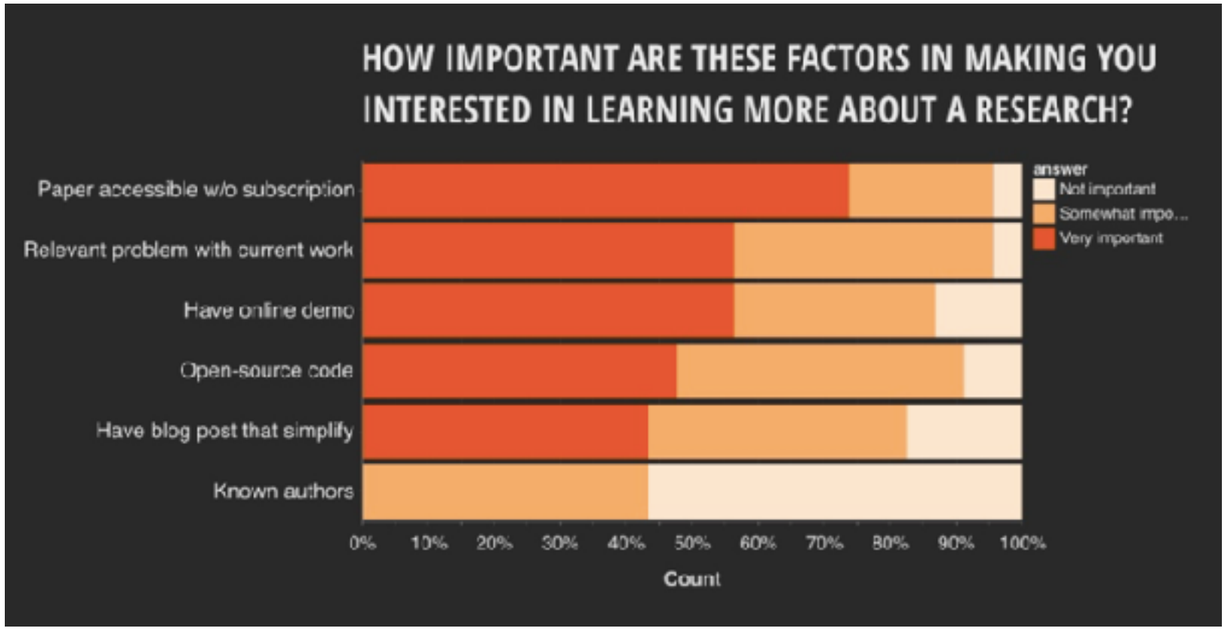
- paper
  - post it online
  - make sure it stays accessible when you move on to new place
  - external archives are better yet (arxiv.org)
- algorithm
  - well documented in paper itself
  - document further with supplemental materials
- code
  - make available as open source
  - pick right spot on continuum of effort involved, from minimal to massive
    - just put it up warts and all, minimal documentation
    - well documented and tested
    - (build a whole community - not the common case)

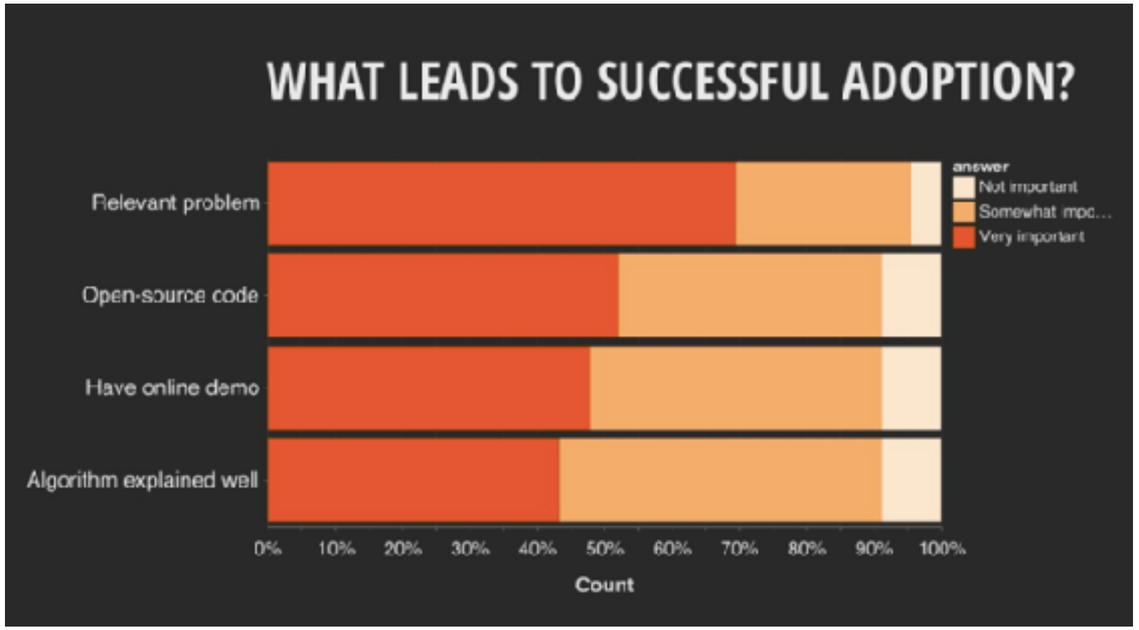
Reproducibility: Levels to consider, cont.

- data
  - make available
    - technique/algorithm: data used by system
      - tricky issue in visualization: data might not be yours to release!
    - evaluation: user study results
      - ethics approval possible if PII (personally identifiable information) sanitized, needs advance planning
- parameters
  - how exactly to regenerate/produce figures, tables
  - example: http://www.cs.utah.edu/~gk/papers/vis03/

View from industry

- Increasing the Impact of Visualization Research panel, VIS 2017
  - Krist Wongsuphasawat, Data Visualization Scientist, Twitter





https://www.slideshare.net/kristw/increasing-the-impact-of-visualization-research

Replication: crisis in psychology, medicine, etc

- early rumblings left me with (ignorable) qualms
  - papers: Is most published research false?, Storks Deliver Babies (p= 0.008), The Earth is spherical (p < 0.05), False-Positive Psychology
- groundswell of change for what methods are considered legitimate
  - out: QRPs (questionable research practices)
    - p-hacking / p-value fishing / data dredging
    - Hypothesizing After Results are Known (HARKing)
  - in
    - replication
    - pre-registration
  - brouhaha with bimodal responses
    - some people doubling down and defending previous work
    - many willing to repudiate (their own) earlier styles of working

Remarkable introspection on methods

- thoughtful willingness to change standards of field
  - Andrew Gelman's commentary on the Susan Fiske article
    - http://andrewgelman.com/2016/09/21/what-has-happened-down-here-is-the-winds-have-changed/
  - Simine Vazire's entire Sometimes I'm Wrong blog
    - http://sometimesimwrong.typepad.com/
    - especially posts on topic Scientific Integrity
  - Joe Simmons Data Colada blog post What I Want Our Field to Prioritize
    - http://datacolada.org/53/
  - Dana Carvey's brave statement on her previous power pose work
    - http://faculty.haas.berkeley.edu/dana_carney/pdf_My%20position%20on%20power%20poses.pdf

When and how will this storm hit visualization?

- they're ahead of us
  - they have some paper retractions
    - we don't (yet) have any retractions for methodological considerations
  - they agonize about difficulty of getting failure-to-replicate papers accepted
    - we hardly ever even try to do such work
  - they are a much older field
    - we're younger: might our power hierarchies thus be less entrenched??…
  - they are higher profile
    - we don't have vis research results appear regularly in major newspapers/magazines
  - they have rich fabric of blogs as major drivers of discussion
    - crosscutting traditional power hierarchies
    - we have far fewer active bloggers
- replication crisis was focus of BELIV 2018 workshop at IEEE VIS
  - evaluation and BEyond - methodoLogIcal approaches for Visualization
  - http://beliv.cs.univie.ac.at/