CS 795/895
Vehicular Networks

Research Methods

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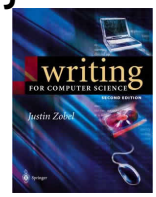
http://www.cs.odu.edu/~mweigle/CS795-S10/

Outline

- Performing research
- Reading papers
- Writing summaries
- Writing papers
- Presenting data
- Giving presentations

Main Resources

- *The Art of Computer Systems Performance Analysis* by Raj Jain
- *The Elements of Graphing Data* by William S. Cleveland
- *Writing for Computer Science* by Justin Zobel
  - this book is highly recommended!



Other resources are linked on course webpage

Performing Research

The Devil's in the Details

- Good researchers pay great attention to detail…
  - when designing and running experiments
  - when analyzing data
  - when creating graphs
  - when writing papers
  - when preparing and giving presentations

Performing Research

You Must Have a Plan

- State goals and define the system
- List possible outcomes
- List possible parameters and variables
- Select metrics to study
- Select input model
- Design experiments
  - justify parameter settings
- Analyze and interpret data
  - do the results make sense?
  - can you explain them?
- Present results

From *The Art of Computer Systems Performance Analysis*, by Raj Jain

Performing Research

Documentation is Essential!

- Get a lab notebook and use it!
  - bring it to research meetings
- Document experiments
  - why was the experiment run?
  - what were the expected results?
  - what were the experiment parameters?
  - what were the results?
  - write a one-page summary *before* presenting results to your advisor

Reading Papers

Three Pass Approach

- First Pass
  - title, abstract, introduction, section headings, conclusions, references
  - answer 5 Cs: category, context, correctness, contributions, clarity
- Second Pass
  - entire paper, ignoring details such as proofs
  - look at figures, graphs
- Third Pass
  - entire paper, identify and challenge every assumption in every statement

From "How to Read a Research Paper" by S. Keshav

Reading Papers

Questions to Answer

- What are the motivations for the work?
- What is the proposed solution?
- What is the evaluation of the work?
- What are the contributions?
- What are the future directions for this research?

From "How to Read an Engineering Research Paper" by William Griswold

Writing Summaries

- Turn answers to the questions into a summary
- The summary must be in your own words
- Don't "cut and paste" the article
  - If your summary is a "jumble of statements nearly straight from the article", then you haven't really understood what the article was about.

From "Summary of a Scientific Article", Department of Biology, George Mason University

Writing Papers

Organization

- Abstract
  - single paragraph
  - readers use it to determine if article is relevant
  - concise summary of aims, scope, conclusions
- Introduction
  - describe topic, problem/motivation, approach, scope, conclusions
  - clearly tell reader what is novel
- Related Work
- Approach and Results
- Conclusions and Future Work

From *Writing for Computer Science* by Justin Zobel

Writing Papers

Style

- Be clear, simple, correct, interesting, direct
  - delete unneeded words, simplify sentence structure, establish logical flow
- Be objective and accurate
  - primary objective is to inform, not entertain

From *Writing for Computer Science* by Justin Zobel

Writing Papers

Style

- Don't use contractions or slang
- Use examples when needed for clarification
- Link text together as in a narrative
  - each section should tell a clear story

From *Writing for Computer Science* by Justin Zobel

Writing Papers

Style Specifics

- Pay careful attention to the abstract and opening paragraphs of the introduction
  - first thing people will read
  - concisely written, no wasted words
- Vary sentence structure - more interesting

Writing Papers

Style Specifics

- Every sentence in a paragraph should be related to the paragraph's topic
- Don't italicize words unnecessarily.
- Don't use capitalization for emphasis, only for abbreviation

Writing Papers

Editing

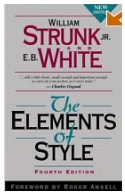
- Your first draft is not your final draft
- The goal is to make the paper clear and readable
- There is no excuse for spelling errors!
- Double-check noun-verb agreement

From *Writing for Computer Science* by Justin Zobel

Writing Papers

Editing

- Double-check bibliography - make sure that the citations match your list of references
- Make sure that you have been consistent throughout the paper



- If you are unsure of grammar usage, look it up!

From *Writing for Computer Science* by Justin Zobel

Writing Papers

Improving Your Paper

- Use the spell checker (and grammar checker)!
- Sloppy papers take away from the content
- Don't rely on color graphs
  - everything should be readable in black & white
- Don't give too much background material
  - remember your audience

From "A Referee's Plea" by Mark Allman

Writing Papers

Citation Style

- Don't use the citation label (e.g., [16]) as a noun
- *et al.* ('and others') is an abbreviation. It should be italicized because it's a foreign language phrase
  - *et* means 'and' - no period
  - *al.* is an abbreviation for *alii,* meaning 'others'
- Provide a complete a citation as possible
  - include page numbers, dates, etc.
  - follow conference/journal guidelines
  - don't just copy from citeseer, use citation in ACM Digital Library, IEEE Xplore, or author's webpage

From *Writing for Computer Science* by Justin Zobel

Presenting Data

The Data is the Most Important Part

- Plotting symbols should be easy to see and distinguish
  - If different plotting symbols overlap, make sure they can be distinguished
- Don't allow labels to interfere with the data
- If multiple data sets are plotted on the same graph, make sure they can be easily followed

Don't make the reader work to understand your graph!

From *The Elements of Graphing Data* by William S. Cleveland

Presenting Data

Graphs in Papers

- Each figure or graph should be numbered with an informative caption
- Don't make readers flip backwards to find your figure
- If you use a figure from another source, give attribution in the caption

From *The Elements of Graphing Data* by William S. Cleveland

Presenting Data

Graphs in Papers

- Write descriptive *x* and *y* axis labels that include units. Use large fonts (but not too big)
- Don't use a line graph to represent data that should be shown in a bar graph (unordered data)

From *The Elements of Graphing Data* by William S. Cleveland

Giving Presentations

- Consider the audience
  - don't bore them with background they already know
- Think about what you want the audience to walk away knowing
- Keep in mind your time limit
  - leave time for questions

From *Writing for Computer Science* by Justin Zobel

Giving Presentations

- Don't provide too much detail
- Start with motivation
- First slide should always contain the title, your name (and names of your collaborators), and your affiliation

From *Writing for Computer Science* by Justin Zobel

Giving Presentations

- Proof-read your slides
- Check consistency in capitalization and font usage
- Keep slides clean and simple

From *Writing for Computer Science* by Justin Zobel

Giving Presentations

- Make transitions between topics smooth
  - don't just read the title of each slide as a transition
- Speak clearly and slowly
- Face the audience
- Practice! Practice! Practice!

From *Writing for Computer Science* by Justin Zobel