How to Read a Research Paper

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CS 7001
August 30, 2006

Administrivia

- Check web page for lecture schedule/assignment writeup

- Use class time to meet as a group
    - Simplifies scheduling: everyone should be free
    - Meet wherever you like
    - We will be at the classroom on Friday

- Subscribe to mailing lists if you haven't done so
    - cs7001

Agenda

- Finding and crafting good problems (conclude)

- Reading research papers
  - Should help with PS1

How do you find ideas/problems?

- Frustrations
  - Your own
  - Others'… how to find out about these?

- Read, read, read to stay relevant
  - Mailing lists
  - Conferences ("real world" ones, in particular)
  - Certain news rags (*Economist, Tech Review*, etc.)
    - Can often be a good source of ideas for applying one problem domain to another, etc.

Where *not* to find ideas/problems

- Your imagination
  - Don't make problems up. Plenty of real ones out there…
  - The new approach, question, etc., should come from your thoughts. The problem itself should not.
  - Asking for feedback is key (e.g., asking people to read your papers…today's topic)

- Conference proceedings (sometimes)
  - The last 80% of papers on a topic solve the last 5% of the problem
  - Often, that 5% "doesn't matter"
    - Engineering or time travel will solve it…

Making a good problem from a big one

- Baby steps: simplifications of the problem
  - Taking care to keep assumptions valid

- Special cases of the problem
  - When you can't find the answer, sometimes changing the question works.

- Multiple perspectives on the same problem
- Surrounding the problem by knowing all aspects; massive knowledge
- Big analogical leaps

Questions

- Why read research papers?

- What to read?

- How to read?
  - Quickly
  - Selectively
  - Critically

Why Read Research Papers?

- Keep up with the field
- Understand different perspectives on your problem
- Learn the lingo
- Avoid trying to reinvent the wheel
- Have you picked a problem of the right size
- Learn writing style and culture
- Pick problems
- Combine problems

Why Read Research Papers?

- Look for new ideas

- Understand the context of your own work
  - General problem area
  - Related results

- Build your body of knowledge

- Keep up with a research area

- Someone asks you for feedback

Where to start? So much to read!

- Start with the classics
  - These themes will recur
  - Can provide context for the current readings
  - These folks often tend to have written books (often have a good writing style, etc.)
  - Where to find them? Course notes, Springer notes (?), area exam lists, your own hunting, test of time awards, etc.
- Check the references
- Conference proceedings!

What to Read

- Proceedings of top conferences
  - Skim everything
  - Read the subset that directly applies
  - Each proceedings will probably have < 3 papers that you will read-end to end

- The lost gems
  - In your area: Follow the people you respect
    - Develop rapport with more senior mavens
  - Out of your area: You'll hear about them
    - No need to be the maven out of your area
  - (What do to when your paper becomes a lost gem?)

- Journals: Importance is variable by field. Find out!

How to Quickly Understand a Paper?

- Abstract, Introduction and conclusions first!
- Section headings
- Pictures, graphs, etc.
- Explanation of previous work
- See if you can summarize the paper in a sentence or two
- Check out the authors to get context

Takeaway: Read Selectively

- Don't read every paper the same way
  - Not necessary (or advisable) to read every paper end-to-end
  - Different from *reviewing* papers

- Use your time wisely
  - Time management task!
  - Too much to read: Can't even read all of the work related to yours
  - How to decide which papers to read?

Reading Selectively

- Like peeling an onion: many layers of detail
  - Go breadth first
  - How much detail you need depends on what you're going to do with the work

- One approach to reading a paper
  - Read abstract, intro, and conclusions first
  - At this point, decide whether you need to read on
    - Ask the questions about "Is this a good problem/idea?"
    - Need to understand results better
  - Read experiments/results last
    - Will take 80% of the time
    - Often, summary of results in intro is enough

Reading Selectively (cont.)

- Speed Reading
  - Only read first and last sentence of each paragraph
- Can quickly get a sense for things like formality level
- Evaluation sections
  - Don't read unless:
    - You need the detail
    - The technique itself is interesting
  - Look at graphs and captions first
- Reviewing: focus on flaws

Answer key questions first

- Is the main point obvious?
  - What is the key "intellectual nugget"?

- Are there any experimental results?
  - Does the rest of the paper have anything to do with abstract and intro? (i.e., are the claims backed up?)

- Are there any theorems?

- Did they compare to any competition?

Reading Critically

- Multi-pass approach
  - Read with a pen
  - Return later to parts you don't understand
  - Write down main points at the top of 1st page (quick reference)

- Summarize the paper in 1-2 sentences
  - If you can't do this after reading the abstract/intro/conclusion, think hard about whether you want to read on
  - Useful when you review a paper, too (signal)

- Ask these questions
  - Does the paper address a "good" problem?
  - Does the paper follow through on the claims?
  - What assumptions were made? (valid?)
  - Soundness of methods/experimentation

Reading a Paper End-to-End

- Classic papers

- Papers that are directly related to your research

When Someone Asks You for Comments…

- Personal favors are important
  - You will need readers for your own drafts
  - Feedback is critical to research
  - Still, you've got stuff to do. Can't read every word!

- It is important to prioritize
  - Your advisor, friends, and immediate colleagues
  - People doing work directly related to yours ("contemporaries")
    - Sometimes can give you a sneak peak into what others are up to
  - Work by colleagues unrelated to your research

- High-level feedback can go a long way