Writing about Research

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The Title

- Should be around 7-8 words
  - Try to be precise and don’t use words that are general catch-alls
  - Think of what you would want others to Google to find your work
- You don’t have to decide the title early on
  - The title should easily emerge after you’ve written the abstract
- Think of FUTURE PUBLICATIONS
  - Don’t squeeze yourself out of your next title
  - Happens ALL the time
Almost everything comes with an abstract
A very well-written 1/2/3-paragraph summary
Luckily there is an expected structure:
1. What is the area and why is it an important area?
2. What is the problem that you tackle and why is it hard?
   - In as simple English as possible
   - Why are the challenges and why do they elude us?
3. What does the literature say about this problem?
   - Results and shortcomings
What is your approach in solving this problem?
   1. How come you solved it?
   1. How do you implement your solution?
      - In simple, high-level English
What are the key findings and the overall impact?
   1. What you discovered
Some of these are optional but it’s a good idea to write too long an abstract and cut it down later (150 words)
Passive/Active voice?
The Abstract

The Abstract is a **sanity check**: If you can’t write a compelling abstract, there is likely something wrong with your work.

- It’s a **plan** for your argument.
- It’s a **story** that you can tell to answer the question “So, what’s your work about?”
Writing Top-Down

This is something I use and it works for me and has worked for my students

Write 2/3 sentence that describes each section (in informal English)

Example:

Section 1: “Fault-tolerance is a big issue for upcoming machines, and checkpointing-recovery is the typical approach. Finding the best checkpointing strategy is crucial and a well-studied question. In this work we make new contributions”

Section 2: “Previous works have studied this question in many ways and many results are available, but it turns out that X and Y are not well-known or studied, which is what we do”

Section 3: “Here is the definition of the problem, of the objective, and a statement of our assumptions”

Section 3: “We can compute the optimal checkpointing frequency and some cases, or have a dynamic programming approximation in general”

Section 4: “We use state-of-the-art simulation methodology, described here, to evaluate our work and compare it to those by X, Y, and Z.

Section 5: “Our results show that we rule in terms of expected application makespan”

Section 6: “The impact of our work is significant and

Stop. Read. Discuss with co-authors. Check coherence

At this stage, it’s often obvious but sometimes not
Writing Top-Down

Expand each sentence into a set of sections and sub-sections, summarize each section/sub-section with one sentence

Example: “We can compute the optimal checkpointing frequency in some cases, or have a dynamic programming approximation in general”

3.1. We remark that the problem can be written as a recursion, and we write it

3.2 If failures are exponential, then Theorem 1 gives the solution to the recursion
   - Proof of the theorem
   - Give the closed-form solution and say that it’s a major new result

3.3 If failures are non-exponential, then we need a dynamic programming solution
   - Proof of correctness
   - Computational complexity

Stop. Read. Discuss with co-authors. Check coherence

This is when first issues arise
Writing Top-Down

In each section write one sentence per paragraph, still informally

“Algorithm Y sucks”

“We reuse the same methodology as in [12], but enhance it with a and b parameters”

Stop. Read. Discuss with co-authors. Check coherence

MANY ISSUES HERE: shuffling of sentences

DO NOT get tempted to write full paragraphs until you have a full version

your co-authors/advisor will blow your wordsmithing to smithereens anyway

Then, write 10 paragraphs a day and feel productive

Keep the informal sentences for each paragraph in comments (e.g., LaTeX comments)
Tip #1: Every sentence should be factual and justifiable!
- This is supposed to be a rock-solid piece of work, no leaf unturned
- References at the end of sentences are a good thing
- e.g., “Computers are moving towards many-core architectures [12]”
- e.g. “This has never been considered before” -> “The authors are not aware of any other work where this has been considered
- “All other works apply the slow method” -> “In [2, 4, 8] the slow method is applied.”

Tip #2: Avoid hyperbole
- Terms like “extremely,” “very,” “highly,”... should used rarely (never?)
- Be quantitative: “3 orders of magnitude larger,” “within .5%,” “in 95% of the cases,” etc.
- Avoid all imprecision “almost,” “soon,” “seem,” “probably,”...
- Avoid everything colloquial: “lots of,” “huge,”
- Being vague is a major offense

Tip #3: Get to the point quickly in the introduction
- No “grandmothering” (bores experts, can’t help non-experts enough anyway)
Unsorted Writing Tips

Tip #4: A graph/table should not have too many embedded messages
- Make sure these messages are clearly outlined
- Itemized lists are always a good thing

Tip #5: Each paragraph must describe a single idea
- The first sentence links with the previous paragraph
- The last sentence concludes and/or links with the next paragraph

Tip #6: Your conclusion shouldn’t just be the introduction in the past tense

Tip #7: What about having “this paper is organized as follows. In Section 2 ...” paragraph at the end of the intro?
- No idea what I think about this but some really hate it even though it’s almost always there
Unsorted Writing Tips

Tip #8: Use your advisor!
- Your advisor wants you to have a good thesis
- You should get continuous feedback on the outline and the writing
- Being on the same page regarding the outline is absolutely necessary
- I love it when students give me the “top down approach” informal writing pieces
  - We detect problems early, when they’re clear, rather than later once they are buried within pages and pages

Tip #9: Set yourself writing deadlines
- Defined with your advisor
- Based on conference deadlines perhaps

Tip #10: Overlap writing and research
- As time goes by, you want to dedicate x half-days to writing per week, where x increases as time goes on
  - Start when you have enough for a chapter
- Some students do all the writing at the end, but I don’t think it’s a good idea
  - It feels great to have a few written chapters
  - You get early feedback on your writing strengths/weaknesses
  - Doing only writing for weeks and weeks is really tough
Unsorted Writing Tips

Tip #11: Start writing the “easy” sections
- The introduction and conclusions are tough
- The related work section shouldn’t be too hard
- The “meat” sections are typically the easiest
  - methodologies, graphs, and results are easier to write about than research vision

Tip #12: After reading a paper you like, think about what you liked in terms of the writing and shamelessly steal writing techniques

Tip #13: Add “sign-post” sentences
- “In the previous section we saw that....”
- “In this section we....”
- “Up to now, our results indicate that.... but...”
- Put TOO MANY of them, and remove them later
Tip #14: **Use consistent terminology**
- Pick a term for a concept, and stick to it!
- If you use “computer”, don’t start using “machine”, “host”, “processor”, “node”
- If you use “framework”, don’t start using “environment”, “infrastructure”
- If you use “approach”, don’t start using “scheme”, “technique”, “solution”, “strategy”
- **Synonyms are death**
- You can be upfront about two terms used interchangeably if truly necessary

Tip #15: **Spell out conclusions from the data**
- Don’t expect readers to go look at tables/graphs and figure anything out for themselves
- Every figure/table should be referenced in the text
- Describe axes/rows/columns meaning in the text
- Have detailed captions (it’s ok to have a multi-line caption)
Unsorted Writing Tips

Tip #16: It’s all about critical thinking, not describing data
   Always bear this in mind when writing your “meat” sections

Tip #17: Use jokes/spun sparingly (never?)

Tip #18: Beware of the word “optimal”
   Even worse is “more optimal”, “most optimal”
   More generally speaking, know when a term is loaded

Tip #19: Use the present tense as much as possible
   No “In Section 4 it will be shown that...”

Tip #20: Good grammar and good style are important
   There are books to help you (e.g., “The elements of style”)

Tip #21: Consistency, consistency, consistency
   We’ve seen consistency of terms, but it applies throughout
   Graph scales, orders of curves, style of bullets, infinitive vs. -ing, tenses, etc.

Tip #22: Spellcheck!
There is much on-line material on this topic general or CS-specific

A good list of 68 tips: http://www.cs.columbia.edu/~hgs/etc/writing-bugs.html

Tips 1, 4 (overuse it at first), 21 (make a removing pass), 27, 32, 48, 58 (personal pet peeve), 64,
Writing Meta-Tips

Meta-Tip #1: Thinking that we’re not in an English dept. and the only thing required is to read binary and write assembly is not a fair assessment
- Writing in research is sickeningly important

Meta-Tip #2: Ignoring all writing tips, forging ahead, and applying tips at the end will only result in pain and suffering
- And not only your own pain and suffering, but that of your advisor, the person that should be your advocate at your defense
- Many defenses private deliberation: “Writing was like pulling teeth and I almost lost my sanity”

Meta-Tip #3: Thinking that my list of Tips is sufficient for all advisors is a mistake
- But it’s hopefully a good start
A Note on Critical Thinking

Too often authors do not show critical thinking in their writings

Extreme case: Ph.D. portfolio literature reviews

When describing related work and your own contribution, critical thinking is key

The thing to do: compare previous work and your work in terms of strengths and weaknesses

Be assertive, and 100% factual

Your reader should be able to engage in discussions in your area of research

“Well, yes, Algorithm X is great but it doesn’t work when Y happens” (“Am I happy I read that paper that had such a clear critical analysis of the state of the art”)

But always be civil and not disparaging

Even if you think that some work is of poor quality
The End

- Questions?
- Comments?
- Personal Stories?