Practical Tips and Tricks for Paper Writing

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24-02-2011

Writing a paper is a challenging task. A publication means you are writing about *something* for *somebody*. *Somebody* refers to the audience. It is important to know for whom you are writing. Presenting the same *something* to two different audiences (like experts and laypersons) will lead to very different papers. This short tract is more on the practical aspects of how to present the *something*.

1. Overall Structure of a Paper – The Story

A scientific paper typically describes a research effort. It clearly has to tell a story, there must be a red thread. To present a story there should be clear answers to the following aspects:

Problem: What scientific(!) problem are you solving? Why is this a relevant problem for whom?
Goal: What do you want to achieve with your research work? Examples might be: new algorithm, new workflow, software prototype, performance improvement, quality improvement.
Approach: How did you tackle the problem? How does the new algorithm/workflow/system look like?
Outcome: What is your solution? What characteristics does it have? Internal evaluation (performance, quality analysis), external evaluation (comparison with other existing approaches).
Costs: How much did it cost to realize/implement the solution? Cost of deploying the prototype, performance analysis.

The following is a slightly different view on the same topic (as sneaked from Helwig Hauser, UiB) concerning visualization papers which are separated into methodological VisPapers and application VisPapers (there are further paper types though, like evaluation, systems, theory, design study papers, aso):

Methodological VisPaper:

* **problem?!**
  - no solution without a problem
  - problem statement
* **relevance?!**
  - don't solve a problem that no one has
  - impact of solution
* **originality?!**
  - don't solve a problem that has been solved
  - discuss related work sufficiently
* **solution (sure!) - contribution**
* **evaluation, demonstration, proof**
  - show that it actually works
  - provide convincing evidences, e.g., from an application
* **measures of success**

- quantify your contribution, if possible
- qualitative comparisons are harder, but possible

Application Vis paper: Show how the application of an innovative visualization solution led to a measurable advantage in the application.

Yet another but shorthand take on the paper story is to follow the **WHW**-rule:

What are you visualizing?
How are you visualizing it?
Why are you visualizing it?

Not having a good answer to **any** of the above points can easily be a knock-out criterion for your paper!!

2. Specific Remarks - Readability

The following are some practical tips and tricks which you should follow before handing your paper draft to co-authors for review/revision. The list shall act as a sort of a check-list which you should go through first and verify.

1. Your paper has to tell a story
   a. Before going into the details give a high level explanation first (this holds for the entire paper, individual chapters, sections)
   b. Red thread must be clearly visible
   c. Tell the story, structure of the paper: What are the major innovations in the paper (at three places: abstract, introduction, conclusion)
   d. Tell the story in a simple consistent language
   e. Maybe give a simple easy to comprehend example first, before you generalize.
   f. Clearly separate algorithmic details from implementation details from user-interface details

2. Abstract
   a. Should answer concisely three questions
      i. Which problem did you solve
      ii. How did you solve the problem (high level specifics of a technique for example)
      iii. What results did you achieve ("Our technique is now 1000% faster than…")
   b. Abstract is NOT an introduction
   c. Abstract is NOT a summary

3. Consistent naming, use of terms
   a. Define terms before usage
   b. Use same terms for same things (many different terms for the same thing is just confusing)
   c. Make notation consistent if you are using different sources with differing notations
   d. Unambiguous use of symbols and terms. Do not re-use the same symbol for different meanings

4. Composite words
   a. Do not use long composite words (avoid composite words with more than three words)
   b. Use hyphenation to structure composite words ("ray casting" but "ray-casting method", "ray-casting method-overview")

5. Figures

a. There should be an overview figure which acts as a visual index of the content
b. Figures alone (without text) with captions should tell the story of the paper (like a comic book)
c. Are all figures cited in the paper?
d. Citation order should determine the appearance order of figures.
e. Captions should be short and expressive (not longer than two lines)
f. Annotation, axes labels, color legend exist and are legible?
g. Use consistent style, font, font size aso. across all the images.

6. References
   a. Consistent style for all the references (e.g., first name of authors abbreviated)
   b. Consistent referencing to the same conference or journal (this is especially an issue with bibtex where people are copying inconsistent entries from various sources)
   c. Are all references cited in the text
   d. The number of references for a research paper should be in the range between 10 and 30
   e. Citation in text: A two authors paper is cited as "A and B [nn] …". Papers with more than two authors are cited as "A et al. [nn] …"
   f. Citation to web resources: Use title of page, Url, date of access

7. Grammar, textual style
   a. Avoid long, convoluted, nested, run-away sentences. No sentence should be longer than two lines on a double-column page.
   b. One thought, one sentence.
   c. Avoid side information in brackets, as this reduces legibility.
   d. Juxtaposition is in English expressed just by giving the sentences in sequence. Therefore use words like "Therefore", "However", "Thus", "But" very cautiously and rarely to start sentences.
   e. Decide on which tense you are using and stick to it. Use either the present or past tense.
   f. Avoid abbreviations like "can't", "don't"
   g. Do not be colloquial or address the reader directly ("You can…")
   h. Avoid one sentence paragraphs
   i. Avoid one point subsections, e.g., having a section 6.1 but no 6.2.
   j. Avoid footnotes

8. Evaluation issues could be:
   a. Internal evaluation (space requirements, time requirements, user interaction time, robustness)
   b. External evaluation (comparison to other approaches in performance, quality)
   c. If you use ad hoc parameters, discuss sensible choices, robustness, aso.

9. Miscellaneous
   a. Avoid unsubstantiated assertions.
   b. Use the spell checker!
   c. Use all the available space, e.g., make images as large as possible

10. Further links
    a. - http://www.ece.ucdavis.edu/~jowens/commonerrors.html
    b. - A Handbook for Scholars by Mary-Claire van Leunen (available in our library)

3. Handling of Paper Revisions

Submitting a paper to a high level venue with low acceptance rates means that in many cases you will get back the paper with a minor revision, major revision, or reject decision together

with typically detailed reviewer comments. How do you improve the paper given limited resources from your side?

It is advisable to reflect on the reviews for some time which also allows to overcome the emotional distress of having gotten a critical evaluation. Then it should be decided how to go on. Reviews and reviewer comments might be redundant, repetitive, contradictory, but take them seriously. Typically reviewers spent a considerable time on trying to get an objective opinion on your paper. Structuring and prioritization is necessary. Based on the reviews, it is helpful to come up with a condensed list of topics to do. Each topic gets two weights, one weight describes how much effort it is to implement (from impossible to very easy) and the second weight describes the added benefit this topic would bring to the revised paper. For the revision the first part of this list, i.e., those topics with the best cost/benefit ratio, are realized/implemented. This is sort of a knapsack problem, the knapsack is your available resources that you can/want to further invest in the paper. You pack as many as possible high-gain topics into the knapsack so that the added value is maximized.