How to write a paper?

Reference: CS211@UCLA, by Prof. Songwu Lu; with slight revision.
A nice paper structure

Example: a 12-page paper
- Abstract (1/8~1/4 page)
- Introduction section (1 page)
- Background section (0.5~0.75 page)
- Design section (3.5 page)
- Implementation section (1 page)
- Evaluation section (3.5 page)
- Discussion section (0.75 page)
- Related work section (0.5~0.75 page)
- Conclusion section (0.25~0.5 page)
What you have in mind before writing your paper?

• Does it solve an important problem?
• What is the novelty?
  – formulating a new problem?
  – proposing new solutions?
  – presenting new evaluation methods/techniques?
  – The work is not incremental!
• Relevance of the work
  – On a hot problem in a hot area
  – Or, the first one in this area, and can stimulate a lot of follow-up work even though the solution is still rough

• Readers learn something they did not know before
Introduction

• A few key questions to answer
  – The problem statement: what exact problem it is solving?
  – The importance of the problem: why it is worth the effort to solve it
  – Challenges for the problem: there are many problems to solve, why is this one difficult to solve?
  – Current solutions: what are the limitations of current solutions and motivate the proposed one?
  – New idea & technique of the solution: why is the solution different?
  – Performance summary: how good is the solution based on the experimental/analytical evaluation?
  – Main contributions of the paper (optional): simple recap and main points for the reader to carry home
  – Structure of the paper: what each of the remaining sections in the paper talks about
Background

• Provide brief intro. to people not working in the area
  – State from the standpoint of the problem, NOT general tutorial about the area
  – No copy from the literature (or even your previous writeup)

• Models used

• Assumptions made
  – Every paper makes assumptions, it is fine
  – Try to explain why the assumptions are not strong, give cases why the assumptions are realistic in practice
  – Spell out the issues not addressed in the paper, which are out of the scope of the work
    • No one expects a paper to solve all the problems
Design

• Provide a brief overview of the solution at the beginning
  – Key ideas or principles
• For each component of the solution, clearly elaborate
  – What the issues/challenges to address?
  – How the solution component works?
  – Why choose such a solution approach?
  – There are many ways to address the same issue, why this one?
    Provides cons and pros for this one

• Novelty, novelty, novelty!
  – Explain why the solution is different, not necessarily better
  – Tell readers why it is different from the related work in brief terms when describing each component of the solution
Implementation

Required for a system work

• What are the challenges for the implementation of the design, if any exists?

• How does it address each challenge in the implementation?

• What are the software/hardware platforms for the implementation?

• Complexity of the implementation?
  – E.g., lines of codes
  – Hacking tricks
  – Does it work with other existing software/hardware platforms?
  – If not, is it easy to export it to these platforms?
Evaluation

• To show quantitatively how good the solution is
  – Corresponding to the design
• Describe the testing scenarios
  – What devices used, the supporting environment, etc.
• Describe the analytical results
  – Spell out the assumptions and conditions for the analysis
  – explain figures, tables, bar charts, etc.
    • Tell the readers the % improvement, the gains etc. Do not expect the readers to get such numbers by themselves from the figures, etc.
• Share the insights why the solution provides better results
• For those results worse than the existing solutions, explain why they are so
  – It is okay to share negative results, as long as they are explained why; provide some justification if possible
• Micro-benchmark vs. system evaluation
  – Evaluation for single design component
• (optional) a short summary of the performance results
  – The main items for the readers to take home
Discussion (optional)

• This section basically serves as the storage room for the work

• If there are messy issues, state here
  – Not in the design section, which may distract the readers from your main idea

• If there are straightforward extensions of the solution, state here

• If there are unaddressed, but important issues, discuss here
  – They are basically the loopholes of the work, argue them here

• If there are suggestions/improvements to the current solutions, state here
  – These are items that authors do not have time to evaluate and test out
Related Work

• Main point to make: the work is significantly different from all the existing solutions!
  – Not necessarily better
  – It is not incremental, which extends the existing ones a little bit

• Novelty of the problem: one of the following
  – formulated a NEW problem in this paper!
  – identified NEW issues to an existing problem

• Novelty of the solution
  – The idea explored in this paper is completely different from all others in the literature
  – used new techniques borrowed from other areas or fields
    • No one has done so, I’m the first one

• Novelty of the evaluation
  – used new analysis/experimental methods that no one has used before

• Stay at the level as high as possible: the contribution is major, not minor improvements (no need to comment on the detailed level)
  – Do not discuss the novelty of each component of the solution, only the main idea of the solution
    • Component novelty is described in the design section already, not here
Conclusion

• Brief recap of the problem solved, and the solution proposed in this paper
• Articulate the importance of the solution
  – Is it applicable to other areas or problems?
  – Does it explore new design principles/philosophies that offer new ways to solve many other problems?
• Share insights gained and lessons learned
  – What are the new positive insights gained?
    • E.g., certain ideas really work
  – What are the negative lessons learned?
    • E.g., complex solutions give only marginal improvement
    • E.g., certain ideas proposed in the literature do not work at all in the tested scenarios
• Ongoing/future work (optional)
  – One or two sentences are enough
  – Not too much, otherwise, the paper sounds work-in-progress that reviewers can reject easily!
Alternative structure

• Sometimes, the related work section can appear as the 2nd section right after the introduction section
  – When to use it? The work builds significantly on the existing ones
  – merge the background with the related work in a single section
    • Provide the tutorial to your design section
  – Downside of this layout: this may make the paper sound incremental, and the novelty is limited