Advice on Drafts for Research Students

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Title: Does the title of cover the key aspects. Make sure you are not over representing your work e.g. "Algorithm for optimization" or "Algorithm for constrained optimization" or "Evolutionary algorithm for constrained optimization?"

- Check the case of the title: "Algorithm for Constrained Optimization" or "Algorithm for constrained optimization" but not "Algorithm for Constrained optimization". Refer to the actual papers in the targeted publication to select the appropriate one.

"**Catchy title versus not a Catchy one**": As for papers, my suggestion would be to leave that one out till you are considered a leading researcher in the field. You can still use them for presentations to attract attention (3MT, Research day etc).

Author List: Check they are consistent. You cannot use "Hemant K Singh and T. Ray" but "Hemant Kumar Singh and Tapabrata Ray" or "H.K. Singh and T. Ray" is fine. Do not use titles such as Prof. Dr. etc before the names. Make sure the information is consistent i.e. if you use emails for one, you should provide that for all.

Abstract: Convey the information highlighting what is it about, what is unique, what you went about comparing with and what it can lead to. Do not use references such as "this is an improvement beyond [4]".

Structure of the draft: Spend significant time thinking about the structure. It is extremely important that you have a coherent view and take the reader through things in a structured manner. Typically, you would have a section as "Introduction:" i.e introducing what is the problem and why it is important, leading into what has been done so far. This leads to the next section, which could be "Background" where you discuss existing methods. It is sort of literature review, but with a purpose. Your intention is to write maybe two lines conveying what and how they went about and highlight what is still a problem with that approach, which in turn drives the reader towards what you went about doing i.e. your contribution.

Literature Review: Literature review is a very important aspect of research, which should be done in a comprehensive manner. Use SCOPUS or appropriate repositories with keywords to identify documents. If you really want to go all out, indicate a search using these keywords led to 5690 documents of which 327 documents were relevant. Once again, in literature review, make sure you have structure and its not a random list of previous work in any order. You should discuss "methods for unconstrained optimization" first before "methods for constrained optimization" It is also important to think why it is this order and not the other way around. Again in "unconstrained optimization", methods based on "mathematical programming" should go first and then "heuristics" and not the other way around. You should construct a tree in your mind or paper to get the structure right. Many of you would read lot of papers as a part of literature review but at the end completely lost when you start writing. An easy way would be to create a spreadsheet and attempt to list column titles and capture information from the papers as you go along. Say a column title as "Underlying method:" could have mathematical programming, evolutionary algorithm etc. Another column

title as, "Number of variables: could list 5, 10 or more than 10 or yet another column could be "Dealt with constraints:" yes no" etc listed against each paper that you encountered in literature review. This is extremely valuable and will help you to write the literature review in a structured manner. In reality, the number of columns could also grow and you may need to get back to earlier papers to fill in information corresponding to those. This is the case when you realize that some important aspect needs to be captured but you did not think about it until you read this paper.

An important element of literature review is to identify the research gaps. You should be driving the reader towards why what you are attempting to do i.e. you are indicating that you are plugging in some gaps. Once you have listed the gaps, its important to convey what gaps you are attempting to address in your research. Usually before you move on to the next section i.e. proposed approach, you can use the last paragraph in Background to list how you attempt to alleviate some gaps (say 5 lines). This would set the scene for what to expect in your proposed approach section.

Interlinked with literature review is means of citation. Please make sure the references are captured properly i.e. complete with page numbers, volume numbers, authors and titles. Make sure the journal titles follow proper case format i.e. "Journal of global optimization" and "Engineering Optimization" cannot appear in your reference list, its either one of them. It has to be in a consistent format. Once again authors as "Singh, H.K" and "Hemant, Kumar Singh" cannot exist together. Pay attention to the format style of the publication template. Often citations picked up from the web have missing and inconsistent information. It is your responsibility to fix those.

Proposed Approach: When you write your proposed approach its important that you link if you have drawn something from somewhere. Since you will be reading and referring to multiple literature sources, make sure you adopt a consistent terminology. Do not mix terminologies such as "Kriging" and "Gaussian Process Model". While they are the same, you should use one consistently. Again all variables should be defined immediately after they appear in an equation. Take note of mathematical symbols and use appropriate symbols for vectors, scalars etc etc. Make sure you are not using the same symbol and defined it twice as different things. Nothing should be left to the imagination of the reader, all variables, and parameters to be completely defined. Just because you have taken some formulation from a paper, does not mean its right. Its your responsibility to ensure that it makes sense and is correct.

Pseudo code Some people are good with pseudo codes which some can follow verbose statements. In pseudo code, use mathematical symbols with minimum verbose or text. You can have some text in the paragraphs following the pseudo code to convey the above but be precise and limited. Again refrain from writing one page pseudo code. Use components and provide pseudo code of the components whereas the main algorithm could say "Select A using Algo 2.1" and Algo 2.1 is the pseudo code of the selection scheme. Break it in bits. Make sure you use consistent terms e.g. If the main algorithm says "Select A using Selection Scheme" I would expect to see a pseudo code of "Selection Scheme" not "Selection" and not "Selection scheme". Proper association and use of keywords is extremely important to ensure the reader is not lost.

Results: List all the parameters that were used in your experiments. Clearly indicate the termination condition and metrics of comparison. The "results of the proposed approach is better than algorithm A" does not mean anything. Is it the accuracy is better or is it better in the computational time? Again is it better based on the mean, median or standard deviation? It is also true that it is better based on the mean accuracy for all the problems studied in this paper. Be extremely careful, not claim more than what your

results or experiments reflect. Once again think how to best present the results, Tables or Graphs. There is no need to convey the same information in both forms. Everything that you have in the paper should have a purpose. Do not list 10 Tables without discussing what is it that you want the reader to take note from them.

Summary/Conclusions/Future Work You should summarize what you achieved and what can be possibly done in the future. In my opinion, it would be worthwhile to think what are the limitations of your approach and state it too and build future work from there. There are instances where one could have a separate section on "Limitations". It by no means convey the wrong impression. It conveys that you recognize that its still not perfect and future work should be focused on addressing these.

Figures/Tables Please pay extreme attention to the level of accuracy. You should not have "2.0043" and "4.08" in the same column. Again use of such values consistently across all Tables in the paper. You may opt to align Tables landscape or portrait to convey the information in the best possible way. You may use smaller fonts (make sure its legible) in Tables. You may use bold for certain values to highlight or draw immediate attention. Say the best results are in bold.

Figure captions, labels, axis and legends to have consistent formats. All figure captions, axis labels, and legends to have the same size of fonts. When using colors think if it is necessary. Use symbols, line types appropriately and consistently. If you associate results of your algorithm in red in a plot, I would expect to see red as a color associated with your results. It should not appear blue in another plot. Think about reducing clutter, maybe use insets or plot in log scale to show information. You have taken the time and effort to generate them, it is equally important to convey them appropriately.