Technical Writing and Oral Presentations

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This document provides advice on technical writing, and on giving oral presentations. Good communication skills are essential for success in your career. Every time you write or present, you have the opportunity to work on improving these skills. The advice I give below is applicable to presentations of any length, ranging from a single paragraph to a long report or thesis.

Start with a Specification

Technical writing is a complex skill, one that can be developed and improved over many years. Computer programming is the same: it takes a lot of experience to go from "first learning how to program" to being a good software designer.

In computer programming, it is good practice to start with a *specification*, a clear description of what the program is supposed to do. The same is true with technical writing and oral presentations. Write down a specification for your presentation.

- Describe the audience: for example "graduate students in the School of Computing", or "readers of journal X" or "attendees at conference Y". Describe the technical background that you expect the audience to have. The easiest situation for a presenter is when everyone has the same background. In more complex cases, the audience is mixed: some audience members know this, others know that, some are interested in this, some are more interested in that. Make a list of the concepts that you assume the audience is already familiar with, and a list of the concepts you have to introduce/explain in your writing.

- Describe the main points to convey in the paper/presentation. The following general questions should always be answered in any technical presentation. What area of research are you discussing? (What is the general topic of your talk?) Why should anyone care about this area of research? Provide motivation.

Once you have written the specification, you can plan your presentation (oral or written). What extra topics do you have to include, in order to be able to present the main points, given the audience background? Find a good order for presenting the topics. This is often difficult because topics are circular: it would be good to for the audience to know about B when I explain A, but the opposite is also true: knowledge of A would help when I explain B.

When you are done, review your presentation, compare it to the specification. For a written report, make sure that your first paragraph touches on all the main topics, that the rest of the paper elaborates on those, and that the whole thing is readable for your "model audience". Similarly, for an oral presentation, make sure that in your first few minutes you introduce the main topics, and that you then elaborate on these, in a way that is understandable for your model audience.

Advice for writing

Focus on writing a great first paragraph, and a great first sentence for all the other paragraphs. Use the first sentence of each paragraph to state the topic for that paragraph. Put extra effort into making the very first sentence of the document be informative and interesting. Aim to make your paper *skimmable* so that a hasty reader gets the main points. These comments particularly apply to the writing of the abstract and introduction for a thesis or conference paper. Such overview sections are often the weakest part of a document because authors write them last, when they are in a hurry. However, the abstract, introduction, figures, and conclusion are the most important part of a document: they are critical to the perception the reader will have of your work. Abstracts are commonly used as stand-alone pieces of text to represent your thesis or technical paper. Write them carefully. Writing a good abstract takes a lot of time. Show drafts of your abstract to a lot of different people, to get feedback. The abstract should be comprehensible to a non-expert, and should make a good impression on an expert in the area.

The following paragraphs provide advice about writing a one-page paper summary, but much of the advice is applicable to longer documents as well.

Do not use section headings in your one-page paper summary. In a document this short, section headings just cause distracting breaks in the flow of the text.

Motivate the topic, briefly convey what this paper is about, what problems it addresses, how it fits into the larger context of pattern-recognition research. Specifics depend on the paper and your reaction to it. Suppose you find the paper excellent and informative. Then you want to convey (an overview of) what you learned from it, why you found it interesting and worthwhile. Your goal in this case would be to transmit enthusiasm: after reading your summary I would know roughly what the paper is about, and why it's important, and I would be motivated to read the full paper for further details. Suppose, on the other hand, that you find the paper rather disappointing. Then your summary should convey what the general research area and general approach are, and discuss the shortcomings. This is valuable information for the reader. Depending on the paper, you might convey that "this is a promising research area, but this particular paper is poor, and (if you happen to know) a better alternative is paper X". Or you might write that "not only is this particular paper flawed, but the whole research area is fundamentally flawed because Y". Such "negative results" can be very useful, and may well suggest fruitful areas for future research.

You do not have room to discuss details of the paper. Instead, provide context, critique, analysis, and overview. If you do a good job in convincing the reader of the importance of the material, then the full details are available in the original paper. Think of yourself as an author for an Abstracts journal, which is devoted to publishing critical summaries of papers. You can refer to the journal *Computing Reviews* for examples; visit www.reviews.com. Readers use a journal like this to scan the entries, quickly becoming up to date (in a general sense) on a large variety of topics, and with the ability to find detailed information on selected topics. There are many styles of writing reviews -- read a few reviews and decide what style suits you best. Make sure that you don't attempt to include too many technical details in your review. Your job is to convey what is in the paper, without going into a lot of technical detail.

If you find the one-page limit confining, start by writing only half a page, or only three sentences. This forces you to state the most important ideas concisely. Then expand to the luxury of a whole page. The ability to write convincing summaries (for grant proposals, paper abstracts, theses, etc.) is essential in academic work. Writing a good summary is hard; the shorter the summary is, the more difficult it becomes.

Provide your own perspective on the paper, not just a summary. What are the strong and weak points of this paper? Why did you find the paper interesting? (If you didn't find anything in the paper interesting, then choose another paper!) To evaluate a paper, try to judge whether the work is theoretically sound, whether it is practical, whether it has been tested sufficiently, how it compares to competing approaches, whether you can devise improved or alternate approaches. Even if you feel underqualified to judge the research content of a paper, you should be able to form some opinions, and justify those opinions.

Advice for the oral presentation

Be enthusiastic: choose a paper that you find interesting, and project this interest and enthusiasm to the audience. You don't have to force yourself to show noisy cheerleader type enthusiasm; quiet enthusiasm will do.

Identify two to four main ideas that you want to get across in the talk. These are the points the audience should remember even after details have been forgotten.

Focus on presenting the contents of the paper, not the structure of the paper. In particular, avoid organizing your talk or your written summary as follows:

> "The paper I am summarizing is titled AAA. In the introduction, the authors state BBB. In section 2 the authors provide a literature review, stating CCC. Then in section 3 the authors introduce their approach DDD. In section 4..."

This type of organization puts an unnecessary and distracting amount of emphasis on the structure of the paper. To get away from this: read the paper, decide on the main points you want to convey, and then organize your presentation to convey those points. For example, you might want to start by showing the results that the authors obtain, even if those results were placed at the end of the paper written by those authors.

Don't show too many details. For example, there is no use showing us a big table of results, full of information about "this method gets 72.4% correct and that method gets 69.1% correct": the audience does not have time or motivation to understand all these details. Most likely, audience members aren't even fully clear about the differences between the methods being compared in this table. Instead, focus on presenting the gist of the various

methods, and summarize the results in words (for example, "method A generally outperformed method B in the tests done by the authors"). Of course it is fine to show a few sample values for "percent correct", but avoid showing a big table full of numbers. Be sure to provide information on "how many classes are there" and also information about the test set (how many test cases, what types of noise, real data or synthetic data etc).

Don't present a lot of equations. Don't define a lot of symbols on one slide, expecting that the audience members will remember this notation while viewing the following slides. This simply does not work. The audience members will feel lost because they don't know what the symbols mean. Keep in mind that audience members frequently "space out", briefly thinking about unrelated things such as "Gosh, I have to remember to buy potatoes later today". After spacing out, the audience member should be able to rejoin the thread of your presentation. So make each of your slides as self-contained as possible. Limit your use of acronyms and symbols, and where possible include the definitions of acronyms and symbols on every slide that uses them.

Don't try to present all the details of a complicated method -- there isn't time. Instead, provide a brief overview: "The authors solve this problem using the following 8 steps [list of steps, with a short phrase describing each one, ideally include images to illustrate]. In my talk I am going to focus on steps 2 and 5 because [I found those most interesting... or whatever reason]".

Provide sufficient introduction. Suppose your paper is presenting method A to solve problem B; don't feel constrained that your talk must focus exclusively on method A. Instead, introduce problem B in general: what is the problem, why are people interested in solving this problem, what is difficult about solving this problem. Then you could state (if you have this information) "There are five general approaches to solving this problem [a list with a short phrase describing each approach -- ideally include images to illustrate]. Now I will describe method A, which falls into the second category." Then at the end of your talk you can recap about how method A compares to the other four categories of approaches -- advantages and drawbacks of method A.