Guidelines for your research paper/thesis

Jan van Gemert,
j.c.vangemert@tudelft.nl

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The goal of this document is to give structure to writing. Here I give my personal guidelines about the structure and form of your research paper or thesis as I expect it. Benefit for you: many of my comments will be avoided by following these guidelines. The document ends with some examples and further reading.

General	**Intro**	**Related**	**Method**	**Exp**	**Discuss**
G1 Unburden reader	I1 Motivate	R1 Method subject	M1 No arguments	E1 Exp aswers Q	D1 Summary
G2 Widow/Orphan	I2 1st sentence	R2 Par topic	M2 No datasets	E2 Group exps	D2 Limitations
G3 Less is more	I3 3 contribs	R3 Par layout	M3 Number eqs	E3 Analyze modular	
G4 Very	I4 Fig 1		M4 Eqs are text	E4 Types of exps	
G5 Discussed before	I5 Few research		M5 Explain symbols	E5 0-1 scores	
G6 In order to			M6 Eqs in words	E6 Proved	
G7 Sort citations			M7 Read w.o. Eqs	E7 One more	
G8 Self-contained			M8 Relevant defines		
G9 Consistent					
G10 No guessing					
G11 Single topic par					
G12 Relations of par					
G13 Reference words					
G14 No ref across par					
G15 Write = code					
G16 Captions					
G17 Figs are complete					
G18 Read it loud					
G19 Audience					
G20 Space					
G21 (brackets)					

General writing tips

G1. Unburden the reader. If a reader misinterprets the text it is the fault of the writer. Its the writer's responsibility to reduce the reading effort. Prof Freeman: *The most dangerous mistake you can make when writing your paper is assuming that the reviewer will understand the point of your paper.*

G2. Widows and Orphans. Avoid ending a paragraph with a single word on a new line. Avoid ending a paragraph with a single line on a new page.

G3. Less is more. Every word should have a reason to exist. To quote Blaise Pascal: *"I would have written a shorter letter, but I did not have the time."*. Writing concisely takes time and effort; it enhances readability.

G4. Very. Do not use "very". It is supposed to emphasize, yet, it does the opposite. See also: `https://www.proofreadingservices.com/pages/very`

G5. As discussed before, as motivated in section XXX, as will be described in XXX Do not use this, it has no function.

G6. In order to. Can almost always be replaced with 'To'.

G7. Sort citations. If using numerical citation, make sure not to cite it as [7,2,5], but sort them like [2,5,7].

G8. Self-contained. The reader has not memorized the full text. Remind the reader of definitions or symbols when defined 'a long time ago'.

G9. Consistent. Use a defined symbol consistently and uniquely.

G10. No guessing. Never expect a reader to do inference. If the reader has to guess, the guess will often be not what you had in mind. Always explicitly write what the reader is supposed to see/conclude.

G11. A single paragraph, has only one single topic. A paragraph has an intro sentence to define the topic. Each sentence logically follows the previous sentence. It has a concluding sentence that concludes the topic.

G12. Relation between paragraphs. Paragraph topics follow a logical order. It is helpful to start with a skeleton of topics and keywords.

G13. Reference words. Reference words such as 'this', 'it', 'that', 'there' are often confusing. Instead of referring, explicitly repeat what 'it' refers to (For example, 'it' should have been replaced with 'the reference word').

G14. Do not use reference words across paragraphs. For example, do not start a paragraph with 'however'. It is unclear to what you refer to.

G15. Writing is like coding. Like good code, a paragraph is modular and self-contained. Do text refactoring just as you would do code refactoring. Good code is not written in one go, neither is text. Like code, you start with a draft structure, and restructure several times.

G16. Captions in figure/table. Figures and tables should be self-contained. A reader often starts an article in 'comic book' mode: first look at all the pictures. The caption should explain everything to understand the figure/table. Always end with a conclusion: what do you want the reader to see.

G17. Figures are complete. Label all axis, show the units on the axis, use a legend with clear differences between entries and add a title to each (sub)figure. Do not label sub-figures (a), (b) and explain what (a) and (b) are in the caption: instead label each sub-figure with a title. Do not use too thin lines or too small of a font.

G18. Read out loud. After some time, you will no longer be able to read your own text. Instead, you will read what you meant; not what you wrote. Tip: read your own writing out loud.

G19. Audience. Who are you writing for? What is their background and what are they looking for? Help your audience find it.

G20. Important topics take more space. The more important or relevant something is to your paper, the more space it takes. If it is not so important don't write too long about it.

G21. (brackets). Avoid brackets. If its not important remove it; yet, if it is important, then it should not be in brackets.

Section 1: Introduction

I1. Motivation and scope. The intro starts with a just broad enough motivation, then narrows the scope smaller, and smaller, culminating to exactly your research topic.

I2. No generic first sentence. The fist sentence should focus your audience. Don't use a sentence that can be added to any other paper in your field.

I3. 3 contributions. Rule of thumb: your paper has 3 contributions. A contribution is something that a peer researcher will find interesting. End the introduction by explicitly stating your contributions.

I4. Figure 1. Make a visual abstract of the paper in Figure 1. Best if this is the main idea, but it can also be a pipeline figure.

I5. Few research. Just because a topic has seen little research is not a good motivation (For example: my right thumb has not been researched at all, but its still uninteresting.). Don't motivate by what others have not done (related work), instead: motivate what is interesting about your research.

Section 2: Related work.

R1. The subject is the method, not the paper. Do not write: *The important work of [a] does X which is followed by the work of [b] that does Y.* It has papers as the subject. Instead, make the method the subject and add citations to the method: *X [a] is important, and extended by Y [b].*

R2. Paragraph topic. One paragraph is grouped around a single topic. Related papers often have multiple topics. It is up to you to group related work as best for you. Rule of thumb: Each paragraph has 3-10 citations.

R3. Paragraph layout. The first sentence defines the scope. Then, per next sentence, you group papers based on what they do. The final, concluding, sentence is how are these methods *related* to your method. You have two options: option 1. *All so great, we make use of it.* Option 2. *All is great, but we do something different because ...*

Section 3: Method

M1. No general argumentation. The method should only motivate and explain the technical method. All argumentation for the main idea should be in section 1 or section 2.

M2. No datasets. Datasets and their description belong in the experiments. Only a toy problem is allowed in this section if it helps to explain the method. The method section only explains the technical part of the method.

M3. Number all equations. Maybe you do not refer to them, but others (reviewers, readers) may want to. Only if the equation is very simple, it is OK to have it in the flow of the text without a number.

M4. Treat equations as normal text. If an equation ends the sentence, the equations ends with a period. If the sentence continues, use a comma after the equation.

M5. Explain all symbols. Directly before, or directly after introducing an equation **all** symbols should be explained. A formula should be self-contained: the reader should be able to understand it without searching for symbol definitions elsewhere.

M6. Explain equation in words. Directly before giving an equation, first explain why and what you aim to achieve in English. This makes the following equation easier to follow.

M7. Should be understandable without equations. The method should be understandable without reading the equations. Motivate and describe in English what is happening, the equations make the words exact.

M8. Only define the relevant. Do not define everything you can think of, only define things you will actually use. Best to first write the results, and later define only what is needed to obtain these results.

Section 4: Experiments

E1. Answer a question. Every experiment starts with a question. Explicitly write this question. The experiment should answer that question.

E2. Group an experiment together. Make use of sub-sections or bold-words, to help the reader understand the structure of the section. Each experiment is grouped in a module. Give each experimental question a number: "Experiment 1: How X applies to Y".

E3. Analyze results modular. Every experiment has its own tables/figures for the results. Do not mix experiments by grouping all results in a single huge table. Group results together that you want to compare together, and yes, that may mean you may have to repeat values in multiple tables/figs.

E4. Types of experiments. Broadly speaking there are three types of experiments. 1: *Validate*: does it do what you claim it does, (toy-sets?). 2: *Investigate*: what unique properties does your method have. 3: *Compare*: how does it compare to others. Present them in that order.

E5. Scale scores between 0 and 1. Avoid useless zeros, scales 0-1 scores to 0-100. E.g.: '0.07' becomes '7'.

E6. Proved. Experiments do not prove. A proof is derived in math, experiments demonstrate empirically.

E7. One more. When you think you are done, add one more experiment to show relevance for a different domain. In the following example, the story is complete after section 4.4.1, yet one more experiment drives it home, see: `https://richzhang.github.io/antialiased-cnns/`

Section 5: Discussion

D1. Summary. Small summary of what you did to highlight the context.

D2. Limitations. No method will always be the best. Showing insight where it fails is strong. The goal of research is understanding.

To conclude

Example. Here is an example of one of my own papers. I am not saying this is perfectly written, but I try to adhere to my own rules. Your task: analyze the structure of the paper and spot inconsistencies between the guidelines and the following paper:
`http://jvgemert.github.io/pub/huijserICCV17ActiveBoundAnnoGAN.pdf`

Scientific writing. Read "The science of Scientific writing": `https://cseweb.ucsd.edu/~swanson/papers/science-of-writing.pdf`. Read it before you start writing. After you wrote your first draft, read it again, and use it to analyze your draft.

Research paper writing. Prof. Bill Freeman has insights and links:
`https://billf.mit.edu/sites/default/files/documents/cvprPapers.pdf`

Peer review. Find a peer to review each other's texts. Check if their manuscript follows these guidelines. Keep in mind that if an honest reader did not understand it, it is the mistake of the writer.