Research organization guidelines

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Full Research Guidelines are:
`https://jvgemert.github.io/ResearchGuidelinesInDL.pdf`

1 Research Organization, Research Process, and Research Mentality

Doing research often assumes a certain mindset, process and organization. This holds for the individual researcher, but also for an advisor. Here, I make such assumptions explicit.

Organization	Process	Mentality
RO1 Full responsibility	RP1 One main Q	RM1 Be critical
RO2 No dependencies	RP2 Min. 3rd party	RM2 Find todos together
RO3 Meet advisor	RP3 Validate baselines	RM3 Consistency
RO4 Focus advisor	RP4 First break it	RM4 Question everything
RO5 Take critique	RP5 Depth first	RM5 Simple is strong
RO6 Constructive disagree	RP6 Exps answer Q	RM6 Embrace limitations
RO7 Analyze results	RP7 Proof of concept	RM7 Write early and often
RO8 Suggest solutions	RP8 Exps max 1 night	RM8 Not eureka
RO9 Give feedback	RP9 Change 1 var	RM9 Show the problem
RO10 Safety	RP10 Debug science	RM10 Motivate everything
	RP11 Figures	

1.1 Research Organization

RO1: Take full responsibility. This is your project. Not your adviser's. You are in charge of everything, including: planning, progress, direction, meeting topics, bureaucratic formalities, etc. You are not alone: your adviser is there to help you as best as possible, yet the final responsibility remains yours.

RO2: No dependencies. Avoid dependencies on third parties. Such parties intend well, yet reality is often different from intentions. Do not become the victim of this and make sure you have full control. E.g.: Promised data, labels, experts, constraints, or other agreements have to be there *before* you start.

RO3: Meet your adviser. Try to see your adviser at least once every 2 weeks; once per week is better.

RO4: Focus your adviser. Meeting time is limited. Avoid needless chronological updates (no need for "proof of work"). Discuss problems, choices, dilemmas and directions. It is your responsibility to choose to discuss what benefits *you* most.

RO5: Do not take criticism personal. All feedback is meant to improve and benefit you. Do not fight the feedback, even if you think it is wrong: Make a note, and think about why your advisor gave this feedback.

RO6: Constructive disagree. It's OK to disagree with a suggestion of your adviser, but if you repeatedly do this then also try to propose something yourself.

RO7: Analyze results. When presenting (intermediate) results, give an interpretation and conclusions (ie: answer the "So what?" question).

RO8: Suggest solutions. When encountering research or organizational problems; suggest a solution yourself.

RO9: Give feedback to your advisor If you are unhappy about something (eg: how feedback is given, how meetings go, meeting time; etc.) then please let your advisor know this. Your advisor cannot read your mind, and is there to help you, give your advisor the opportunity to help you best.

RO10: Safe environment   Meetings and the advisor-advisee relationship should be safe and based on mutual respect. If you do not feel safe, contact a (confidential) counselor at your organization, your advisor's advisor, and speak out to friends/peers. It is your advisor that needs to change.

1.2   The research process

RP1: Only one main research question / problem statement.   It may change over time but explicitly pursue a single topic: Write it down to make it precise; this gives focus and direction.

RP2: Minimal effort for 3rd party building blocks.   If you build on top of existing work (e.g. an optimizer, object detector, pose estimator, etc.) start with the *least effort* approach to obtain this building block. It should not matter which building block you take, so start with the easiest available implementation. If you work modularity, you can always add another one later.

RP3: Validate published work.   It is not obvious that a published work generalizes to your problem. There may be subtleties: Validate this.

RP4: Prioritize idea breaking.   Start by investigating the greatest risk to your main research question. Do not invest heavily on the foundations, only to find out months later that the main idea did not work.

RP5: Depth-first instead of breadth-first.   Do not explore sub-topics too deep. Identify the minimum requirement per sub-topics and get to this minimum as soon as possible. Try to get ASAP to a first full version to validate your idea. More baselines/variants/datasets can always be done later.

RP6: Experiments answer a single question.   Write down before you do an experiment what your expected answer to the question is. Validate.

RP7: Show proof of concept. Start with a fully controlled (possibly toy) dataset of 'the simplest case possible' which should only vary in the relevant manner. Its goal is to validate that the problem occurs and/or that your model can solve it.

RP8: Experiments take max 1 night. If it takes 1 week, then 10 runs take 2.5 months. Minimize experimental time so you can answer more questions, especially in the beginning; leave larger experiments for the end.

RP9: Change only one variable. If more than one variable is changed, it is not possible to determine the cause of an effect.

RP10: Debug your scientific ideas and your code. Test ideas and test code every time you make a change. Start with the assumption you made a mistake somewhere, gather independent proof that it is correct.

RP11: Figures. Try to script all graphs/figures that you create. Yes: All. Your adviser may ask for a completely different version of a figure, and automating it prevents lots of manual re-doing. I prefer Matplotlib; it can output high-quality PDF figures and graphs that can directly be included in pdflatex.

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1.3 Research mentality

RM1: The critical reviewer. Often switch roles to a savage reviewer (Mr Hyde) who is looking for any excuse to say: *'I do not believe X; Reject.'* Try to identify X yourself and think about which evidence argues for X.

RM2: Your supervisor does not have the answer. We are doing research. By definition, this research has not been done before. Thus, it is impossible for your supervisor to give you a list of ToDos: We'll find them together.

RM3: Be consistent. Assumptions you make in one part of your research should not suddenly change in another part.

RM4: Question everything. Take a step back, and think about what you are really doing. Does the story logically make sense? Try to see the things you take for granted: Is everything justified?

RM5: Simple is strong. Simple is more powerful than complex. Explain the core of your topic to a smart layperson (your mother?) without using math/jargon. If you cannot explain it, it is probably too complex.

RM6: Limitations. Identify the limitations of your method. No method will always be the best. Showing insight where it fails is strong. The goal of research is understanding.

RM7: Write early and often. Writing helps to make thoughts concrete and it is the interface to your work. Writing always takes longer than you think, even if you know that it takes longer than you think. Writing is iterative; don't try to write the perfect text: write a sloppy draft, and iterate.

RM8: Not "Eureka" But "That's funny". (by Asimov) is the most exciting phrase in research. It often becomes most interesting when expectations break.

RM9: Show that the problem exists. Going directly after improvements is risky: if it doesn't work, all is gone. Before proposing a solution/improvement: first demonstrate/validate which problem is solved by it. Demonstrating the problem is valuable in its own right. To demonstrate the problem you are free to choose the setting; a self-constructed fully controlled (toy) dataset is often ideal. Make sure to validate that a proposed solution does well on this fully controlled setting.

RM10: Motivate everything. Novelty is easy: each component can blindly be replaced by another. Always question: *why?*. Each choice needs to be motivated with a reason. Is it commonly done? Then give citations. Is it interesting? Then motivate why. Is it 'obvious' or speculative? Then empirically validate it as an hypothesis. (Hitchens's razor: "*What can be asserted without evidence can also be dismissed without evidence*")