Six Steps to a Successful Research Program

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Thanks to Chris Brooks and Marie desJardins for most of the slides.
1. Set a Research Agenda

- How do you figure out what to work on?
- Try to have several interesting ideas percolating.
- Keep your eyes open for new opportunities.
- Think at various timescales.
  - Weeks, months, year(s)
- Collaborate!
Setting A Research Agenda

- Your thesis is not the pinnacle of your career.
- Magnum Opus vs. Driver’s License

- Find ideas from funding announcements (e.g., http://fbo.gov), calls for papers.

- Research is more about hard work than about brilliance.
2. Get Funding

* **Question 1:** Do you need funding? If so, how much?
  * This will depend on your job and career objective.

* **Government Agencies:** NSF, DARPA, NIH, DOE
  * Larger $$, higher bar

* **Foundations, industry grants**
  * Smaller $$, lower requirements, need to find a good fit.

* **Internal funding**
  * Small $$, good for starting out.
Getting Funding

- Watch for proposals that are a good fit for what you are doing.
- Don’t apply just to “give it a shot”
- Talk to program officers or foundation directors first.
- Have some preliminary results.
- Some programs seek “mature technology.”
  - Technology Readiness Levels (TRLs)
3. Manage Your Time Wisely

- The biggest change between grad school and “the real world” is the number of obligations on your time.

- Developing good time management skills now will make things much easier.
Time Management

- Keep a calendar and list of to-do tasks.
- Schedule time for research.
- Eliminate distractions, inefficiencies, opportunities for procrastination
  - Beware e-mail, texting, web browsing.
  - Phone conversations can be your friend.
  - Beware time vampires.
- Have tasks at various levels of complexity to fill time gaps.
- Do the important things not just the urgent things.
- Learn when to say no, and when to say yes.
- Delegate!
- “Perfect is the enemy of good.” - Voltaire (loose translation)
- Estimate and measure the time to perform a task.
- Ask friends what they do.
- Sleep!!!
4. Engage the Research Community

* Who cares what you do if no one knows about it?

* You’ll need to present your ideas in various forms and venues:
  * PEOPLE: Networking with colleagues at your institution and elsewhere
  * PAPERS: Writing and submitting papers to workshops, conferences, and journals
  * PRESENTATIONS: Giving talks at workshops, conferences, and other institutions

* Put together a website that highlights your interests and research activities.
Networking

- A primary purpose of conferences is meeting people.
- Find collaborators, get new research ideas, get feedback, discover funding and publishing opportunities, make friends.

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Networking

- It’s OK to introduce yourself to strangers!
- Everyone likes to talk about their work.
- Don’t dominate the conversation.
- Have topics/questions prepared in advance.
- Know when to end the conversation.
Be Prepared

* You should have 1 minute, 5 minute, and 15 minute versions of your research prepared.
  * For different audiences.

* The same goes for other projects you’ve been working on.

* Be able to distinguish between your original contributions, your advisor’s contributions, and ideas drawn from previous research.

* Practice with other students!
Community Service & Visibility

* Organize something.
  * workshop
  * panel
  * tutorial

* Get co-organizers.

* Invite people to give talks at your institution.

* Be a good reviewer.
5. Publish Good Papers

- For a master’s thesis, you should aim to have at least one “good” conference paper by the time you graduate.

- For a doctoral dissertation, you should aim for a couple of good conference papers and a journal paper.

- Writing these papers is great practice for the thesis itself... (and you can reuse the material!)
Venues

- Workshops, symposia, conferences and journals.
- Where to submit?
  - Look at others’ publications.
  - Where are the interesting papers?
    - (not just the best location!)
Paper Writing Strategies

First, decide where you plan to submit the paper
- Having a deadline is always helpful
- Two to four months away is a good planning horizon

Next, decide what you will say
- What are the key ideas? Have you developed them yet?
- What are the key results? Have you designed and run the experiments yet? Have you analyzed the data?
- What is the key related work? Have you read the relevant background material? Can you give a good summary of it?

LPUs
On Writing

- **Write early and often**: You can (and should) write in parallel with finishing the work!
- Writing will help you crystallize your ideas.

- Keep a journal/notebook/folder/blog where you document your progress. Get in the habit of writing about results as you produce them.
Paper Design

* Abstract - summarizes the research contributions, not the paper (i.e., it shouldn’t be an outline of the paper)

* Introduction/motivation - **what you’ve done** and **why the reader should care**, plus an outline of the paper

* Technical sections - one or more sections summarizing the research ideas you’ve developed

* Experiments/results/analysis - one or more sections presenting experimental results and/or supporting proofs

* Future work - summary of where you’re headed next and open questions still to be answered

* Related work - usually in or after introduction, sometimes after conclusion.

* Conclusions - reminder of **what you’ve said** and **why it’s important**
Paper Design

* Writing a paper is like building software.
* Start with a top-down design
  * Iteratively refine into sections → subsections → key points.
* Then work bottom-up.
  * Write individual paragraphs, then stitch them together.
* You don’t need to write sequentially.
  * It’s often easiest to write the abstract and intro last.
* Details matter. Grammar, spelling, clarity.
  * Don’t be flowery; simple, clear sentences.
  * Justify adjectives or avoid them; e.g., “very important,” “great improvement.”
  * It’s not a novel. Don’t surprise the reader with an unexpected conclusion. Guide them through your ideas.
* Shrunk and White, *The Elements of Style*
* Don’t just list a bunch of equations. Examples can make a big difference!
* Writing is rewriting. Leave yourself time for edits.
Graphs, Figures, and Data

- Graphs and figures should help tell the story of your paper.
- Create the figure, then describe it in the text.
  - Don’t assume the reader will just get it.
- Label axes and don’t use tiny font sizes.
- Think carefully about what you want to explain with your data.
Avoid the Common Reasons for Rejecting Papers

* Contributions are not clear.
* Work is not motivated. Why should I care?
* Not distinguished from related work.
* Oversold—claims are not supported by the results.
* Not written clearly.
  * Can’t understand algorithm.
  * Results are not explained.
* Results are too preliminary.
* Results are obvious.
* Too much overlap with previous work.
* This should be published somewhere else.
Authorship

**Who should be an author?**
- Anyone who contributed significantly to the conceptual development or writing of the paper
- Not necessarily people who provided feedback, implemented code, or ran experiments
- You can always mention contributors in an Acknowledgments section.

**What order should the authors be listed in?**
- If some authors contributed more of the conceptual development and/or did most/all of the writing, they should be listed first
- If the contribution was equal or the authors worked as a team, the authors should be listed in alphabetical order
- There are always exceptions to this…
Ethical Issues

- Submitting the same paper to multiple locations at the same time.
- Submitting previously published work.
- Plagiarism
- Journal versions of conference papers.
The Review Process

- Conferences
  - Program Committee. Papers are assigned to a subset of reviewers.
    - Sometimes “double-blind” sometimes not.
  - Acceptance rates: ~20%-40%
  - Typically little/no rewriting or responding to reviews.

- Note: reviewing papers is an excellent way to improve your writing.
The Review Process

* Journals
  * Editor will solicit reviewers.
  * Review cycle much longer, higher quality.

* Options:
  * Accept as is
  * Accept with minor revisions
  * Accept with major revisions
  * Reject (possibly encourage to resubmit)
What Are Reviews For?

* Evaluate a paper’s scientific merit.

* Evaluate paper’s relevance to a venue.

* Provide constructive feedback to the author.
Typical Conference Review Form

1. How **RELEVANT** is this paper?
2. How **SIGNIFICANT** is this paper?
3. How **ORIGINAL** is this paper?
4. Is this paper technically **SOUND**?
5. How well is this paper **PRESENTED**?

Additional comments for the author(s)
Good Reviews are ...

- Fair
- Polite
- Clear
- Concise
- Constructive
- Specific
- Represent the community’s point of view.
Rejection!

- We’ve all been there …
- Read the reviews, rant and complain, put them away for a bit, then read them again.
- Be honest: are the reviewer’s criticisms valid? Were you clear about what you were trying to do?
- Have others read your paper?
- If a reviewer misinterprets or misunderstands, it’s probably your fault!
- Revise and improve for the next deadline.

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6. Presentations

- Your talk is an advertisement for your paper.

- Don’t expect to cram in every technical detail; give the audience enough to know that there’s some meat there and want to read the paper for more.
Use Your Time Wisely

- Know your time limits and plan accordingly.
  - 1 slide ～= 2 minutes.

- Keep track as you are talking
  - Have material that can be skipped if necessary.

- Practice your talk ahead of time so you know what you're going to say.

- Practice your talk ahead of time to get a feel for length.

- Practice your talk ahead of time.
Know Your Audience

- Gauge your technical depth to your audience.
- For mixed audiences, try to have something for everyone.
- Be sure to explain new concepts clearly.
- Most important:
  - What have you done?
  - Why should anyone care?
Preparing Slides

- Powerpoint: keep it simple.
- Slides should not be overly packed.
- Examples are excellent. Motivate your problem.
- Think of your slides as reminders to talk about particular topics.
- Don’t read the slides to the audience.
  * Don’t write your talk out and read that verbatim, either.
Giving Your Talk

- Make eye contact with the audience
  - This will give you cues as to whether people are following what you are saying.
- Speak slowly and enunciate
- Don’t fidget, pace or rock
- Think of it as a conversation with the audience.
- Watch the session chair for time cues.
- Beware the demo.
- Anticipate technical issues.
Summary

* Develop a research plan.
* Try to get exactly the funding you need, and no more.
* Manage your time carefully.
* Meet people.
* Learn to write well.
* Polish your presentation skills.