Finding a Research Topic

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- MS, EE, and PhD, EECS, Massachusetts Institute of Technology, Cambridge, MA

- Professor, ECE and ISR, University of Maryland, College Park
- Research:
  - Digital Speech Processing
  - Speech Segregation
  - Detection of Speech Biomarkers for Emotion Recognition and Mental Health Assessment
  - Speech Inversion for Speech Therapy, Accent Reduction, Speech Recognition
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Education

• Bachelor’s degree in Electronics from Indian Institute of Technology, Madras, India
• Master’s and PhD in Electrical and Computer Engineering from Rice University, Houston, Texas

Research Area: Computer systems: architecture, parallel and distributed systems

Post-PhD

• Research scientist at Rice for 4 years
• Faculty member in Computer Science at University of Rochester
  • Albert Arendt Hopeman Professor of Engineering
  • Former Chair of Computer Science at UofR, current co-chair of CRA-WP
  • Secondary appointment in Electrical and Computer Engineering
• Sabbaticals at IBM Watson, HPCLinks/IISc India, EPFL Switzerland
Poll

Are you a first/second/third/fourth year PhD student?

Have you already identified a thesis topic?

Are you currently working on a research problem/project (or have you worked on one in the past)?
Finding a Research topic: Some Basics
The Thesis Equation

Topic + Advisor = Dissertation
Selecting an Advisor

• Picking a good match as an advisor is important!
  • An advisor is for life
  • He/she can teach/mentor you in many things, not just research
  • You will be less stressed out
  • You can expand to adjacent subfield, with his/her help
  • You can get a co-advisor/committee to help with research

What should you consider when selecting an advisor?

• Working style is very important
  • Do some background reading about faculty research
  • Talk with current graduate students to find out working style
  • Talk with current graduate students about expectations
  • Get to know your working style; be honest with yourself
Finding a Research Topic

The path to success consists of three simple elements. Find what interests you that you can do well and would have potential impact.
Find Your Own Strength

• What drives you? bores you?
  • Technology, puzzles, applications, interdisciplinary work?

• What is easier for you?
  • Writing and modifying a complex software and debugging it?
  • Building things?
  • Proving theorems?
  • Analyzing data?

• How to find it if you don’t know?
  • Try various projects/classes
Follow Your Heart (and Head)

Love your topic!
- Sets the course for your next 2-3 years
- Determines, in part, opportunities offered to you upon graduation
- May work in same/related area for years

Is there funding for you to work in the area?
- Working as a TA
- Working as an RA
- Having a university/government/industry/... scholarship/grant
Topic Scale and Scope

Scope
- Is the topic of sufficient depth to qualify as a challenging research problem?
- Is the problem too big for you to handle in the time-frame of a PhD?

Scale
- What kind of impact will the work have?
- What will you become an expert in?
Identifying a Good Research Problem
Flash of Brilliance

• You wake up in the middle of the night with a wonderful idea or a new approach to solve an open problem

• Warnings:
  • It may not seem so wonderful in the morning
  • Even if it does, you may not be able to convince others
A Talk Inspires You

- You hear a talk in your area and think “I could do that better!” or “Why didn’t they think of X?”
- You start a discussion with the speaker...
- Warnings:
  - Your idea may have already been done
  - Your idea may not work--
Data Needs Answers

• You participate in a data collection/analysis effort with another student or in industry
• You become fascinated with the potential to answer questions no one is asking
• Warning:
  • If industry, make sure you can access the data and publish
  • There may be a question of who gets to answer those questions
The Apprentice

• Your advisor has a list of topics/funded projects that need to be worked on
• A fairly common, easy method
• Warnings:
  • Several people may be working on the project: you have to find your own angle
  • Don’t work long on something that isn’t really exciting to you
The Extended Course Project

• You do a project in a course that turns out to be great – you want to do much more
• Another pretty good method
• Warnings:
  • Check with your advisor
  • The project may not be extensible to a PhD thesis
The Stapler

- You work on multiple topics and publish papers that are good and interesting to you
- Can you somehow put it all together into a dissertation?
- Warning:
  - It could be impossible to find a common theme that makes sense
The Interdisciplinarian

• You learn about a problem in another field that you think you can help with (e.g. history and computer science)

• Warning:
  • You will need real collaboration with someone in the other field
  • You’ll need to make the case that this really is a contribution to both fields (especially to your own)
Inspiration vs. Perspiration

“There are two main ways to find a topic: inspiration and scut work. Inspiration is great, but unpredictable. Scut work is a lot more dependable. In other words, join a project, build something, and see what’s hard about it. There’s a good chance that whatever caused you difficulty has a thesis topic in it.”
TIPS & Suggestions
Useful Things to Consider

• Is your topic doable?
  • Do you have the tools? data? equipment?
  • Do you have/can you acquire the skills?
  • What is your metric of success?
  • What will you compare against?

• Do you have a story to tell?
  • Why my topic is new
  • Why my topic is scientifically exciting
  • Why solving my topic will help the world
Now for the Practical Side

• Is it doable in the amount of time (5-7 years total for the PhD) you have?
  • Partition work into publishable units
  • Set a goal/deadline, e.g., conference submission
  • Chart a roadmap
  • Periodically regroup and reevaluate to make sure that your roadmap is realistic and your goals are being reached

• Is it fundable?

• Is it something you can get a job you like with?
When you’re stuck at the start

Read/present papers regularly to find open research issues
• Practice summarizing, synthesizing & comparing sets of papers
• Write your own slides for presentations
• Don’t 100% believe what a paper says

Work with a senior PhD student on their research

Get feedback and ideas from others: conferences, research internships, advisor’s idea

Sometimes you need to take a leap of faith!
Be open to trial – and - error
When you’re still stuck…

• Do internships in industry
  • They have many problems but have no time to solve them
• Attend PhD oral exams, thesis defenses, faculty candidate talks
  • Understand how to formulate problems
  • Understand what constitutes a problem solution
• Assess your progress, with your advisor
  • Set goals per semester
  • Have you ruled out an area? converged on an area?
  • Chosen a topic for an exploratory research project?
When you’re **really really** stuck

- Change research topics?
  - May move you out of your advisor’s comfort zone of expertise
  - Starting from “scratch” (e.g., need to learn the related work in a new area)
- Change research advisor?
  - May go through ‘shakedown’ period again
  - May or may not be better off
- Sometimes taking a few months break can relax you and freshen up your mind!
Things to Keep in Mind ...

• The path to finding a research topic will be a zigzag road
  • Don’t expect to find it in just one shot

• Your topic of research can change along your career
  • No need to feel that you will be stuck with your PhD topic for the rest of your life

• Ok to span two fields
  • Many breakthroughs are made this way
Recap

• *Topic + advisor* are both important

• Follow your *interests* and *passion*

• Learn your *strengths*

• Make a *plan* and continually *reevaluate*
  • Make sure you have the right *tools, data, equipment*
Finding a Research Topic:  
*Open Discussion!!*