CS 2001: Research Topics

Introduction

Prof. Adriana Kovashka
University of Pittsburgh
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About the Instructor

Born 1985 in Sofia, Bulgaria

Got BA in 2008 at Pomona College, CA (Computer Science & Media Studies)

Got PhD in 2014 at University of Texas at Austin (Computer Vision)
Course Info

- **Instructor:** Adriana Kovashka ([kovashka@cs.pitt.edu](mailto:kovashka@cs.pitt.edu))
  - Use "CS2001" at the beginning of your Subject
- **Office:** Sennott Square 5325
- **Class:** Mon/Wed, 1pm-2:15pm
- **Office hours:** Mon/Wed, 9am-10:55am
Topics

1. PhD journey and logistics
2. Learning from and evaluating the literature
3. Developing and pitching ideas
4. Conducting research
5. Writing and presenting your work
6. Mini-project presentations
7. Faculty presentations
Skills

• Reading for research
• Debating yours and others’ work
• Pitching ideas
• Writing for research
• Presenting your work
Grading

• Attendance: 30%

• Reviews of papers, literature review: 30%
  – Review ~20 papers chosen by faculty presenters
  – Write literature review with claim to be defended

• Mini project presentation: 20%
  – Teams of 2; identify a claim to investigate; make small change in existing project code, compare methods, etc.
  – Mid-semester and final reports (presented in class)

• Debates, pitches, participation: 20%
Please bring your laptops!
(and only use them for class work)
Introductions (1-2 min)

• What is your name?
• What topics within computer science are you interested in?
• What do you like to do outside of school/work?
• Why did you choose to pursue a PhD?
• Why did you choose to pursue it at Pitt?
Plan for this lecture

• PhD journey
  – PhD timeline at Pitt
  – Motivation and challenges of doing a PhD
• Managing a PhD career
  – Navigating publishing
  – Communicating with your advisor
  – Gaining confidence
  – Work/life balance
• Resources
  – Computing resources
  – Research fellowships
  – Writing resources
  – Mental health resources
PhD Journey
PhD Timeline at Pitt

1. **Find an advisor!**
   - Demonstrate depth of knowledge
   - Very basic gist of PhD topic area
   - Committee: 3 CS faculty
   - Ideally done by end of third year
   - At least 8 months after proposal

2. **Pass Prelims**
   - 2 Classes, A- or better
   - 2 Classes, B or better
   - CS 2100 - 2899 only
   - Can count towards core reqs

3. **Pass Foundation Course Requirements**
   - One course from each of
     - AI / Database
     - OS / Networks
     - Architecture / Compilers
     - Theory / Algorithms
     - At least a B in each

4. **Comprehensive Exam**

5. **Dissertation Proposal**
   - “Contract” for PhD
   - Committee: 3 CS + 1 external

6. **By graduation:**
   - six elective courses

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**PhD Timeline at Pitt**

- **CS 2001**
- **CS 2002**
- **CS 2003**
PhD Timeline at Pitt

• [https://www.cs.pitt.edu/current-students/phd-computer-science/degree-requirements](https://www.cs.pitt.edu/current-students/phd-computer-science/degree-requirements)
  – Let’s spend 10 min to read and ask questions

• [https://www.cs.pitt.edu/current-students/graduate-policies](https://www.cs.pitt.edu/current-students/graduate-policies)
  – Let’s spend 10 min to read and ask questions
PhD Timeline at Pitt

- Work hard to finish course requirements
- Identify research areas/professors of interest
- Begin reading papers & discussing area

- Attend group meetings
- Read several papers per week
- Research! Develop your niche.
- Work on time management skills

- More than smarts: Persistence!
- Time management should become an art...
- Identify larger open problem, not just many small “neat” problems
- writing, Writing, WRITING

- Good thesis or great thesis?
- To defend, you must be an expert. Are you?
- Resist the temptation to take a job before you defend. This is a recipe for disaster.
What is a PhD?

Imagine a circle that contains all human knowledge

Borrowed from http://matt.might.net
What is a PhD?

By the time you finish elementary school, you know a little
What is a PhD?

By the time you finish high school, you know a bit more

Borrowed from http://matt.might.net
What is a PhD?

With a BS, you begin to develop a specialty

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What is a PhD?

An MS deepens that specialty

Borrowed from http://matt.might.net
What is a PhD?

Reading research papers takes you to the edge of human knowledge

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What is a PhD?

Once you're at the boundary, you focus

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What is a PhD?

You push at the boundary for a few years…

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What is a PhD?

Until one day, the boundary gives way

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What is a PhD?

And that dent you've made is called a PhD.

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What is a PhD?

Of course, the world looks different to you now…
What is a PhD?

Keep Pushing.

So don’t forget the bigger picture

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So... What is a PhD?

A PhD is a process!

Smart is not enough, so a demoralizing process at times...

- So much has been done already, how do I keep up?
- What new problem should I be solving?
- Solving this problem is way harder than I thought it would be...
- Why doesn’t my code (or code that I’ve borrowed) work?!
- Why do my papers keep getting rejected?

But a process that will educate you greatly

- Problem identification and solving
- Persistence and hard work
- Clear (written and spoken) communication skills
- Team work, management, and mentoring
My Path

- Decided to do a PhD because I thought I would enjoy learning more about AI— but no clear plan or goal
- My first paper got into CVPR with good reviews, but I quickly got demoralized because the field seemed like chasing 0.5% improvement in accuracy on a benchmark
- Then I discovered a topic I was really, really excited about, by reading a paper in reading group; my thesis ended up revolving around it
- Even so, my first attempt on this topic didn’t succeed— yet a labmate later got a best paper award out of a similar idea—the line between success and failure is thin
- I learned the importance of how you present and argue the importance of your work
- I had to at least once read through related work in great detail and implement mathematical details from scratch
- I greatly enjoyed having huge time flexibility; one time, this meant I even took an acting class; more than one time, it meant spending weeks on 4 hours of sleep—but it was my choice and I felt that it was worth it
A PhD journey is long and not very well defined. What are you worried or confused about?
Managing a PhD
Navigating Publishing

• Conferences and journals
• Ratio of conference to journal pubs typically higher in CS than other areas
• Conferences at different tiers; top-tier may have acceptance rates of 15-30%
• Example goal for your PhD:
  – 2-3 top-tier conference pubs,
  – 2-3 second-tier conference pubs,
  – 1-2 journal pubs
Conference Review Process

• Papers are submitted by a fixed deadline
  – The more prestigious the conference, the less likely deadline will be extended
• Program Chairs assign papers to Area Chairs (semi-automatically) for handling
• Area Chairs select reviewers from available pool (and help recruit reviewers)
• A paper may be reviewed by 3-5 reviewers
Conference Review Process (cont’d)

• In many conferences, reviews are released before final decision, and authors get a chance to respond to comments (rebuttal), to correct misunderstandings and provide further details.
• Next, reviewers discuss (moderated by AC), update their reviews, and AC makes decision recommendation based on final reviews.
Conference Review Process (cont’d)

• If decision is accept, authors have a few weeks to submit final ("camera-ready") version

• If decision is reject, authors may submit to a workshop associated with the conference, or submit to another conference

• Dual submissions usually not ok (can’t have same paper under review for two conferences at the same time)
  – Exception: some 4-page extended abstract submissions, considered work in progress
  – Those are good to do, can add to CV, but they are non-archival and not considered real publications, so don’t invest too much time
Reviewing and Anonymity

• Most conferences use double-blind review: authors don’t know who reviewers are, vice versa – Why?
• Journals may be single-blind: authors don’t know reviewer identities
• There may be policies about “tech report” submissions (e.g. on arxiv.org) during paper anonymity/review time – allowed/not
• You may accidentally find out a paper’s author identities when you review, but you shouldn’t actively try to find it out
Choosing an Advisor

• Choosing an advisor is a big decision...
• Key points: research interest and fit
• You are unlikely to finish a PhD that you aren’t interested in...
  • Use CS2001 to get to know faculty whose work seems interesting
  • Take courses and seminars in these areas
  • Read papers, make sure you’re interested in recent developments
  • Think about whether you like theory vs. applications
• You will be working very closely with your advisor
  • Do you prefer “hands on” or “hands off” advising?
  • Can you take direction/criticism from this person?
  • Use CS2002 and course projects to test fit!

Slide adapted from: Adam Lee
Communicating with your Advisor

- Your advisor needs to know that:
  - You are independent
  - You are reliable
  - You are excited about your research
  - You will find and read literature without pointers
  - You are capable of generating (good) ideas
  - You understand the difference between low-level tweaks and mid-level technical innovation
  - You can express your ideas and motivate them
Communicating with your Advisor

• You need to know that:
  – (Same as above, plus)
  – Your advisor can fund you (as GSR, TA)
  – Your advisor is supportive and kind
  – Your advisor can provide the type of help you need
  – Your advisor knows about and cares enough about the direction you want to pursue
  – What else?
Meetings with your Advisor

• Likely every week, maybe more than once a week—set a schedule (more advisable), or meet as-needed
• Summarize what your goals were in the past week – what hypotheses you aimed to test, and how you went about testing them
• Describe the methods you read about or developed
• Describe results you obtained, and interpret them— are they reliable/significant? What do they imply? What’s next?
• Describe challenges you faced, how you resolved them, and how long it took
• Your advisor may or may not want to see code, depending on research area
• Agree on goals for next week
Communication Issues: Examples

• You tried a method; you can’t explain why it makes sense, or it actually doesn’t make sense
• You spent a whole week working on something, but have nothing to show for it
• You waited a week for a dataset/code/something else to become available, but didn’t ask your advisor for help
• You misunderstood what your advisor asked you to try
Trust and Diligence Issues: Examples

• Your code obviously has a bug (e.g. you are getting 100% prediction accuracy on a difficult AI task) but you present the results to your advisor without analyzing them
• You accidentally deleted your advisor’s dataset/work
• You missed a paper deadline (incl. missing the earlier abstract deadline to register the paper)
• You are not responding to email during business hours, on multiple occasions
Gaining Confidence

• You have to convince yourself you can do research, starting with a small project where perhaps novelty is present, but small

• You have to be strategic about the work you do—it has to be publishable today, given the state of the field

• You have to develop a unique research identity—what do you want to be known for?
What is your work/life balance strategy?
What advice have you heard?
What advice works/doesn’t?
Resources
Computing etc. Resources

- Department labs
- Department cluster (RIC)
- Department storage (AFS)
- Your advisor’s machines
- Center for Research Computing (CRC)
- Google’s Colab
- Code sharing and storage: GitHub
- Collaborative writing: Overleaf
- Reading: Google Scholar, DBLP, etc
Research Fellowships

- Pitt: CS50
- US government: NSF Graduate Research Fellowship
- Industry: Google, Facebook, Microsoft, Amazon, IBM, NVIDIA, Qualcomm, etc.
- Foundations: Anita Borg
- Slightly outdated list: https://docs.google.com/spreadsheets/d/1UpZlMvZ4AMK41MDa8zlnS817BJeeK8ZoCFdhs_AaVbQ/
Writing Resources

• The Writing Center:  
  https://www.writingcenter.pitt.edu/
Mental Health Resources

• University Counseling Center: https://www.studentaffairs.pitt.edu/cc/
Welcome to the program!

Questions? Comments? Concerns?