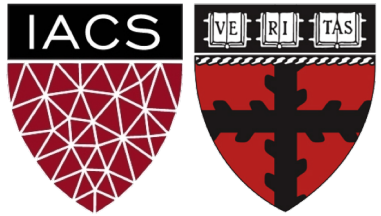
Life after Graduation

Graduate schools, industry, and government, oh my.

Chris Tanner

Harvard

Institute for Applied Computational Science



Learning Objectives

- Understand the main options post-graduation
- Know the pros/cons of each
- Acknowledge that it’s okay to have non-linear paths
- Feel comfortable making choices toward your goals

Agenda

- My Path
- The Big Picture
- Graduate schools: How to Get In
- Graduate schools: How to Succeed While There

Agenda

- My Path
- The Big Picture
- Graduate schools: How to Get In
- Graduate schools: How to Succeed While There

My Path

- After sophomore year: worked with Dr. Chan on a research project for 1.5 yrs
- Junior year: took AI and Machine Learning courses (Dr. Chan)
- Interned at Harris
- Interned at Department of Defense (thanks to research experience with Chan)

My Path

- After sophomore year: worked with Dr. Chan on a research project for 1.5 yrs
- Junior year: took AI and Machine Learning courses (Dr. Chan)
- Interned at Harris
- Interned at Department of Defense (thanks to research experience with Chan)

UCLA

- Interned at Google
- Took an NLP class

My Path

- After sophomore year: worked with Dr. Chan on a research project for 1.5 yrs
- Junior year: took AI and Machine Learning courses (Dr. Chan)
- Interned at Harris
- Interned at Department of Defense (thanks to research experience with Chan)

UCLA

- Interned at Google
- Took an NLP class

MIT Lincoln Laboratory

- Full-time Associate Staff Researcher for 3 years (NLP projects)
- Only person without a PhD. Decided I needed one for my career goals.

My Path

- After sophomore year: worked with Dr. Chan on a research project for 1.5 yrs
- Junior year: took AI and Machine Learning courses (Dr. Chan)
- Interned at Harris
- Interned at Department of Defense (thanks to research experience with Chan)

UCLA

- Interned at Google
- Took an NLP class

MIT Lincoln Laboratory

- Full-time Associate Staff Researcher for 3 years (NLP projects)
- Only person without a PhD. Decided I needed one for my career goals.

BROWN

- Returned to school to research a specific NLP problem
- Taught a class. Loved it

My Path

- After sophomore year: worked with Dr. Chan on a research project for 1.5 yrs
- Junior year: took AI and Machine Learning courses (Dr. Chan)
- Interned at Harris
- Interned at Department of Defense (thanks to research experience with Chan)

UCLA

- Interned at Google
- Took an NLP class

MIT Lincoln Laboratory

- Full-time Associate Staff Researcher for 3 years (NLP projects)
- Only person without a PhD. Decided I needed one for my career goals.

- Returned to school to research a specific NLP problem
- Taught a class. Loved it

- Teaching and research.
- Tons of fun. Love it.

My Path

My path was non-linear.

Each place informed my decisions for the next thing I wanted.

Personally, I couldn't have taken any shortcuts. I'm fine with that.

Currently

- The institute is centered around two master's programs:
  - Data Science
  - Computational Science and Engineering
- Lecturer for data science / machine learning / NLP courses
  - The most in-demand course at Harvard (390 students)
  - Project-based Capstone course (real-world partners)
- Advise Master's students on their thesis
- Research / independent study

Agenda

- My Path
- The Big Picture
- Graduate schools: How to Get In
- Graduate schools: How to Succeed While There

Agenda

My Path

The Big Picture

Graduate schools: How to Get In

Graduate schools: How to Succeed While There

The Big Picture: Career Options

- Master's (1-2 years)
- PhD (typically 5-7 years)
- Industry
  - Large companies (e.g., FAANG) – typically 2.5 years
  - Start-ups
  - Non-profits and NGOs
- Government and Federally-Funded Research Labs (typically decade(s))

The Big Picture: Career Options

Poll #1

The Big Picture: Master's vs PhD

What's the difference between Master's and PhD programs?

The Big Picture: Master's vs PhD

- Bachelor's:
  - Learn a foundation of concepts / knowledge
  - Start to learn how to think critically about a field and its problems
- PhD:
  - Research degree
  - Classes have zero importance, other than extra, continual learning
  - **School pays you** to be a student ($25k – $45k per year)
- Master's:
  - Most programs are a continuation of more intense coursework
  - Some prioritize research
  - **You pay the school** to be a student ($20k – $50k per year)

The Big Picture: Knowledge

- Knowledge, about anything in our world, is created via research and published
- It's further explored and experimented with
- Knowledge/models/approaches that seem sufficiently good and important make their way into courses and books
- Some of this knowledge gets added to the field's foundation

The Big Picture: Job Roles

Researcher:

- What is possible to build?
- How can we use existing blocks in new ways?
- What are the limitations of current blocks and

Image source: lego.com

Software Developer:

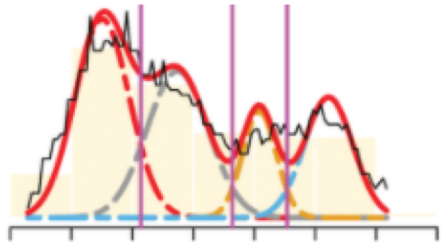
- The Builders
- Interested in tools to build better, quicker, organized, useful structures

Manager:

- Bridges everyone's skills to make great things actually happen

The Big Picture: Organizations

- For any given university or large software company, the difference in quality is not linear or disjoint
- The best people at any accredited university have the ability to do okay at the best places; the worst people at the top-ranked places would do poorly at lower-ranked places, too
- Imagine Gaussian distributions with long tails that largely overlap.



- *"You can get a good education from anywhere; you can get a bad education from anywhere"* – Ryan Stansifer (2006)

The Big Picture: Rejections

- Everything is competitive
- Acceptances have *many* false negatives, few false positives
- Rejections are **not a reflection of one's ability or potential** by any means
- One year, I didn't get an interview with WhitePages.com but Google hired me
- Next year, didn't pass TripAdviser.com interviews but (3) separate groups within MIT Lincoln Lab made an offer
- Tufts never responded to my teaching app, but MIT, Harvard, UW, Brown all made offers

The Big Picture: Considerations

- *Nature of the work – do you find it exciting and fulfilling?*
- *Flexibility, control, and ownership of the exact project and solutions to pursue*
- *Money*
- *Prestige*
- *Its ability to prepare you for an even bigger goal/dream career*
- *Location*

What do you value?

Poll #2

Agenda

My Path

The Big Picture

Graduate schools: How to Get In

Graduate schools: How to Succeed While There

Agenda

My Path

The Big Picture

Graduate schools: How to Get In

Graduate schools: How to Succeed While There

Graduate Schools: How to Get In

Best way to get into anything is to have already strongly demonstrated you can do the job

(i.e., do the job before you have the job)

Graduate Schools: How to Get In

ADDITONAL THINGS TO CONSIDER FOR A PhD

- Your adviser is like a marriage partner
- Be informed as possible, a priori
- Style of adviser (e.g., hands-off, hands-on)
- Speak w/ past and current students
- Where have past students ended up?
- Size of research group
- How much does his/her current students collab together?

Graduate Schools: How to Get In

ADDITONAL THINGS TO CONSIDER FOR A PhD

- Their connections / who do *they* collab with? Other sub-fields?
- Their funding situation (grants)
- Flexibility in what you research (related to grants)
- Are there other profs you could pivot to, if things don't work out?
- How large is the department?
- What are the steps to advance to candidacy?
- What's the average graduation time?

Graduate Schools: How to Get In

BEFORE APPLYING (MS or PhD)

1. Find a sub-field you are interested in

    * *e.g., Natural Language Processing*

    * *Take advanced-level courses / graduate courses*

2. Get an idea of the **types of active problems** in that sub-field

    * *Skim papers from the top conferences of that field*

    * *Talk with relevant professors and see what they work on, and ask them*

Graduate Schools: How to Get In

BEFORE APPLYING (MS or PhD)

3. Identify **concrete problems** that *you* are interested in

    * *e.g., Coreference Resolution or Machine Translation*

    * *skim more papers to get an idea of current models + datasets*

4. ***Ask related prof(s)** if they have any available research projects*

    * *mention your interests in the sub-field*

    * *feel free to reach out to profs from other universities, too*

Graduate Schools: How to Get In

BEFORE APPLYING (MS or PhD)

5. Do good work for at least a year

    * the more initiative you take, the better
    * your current organization is never the "competition"
    * PhD programs want you to become an independent researchers
    * Master's programs admit students who have more than good grades
    * aim to write a paper and submit to arXiv or conference workshop
    * top applicants to top programs have accepted conference long-papers
    * reach out to profs at your desired schools months before applying
    * ask your current adviser if they have contacts you could work with in future

Graduate Schools: How to Get In

WHEN APPLYING

- Statement of Purpose
- Letters of Recommendation
- Research Experience
- GPA
- GRE

Graduate Schools: How to Get In

WHEN APPLYING

- Statement of Purpose – *very important*
- Letters of Recommendation – *very important*
- Research Experience – *very important*
- GPA – *can't get you accepted anywhere; can only get you rejected*
- GRE – *can't get you accepted anywhere; can only get you rejected*

Graduate Schools: How to Get In

WHEN APPLYING

Statement of Purpose (SoP)

- Communicate and prove why you're an excellent candidate and will thrive there
- Be confident in your language
- Be succinct (top programs get hundreds or thousands of CS apps)
- Be very specific as to what you want to work on (not just the sub-field but problems)
- Be very specific about which profs you want to work with (1-3)
  - Ideally, have already introduced yourself months prior

Graduate Schools: How to Get In

WHEN APPLYING

Letters of Recommendation

- Have a relationship with each letter writer beyond just having taken a class
  - e.g., research project, many conversations about your goals and ideas
- Ask each letter writer "*Do you feel comfortable writing me a strong letter?*"
- Give each letter writer a bulleted document that addresses/reminds them of specific attributes that make you excellent, which they could have observed
- Identify with them a date by which you can expect the letter to be written

Graduate Schools: How to Get In

WHEN APPLYING

Research Experience

- Make it clear that you didn't just execute your adviser's ideas
- Demonstrate you have passion, many future ideas, and that the school is just part of your path (as if you don't need them, but some school will be part of the path)

Graduate Schools: How to Get In

WHEN APPLYING

GPA

- Should have at least a 3.7 to be competitive. Higher if school isn't well-known
- Anything less, you should address such briefly in your SoP
- Don't let a bad grade in a single course ruin your interests in the material

Graduate Schools: How to Get In

WHEN APPLYING

GRE

- It's an unfair, annoying standardized test
- Some schools no longer accept GRE scores
- If you need to take it, do very well (90% Math, 70% Verbal, 5/6? Writing)

Agenda

My Path

The Big Picture

Graduate schools: How to Get In

Graduate schools: How to Succeed While There

Agenda

My Path

The Big Picture

Graduate schools: How to Get In

Graduate schools: How to Succeed While There

Graduate Schools: How to Succeed in a Master's

- Continue what you did during undergrad
- Reach out to profs and consider research
- Make friends; build a network

Graduate Schools: How to Succeed in PhD school

- Read tons (skim a few papers a week, do 1+ deep dive each week)
- Take initiative
- Talk with your adviser as often as possible (brainstorm with them)
- Talk with your peers as often as possible (brainstorm with them)
- Talk with other profs as often as possible (brainstorm with them)
- Consider conference workshops and short papers, not only long papers

Graduate Schools: How to Succeed in PhD school

- **Invest in your tools** (the software you write, your environment, etc)
- Show others' your paper drafts
- Take rejections in stride

  * top professors commonly get rejected 50% of time

- Be honest in your work
- Ideas are cheap; execute!
- Test your models against reality

Graduate Schools: How to Succeed in PhD school

- Deeply understand and explore the data
- Understand what the current weaknesses are in the current best models
- Start with very simple models
- Pay close attention to results

Graduate Schools: How to Succeed in PhD school

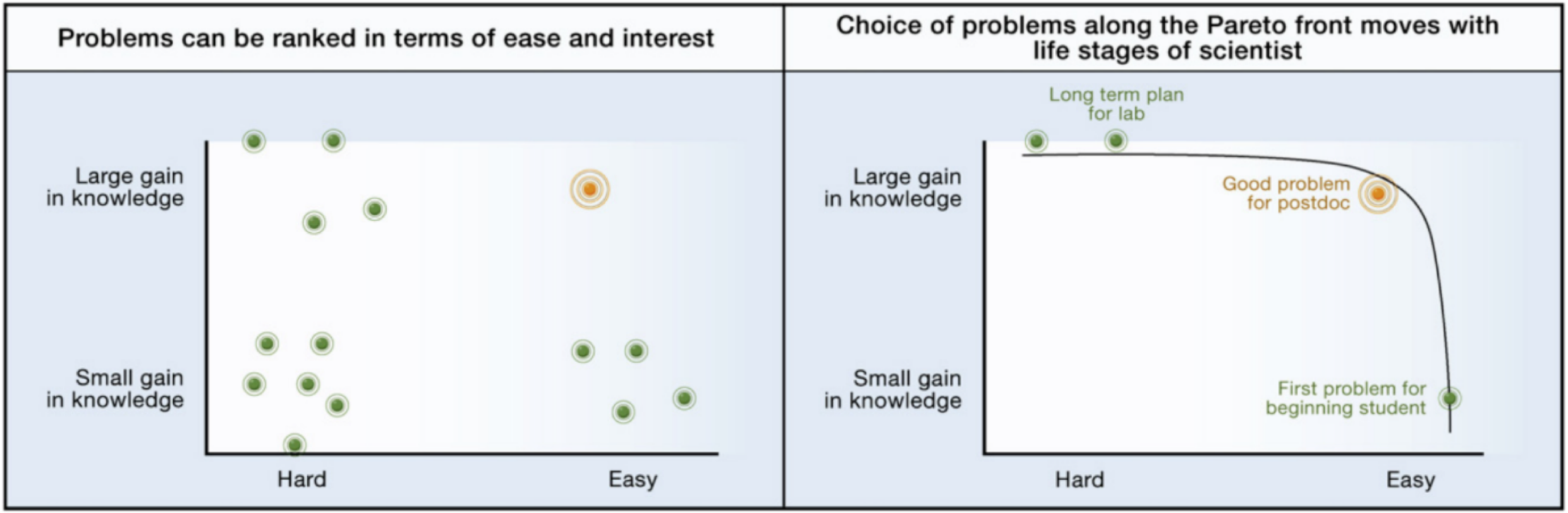


Figure 1. The Feasibility-Interest Diagram for Choosing a Project
Two axes for choosing scientific problems: feasibility and interest.

Uri Alon, How to Choose a Good Scientific Problem

Graduate Schools: How to Succeed in PhD school

- How to Find Research Problems (Jason Eisner at JHU): http://www.cs.jhu.edu/~jason/advice/how-to-find-research-problems.html
- Tips to be a better problem solver (3Blue1Brown): https://www.youtube.com/watch?v=QvuQH4_05LI
- Stay organized, e.g.
  - Inbox Zero: https://xph.us/2013/01/22/inbox-zero-for-life.html
  - Evernote (note manager)
  - ClickUp (todo/task manager)

Graduate Schools: How to Succeed in PhD school

- How to write a research paper (by David Poole): https://www.cs.ubc.ca/~poole/HowToWriteResearchPaper.html
- Presentation Advice (by Gene Freuder): https://freuder.wordpress.com/presentation-advice/
- Talk advice (by Matt Might): http://matt.might.net/articles/academic-presentation-tips/

Graduate Schools: How to Succeed in PhD school

- Helpful resources from Brown:
  https://cs.brown.edu/degrees/doctoral/applications/helpful-resources-applying-computer-science-phd-programs/
- Computing Research Association (CRA):
  https://cra.org/cra-wp/resourcelibrary/?fwp_audience=undergrad-students&fwp_goal=graduate-school

EXTRA

- Once one leaves academia, it's much harder to get back in
- Large companies:
  - Pros: Resources; interesting problems; smart, driven people
  - Cons: May work on boring widgets (50,000 people)
- Small companies:
  - Pros: more ownership, control, and interesting problems
  - Cons: long hours, less pay, maybe rigid deliverables

Government and Federally-Funded Research Labs:

- Pros: job stability; incredibly interesting problems and data; unbelievable resources; easy job hours
- Cons: may be boring; may not be able to discuss your work with others; may not be easy to publish; added responsibility with security clearances

Questions

christanner@g.harvard.edu