Chances of Professorship Looking Daunting? Alternative Career Choices for Astronomers

Presented by Michele Silverstein
Feb 1st, 2013
What do these have in common?

Data Science!
What is Data Science?

• Tons of data everywhere!
• Use that data to make more useful data!

Who are your friends Facebook friends with? How many friends in common do you have? Are you in similar groups? Networks?

What have you bought in the past? What did other people buy who bought what you’re looking at?

How long is each track?

At a given location how frequently are people searching “buzz words” for the flu?
What does it take?
What exactly is the job?

- Build a model!
- Data mining
- Predict what consumers will want/find most useful based on real data instead of assumptions! [1]

- Communicate to leaders

“They’re not IT. They’re not analysts. They’re not programmers. They’re the thing that brings it together and helps organizations communicate about the stories and the answers available in the data.” [2]
Can we do it? What have we got?

- Math & computing skills
  - STANDARD LANGUAGE [4]
- Statistical Model Building
- Ability to get the most from your data
  - Creativity
- Ability to think about the big picture/problem
- Ability to break large problems into small ones
YAY! Wait we need to know more?

• Entrepreneurship
• Languages such as R, Python, Perl
  – R – Statistical Modeling
• Several Programs that Deal with Data
• How to translate between analysis and business. [1]
Additional Skills Needed

- Data Mining/Analysis
- Programming in R, plus SQL (Structured Query Language), Hadoop, other software programs
  - [https://www.gosolar.gsu.edu/bprod/bwckctlg.p_display_courses](https://www.gosolar.gsu.edu/bprod/bwckctlg.p_display_courses)
  - CSC 2310 - PRIN OF COMPUTER PROGRAMMING
  - CSC 3410 - DATA STRUCTURES-CTW
  - CSC 4710 - DATABASE SYSTEMS
  - [http://www.cc.gatech.edu/~agray/4245fall10/](http://www.cc.gatech.edu/~agray/4245fall10/)
    - Course at GA Tech, doesn’t seem to have much in prereq.s (multivariable calculus and “the basics of programming” in a language of your choice)
## Is it worth it?

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Steadily increasing job market</td>
<td>• Bye bye Astronomy</td>
</tr>
<tr>
<td>• Still research-related!</td>
<td>• No teaching</td>
</tr>
<tr>
<td>• Big corporations often have good benefits</td>
<td>• “Not an easy job to get.”</td>
</tr>
<tr>
<td>• Data is everywhere!</td>
<td>– (Although we have a bit of a start)</td>
</tr>
<tr>
<td>• Most of the skills we need to pick up relate closely to ones we already have</td>
<td></td>
</tr>
</tbody>
</table>

[1]
Potential Employers

- Cassandra, Hadoop
- Google, Amazon, Facebook, and LinkedIn
- Centerpoint_Recruiting_Norwalk, CT
- Virtual_Instruments_SanJose, CA
- Cyphort_SanFranciscoBayArea
- Penn_Medicine_GreaterPhiladelphiaArea
- PulsePoint_GreaterNYCArea
- Twitter_SanFrancisco, CA
- Facebook_MenloPark, CA/Austin, TX
- RichRelevance_SanFranBayArea
Jessica Kirkpatrick
Example Astronomer & Blogger!

• Educational Background
  – PhD Astronomy, UC Berkeley, 2012

• Research Interests Before Leaving
  – SDSS
  – Galaxy Clustering
  – Dark Energy
  – Quasars

• Current Employment
  – Data Diva at Yammer, Inc. (Microsoft)
# Jessica Kirkpatrick

## Salary (Pro) (A vs. DS)

<table>
<thead>
<tr>
<th>Data Scientists (at Tech Co.’s)</th>
<th>Astronomers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Starting Salary: $90k-$130k</td>
<td>• Post Docs: $45-$65k</td>
</tr>
<tr>
<td>– 10% annual cash bonus</td>
<td>• All Levels Average: $87k</td>
</tr>
<tr>
<td>– annual stocks/equity bonuses (≈10% base salary)</td>
<td>• Pensions, Summer Stipends, Sabbaticals</td>
</tr>
<tr>
<td>• “Free food, transportation, gym memberships, etc.”</td>
<td></td>
</tr>
</tbody>
</table>

• More moolah!
# Jessica Kirkpatrick

## Hours (Neutral)

**Data Scientists (at Tech Co.’s)**

- 45-50 hrs/wk (longer at smaller/newer co.s)
- No evenings/weekends expected
- 15 vacation days + 12 holidays
- Some companies allow some work at home
- Less time

**Astronomers**

- Up to 100 hours if you’re in Arizona!
- JK has heard 60-70 hrs/wk for post-docs
- Very flexible hours
- Winter/Summer breaks
- More Flexibility
### Jessica Kirkpatrick
Job Availability (Pro)

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<tr>
<td>“Talent shortage” for 140,000-190,000 jobs in the next 5 years</td>
<td>We all know by now</td>
</tr>
<tr>
<td>Shortage of 1.5 million managers</td>
<td>75% can find post-docs</td>
</tr>
<tr>
<td>Location flexibility</td>
<td>4x as many post-docs as tenure-track faculty positions</td>
</tr>
<tr>
<td></td>
<td>Relocate for 5-10 years!</td>
</tr>
<tr>
<td></td>
<td>– Relationships/children 😞</td>
</tr>
</tbody>
</table>

![Help Wanted](image)
Jessica Kirkpatrick
Job Security (Neutral)

Data Scientists (at Tech Co.’s)
- None
- Performing below expectations asked to leave

Astronomers
- Tenure!
- Even post-docs or national labs, never heard being let go
- No guaranteed tenure position (in fact difficult to get)
- Have to relocate for a tenure position
Jessica Kirkpatrick
Project Length (Neutral)

**Data Scientists (at Tech Co.’s)**
- Days, not even weeks
- Must contribute to business!
- Lower complexity
- Not the same in research divisions of companies like Microsoft

**Astronomers**
- Months to years
- Higher complexity and exploration
Jessica Kirkpatrick
Project Direction (Con)

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<th>Data Scientists (at Tech Co.’s)</th>
<th>Astronomers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Must benefit company</td>
<td>• What interests you?</td>
</tr>
<tr>
<td>• Some occasions to be</td>
<td>• Committees are hurdles</td>
</tr>
<tr>
<td>creative (special events)</td>
<td>we can jump over</td>
</tr>
</tbody>
</table>
Jessica Kirkpatrick
State of the Field (Pro)

Data Scientists (at Tech Co.’s)
- New!
- Many remaining easy unsolved problems
- Easier to make an impact

Astronomers
- Been around awhile
Jessica Kirkpatrick
Subject Matter (Neutral)

Data Scientists (at Tech Co.’s)
• Not astronomy!!!
• People!
  – Less predictable
• Can see immediate impact of work
• Misses astronomy
• TIP: Pick a company you are interested in

Astronomers
• Astronomy!!!
Jessica Kirkpatrick

TIPS

• RESUME – highlight your skills
• Short Deadlines
• Do an Internship Program
  – Insight Data Science Fellowship
    • For academics
• Do a program on your own!
Tips from Andrea Leistra (AAS)
Example Astronomer

- **Name:** Andrea Leistra, Ph.D.
  **Title:** Senior Data Analyst
  **Phone:**
  **Company:** Yahoo!

left astronomy immediately after my PhD. My advice for other astronomers in the same situation is that the skills employers are interested in may not be what you're used to thinking of, and the most challenging part of your job search may well be finding the employer who will recognize the transferability of your skills (in my case, working with very large datasets thanks to my thesis work mining the 2MASS catalog), as well as your demonstrated ability to think analytically and learn quickly, which will be useful anywhere!”
Alternative Career Choices
PART II
Patent Law/Agency
Patent Law/Agency

• What to expect of the job/yourself?
  – Writing
  – Legal issues
  – Argue patentability
  – Knowledge of technology!
    • What part of the technology needs patenting
    • Ability to explain the technology clearly
What exactly does a patent attorney do?

• Litigation attorney (Jankowski)
  – “One company sues another”
  – Patents are being infringed by your products!
  – How much damage?
  – Patent even valid?
David Jankowski
Example Astronomer

• Educational Background
  – J.D. Stanford Law School
  – Ph.D. Astronomy, Cornell University
  – M.S. Astronomy, Cornell University
  – B.A. Physics, UC San Diego

• Research Interests
  – “computer modeling the surfaces of solid planetary bodies “
  – “digital image processing and analysis of spacecraft images”

• Career Background
  – Litigation Partner at Knobbe Martin Intellectual Property Law
  – Tenure Track Assistant Prof. of Physics and Astronomy at
    University of Wisconsin, Eau Claire
Why the switch?

• Despite some very good experiences in some classes, hard time connecting with students in others.

• It was cold!

• Something near home?

• Law could be a fit.
## Considering the Change (Law School)

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use math/science skills more marketably</td>
<td>• Going back to school after Ph.D. program – not easy!</td>
</tr>
<tr>
<td>• Nice job can pay off debt</td>
<td>• Must pay for law school</td>
</tr>
<tr>
<td></td>
<td>– $50k-$100k debt common</td>
</tr>
<tr>
<td>• People with a tech background have a leg up</td>
<td>• Similar problem: too many law degrees, too few jobs</td>
</tr>
<tr>
<td>• After Ph.D., law school is pretty easy</td>
<td>• “Law school is all about reading and writing” (con/neutral)</td>
</tr>
<tr>
<td>– Analytical skills reading</td>
<td>– Break down court opinions and “come up with rational”</td>
</tr>
<tr>
<td>• Very intellectual</td>
<td></td>
</tr>
</tbody>
</table>
One big difference in mindset!

- In astronomy
  - Competition for funds and publishing the work before those doing similar research, everyone working toward the same goal of “good robust defensible data”.

- Very different from astronomy
  - Now each side tries to advocate somebody.
  - The “other side tries to lie, cheat and steal.”
  - “High stakes video game”
<table>
<thead>
<tr>
<th>What We’ve Got</th>
<th>What We Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Technological background</td>
<td>• Law education</td>
</tr>
<tr>
<td>• Verbal communications skills</td>
<td>– Law School?</td>
</tr>
<tr>
<td>• Writing skills</td>
<td></td>
</tr>
<tr>
<td>• Ability to defend an idea</td>
<td></td>
</tr>
<tr>
<td>Do we <em>need</em> a law degree?</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Patent Attorney</strong></td>
<td></td>
</tr>
<tr>
<td>• Law school</td>
<td></td>
</tr>
<tr>
<td>• Patent infringement cases in the courtroom</td>
<td></td>
</tr>
<tr>
<td>• Writes up patents</td>
<td></td>
</tr>
<tr>
<td><strong>Patent Agent</strong></td>
<td></td>
</tr>
<tr>
<td>• Pass the patent bar</td>
<td></td>
</tr>
<tr>
<td>• Never steps into a courtroom</td>
<td></td>
</tr>
<tr>
<td>• 1st appeal (dealt with by the Patent and Trademark Office)</td>
<td></td>
</tr>
<tr>
<td>• Writes up patents</td>
<td></td>
</tr>
</tbody>
</table>

[8], [9]
One can start out as a patent agent which is a “pretty good paying job” and become a patent attorney which has higher pay.

- **Agent Starting Average at PayScale $45,000**
  - Range: $30,000 - >$120,000
  - 85% healthcare, 65% dental
- **Attorney Starting Average at $125,000**
  - Lowest start: $45,000
- **Depends on location and other advanced degrees**

[9], [11], [12]
Don’t Underestimate the Ph.D.!

• “...seen as someone with some life experience and some ability depending on what your experience was as a grad student”
• “...experience working with others, reading, writing....”
• “...its certainly an advantage having an advanced degree from someone who has a bachelor's degree.”
• Some places it is required!
A Second Opinion

- “Bachelor’s degrees in technical fields such as physics, chemistry or engineering boost salaries by a supplemental $20,000”
- Likely there is a bigger boost for those with Ph.D.s
## Location

- Patent Agents are needed everywhere there are tech companies\(^9\)
  - DC, bay area, So. Cal., pockets in tech sites (Austin, Boston, Chicago), MN, Seattle, Atlanta, etc.

- US Patent and Trademark Office (USPTO)

- European Patent Office

- (Intellectual Property) Law firms\(^10\)

- Self\(^8\)
The Down Side

• “By going into patent world, you're not going to be exposed to astronomy much if at all because there's not very much patenting in that area.”
Brief Overview

Pros
• Good money
• Location flexibility
• Leg up with Ph.D.
• Involvement in new technology

Cons
• Back to school (for attorney)
  – Debt
• Essentially no astronomy
David’s Advice

• David was rather well-informed before he made his switch, so there was nothing he “wished he had known” before making it.

• “Try to do introspection and look outwardly as to what is out there and try to learn as much as you can before making decisions because there's a lot out there.”
Works Cited/Useful Links

Data Science

• [1] Data Science 101

• [2] The Corner Office
  – http://blogs.sas.com/content/corneroffice/2012/05/29/what-is-a-data-scientist-and-do-you-really-need-one/

• [3] O’Reilly Radar

• [4] Jessica Kirkpatrick - Astronomer to Data Scientist
  – http://womeninastronomy.blogspot.com/2013/01/datascience.html

• [5] Jessica Kirkpatrick Research
  – http://jessresearch.blogspot.com/

  – http://womeninastronomy.blogspot.com/2013/01/astroVdatascience.html

• [7] AAS Non-Academic Astronomers Network
  – http://imis10.aas.org/career/nonacademic/bydegree.cfm

• The Hottest Job You’ve Never Heard of

• [i] Image of Impact – NASA
  – http://www.nasa.gov/topics/solarsystem/features/planet_growth_spurt.html

• [ii] APOD 02/01/2013

• Most images from Microsoft Clip Art
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• [9] Phone interview with David Jankowski
  – http://knobbe.com/attorneys/david-jankowski
  • http://www.ehow.com/about_7444249_average-salary-patent-agent.html
• How to Become a Patent Agent
  – http://inventors.about.com/od/patentattorneys/ht/patent_agent.htm
• What are the differences between a patent agent/attorney? (And related)