Academia to tech: A guided tour
Invitations to industry

Luis Serrano
Quantum artificial intelligence research scientist, Zapata Computing
Backstory

Bachelors in Math

Masters in Math

PhD in Math

Postdoctoral Fellowship in Math

Software Engineer

Head of Artificial Intelligence Content

AI Educator

Quantum AI Research Scientist

Code/ML

Teaching

Research
Problem

PhD

Postdoc

Faculty
Options

Finance

Consulting

Technology
Finance
Finance
Finance

Goldman Sachs

Jane Street
Finance

Math questions
153+83?
145-57?

Probability questions
I play the following game:
I roll a die. I can stick with that result, or roll again.
If I roll again, I have to stick with the second result.
What’s the strategy and the expected outcome?
Things to know:

Probability (Bayes Theorem)

Programming (Python, C++)

Machine learning
Consulting

McKinsey & Company

BCG

The Boston Consulting Group

Bain
Consulting

Human Question
- convinced someone/a group of doing something they didn’t want to do
- achieved a goal you had set for yourself
- had to persuade a group
- deal with a crisis/difficult situation

Case Question
- Industry Analysis
- Merger and Acquisitions
- Entering a New Market
- Pricing Strategies
Practical Question

Entering a new market

- You work for the CEO of a dog food company.
- There are three types of dog food: premium, medium, and basic
- The company does very well on premium and medium
- They want to enter the market for the basic dog food
- Design their strategy

- Don’t cannibalize on your other markets (i.e., lowering price)
- Small calculations: Estimate how many people buy dog food in US
Things to know:

- Take one business course (online, etc.)
- Try to have some real life experience
  - Internship
  - Volunteering
  - etc.
Technology
Types of Tech Jobs

Software Engineer

Data Scientist
Types of Tech Jobs

Software Engineer
Mathematical Software

Python Course
- REFERRAL
- Technical Assessment
- Phone Interview
- On-site Interview
Google Interview Question

Question: Determine if two words are anagrams of each other (e.g., stressed, desserts)

- Solve it the stupid way
- Write pseudocode
- Calculate complexity
- Make it faster
- (iterate if needed)
- Write code
Google Interview Question

- Algorithms: Mergesort, Quicksort, BFS, DFS, …
- Data structures: Stack, Queue, Trees, Linked Lists, …
- Complexity: O(n), O(log(n)), …
- Fast at coding: Python
- Coding on the board
Types of Tech Jobs

Data Scientist
Data Science Interview

Can you code?

Can you do math?

Do you have data intuition?

Machine Learning Knowledge
Can you do math?

You throw a coin 100 times
It lands heads 80 times
Do you think the coin is rigged?

Binomial Distribution
Approximate with Gaussian
Calculate $p(\geq 80$ heads$)$
If $p < 0.05$, then rigged
### Data intuition (management)

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- Filling empty data
- Scaling
- Feature selection
- Categorizing
- Transforms
Machine Learning Knowledge

- A bunch of pretty algorithms (explain how one works)
- How would you use (improve) this algorithm in a sample data?
- Tell us about a project you’ve done before
How to learn these skills?
Books
Best ways to practice
The millionth number with at least one million prime factors

Problem 615

Consider the natural numbers having at least 5 prime factors, which don't have to be distinct. Sorting these numbers by size gives a list which starts with:

32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2
48 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3
64 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2
72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3
80 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5
96 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3
...

So, for example, the fifth number with at least 5 prime factors is 80.

Find the millionth number with at least one million prime factors.
Give your answer modulo 123454321.
Bootcamps

INSIGHT DATA SCIENCE FELLOWS PROGRAM
An intensive 7-week post-doctoral training fellowship bridging the gap between academia & data science.

insightfellows.com
Github is the new resume
Kaggle Competitions

12 active competitions

<table>
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<th>Active</th>
<th>All</th>
<th>Entered</th>
<th>Unlaunched</th>
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<td>Passenger Screening Algorithm Challenge</td>
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<td>Improve the accuracy of the Department of Homeland Security's threat recognition algorithms</td>
<td>Featured · 5 months to go</td>
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</table>
General Questions
Can I do research?

Computer Vision

Autonomous Systems (Reinforcement learning)

Natural language Processing

Quantum computing

Quantum AI
Can I teach?
Why did I leave Google?
Types of Companies

Large companies → Small companies

Growth time (time to learn)

Less relevant → More relevant

Need to start producing quickly
Growth in Industry

Google
Manager

Slow

Google
Data Scientist

Google
Senior Data Scientist

Medium

Google
Data Scientist
Growth in Industry

Large companies

Senior Data Scientist

Google

Data Scientist

Small companies

Senior Data Scientist
General Interviewing Advice
I don’t have a practical degree!

Math (or related) PhD + Knowledge > Some other degree
Luis Serrano, PhD
Educator, Mathematician, Machine Learning Professional

EXPERIENCE

Google, San Bruno, CA — Machine Learning Engineer
SEPTEMBER 2014 - JUNE 2017

- Developed and maintained end-to-end ML pipelines for the video recommendation system.
- Improved the accuracy of recommendations using advanced machine learning techniques.
- Conducted experimental analysis on user feedback to tune model hyperparameters for optimal performance.

University of Québec, Montreal — Postdoctoral Fellow
AUGUST 2013 - AUGUST 2014

- Conducted research on the development of new machine learning algorithms.
- Collaborated with international teams to analyze large datasets.
- Published multiple papers in high-impact journals.

SELECTED AWARDS

Joseph Alpern Prize in Mathematics, UC Berkeley (2013)

EDUCATION

University of Michigan, Ann Arbor, MI — PhD
SEPTEMBER 2006 - JUNE 2010

- Completed a dissertation titled "Algorithmic Aspects of Machine Learning".
- Conducted extensive research in the areas of computational complexity and learning theory.

University of Waterloo, Waterloo, ON — B.Math
SEPTEMBER 2002 - JUNE 2006

- Achieved an honors mathematics degree with distinction.
- Participated in national and international mathematics competitions.

COURSES

- Advanced Calculus
- Linear Algebra
- Probability Theory

LANGUAGES

English, Spanish, French

SKILLS

- Python, R, SQL, M SQL, TensorFlow, Keras, PyTorch
- Proficient in data analysis and machine learning
- Strong understanding of computer science and mathematics

SERVICE

Education Committee, Machine Learning Conference, GPU Open Source Award (2016)

OPTIMAL ETIQUETTE

Luis has a strong background in mathematics and machine learning. He has contributed to various research projects and published multiple papers in high-impact journals. His skills in data analysis and machine learning are highly valued in the industry.
General Interviewing Advice
General Interviewing Advice

You’re enjoying the interview \(\iff\) Your interviewer is enjoying the interview

The job is for you
General Interviewing Advice

You are also interviewing the company
(ask good questions)

Interviewer is picturing working with you
General advice

Learn lots of math aside from yours (diff eq, optimization, statistics)

Learn lots of non-math (programming, economics)

Look for places where you can get teamwork experience

Summer internships

Career Advice, Headhunters, etc.
General advice

Interviewing is the best way to practice interviewing

Think about what is your passion

Share your knowledge (blog, videos, Github, etc)

Don’t stress!!!
Probability that I don’t get an industry job

At a company: \( p = 0.1 \)

\( N \) companies

Probability of not getting a job:

\[ (1-p)^N \rightarrow 0 \]
Advice for the undecided

Continue doing mathematics without pressure of one day not having a job. Industry will always have a place for you if your mind (or situation) changes.
Thank you!

luisgui.serrano@gmail.com