From Physics to Industry

A Collection of Somewhat Coherent Ramblings of:
Dylan Frizzell PhD

7/2/2024

Outline

Types of Jobs and Industries
• Job types, sectors, and salaries
• Focus on Data Science and Software

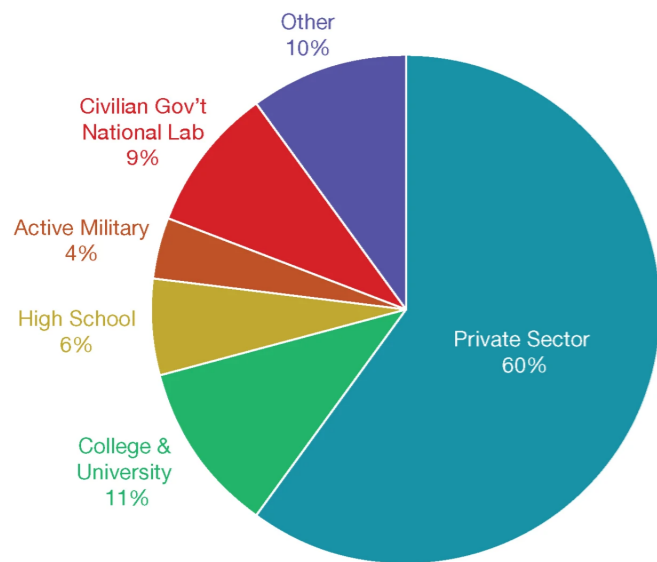**Progressing your career**
• Soft Skills, business acumen

Getting the first job
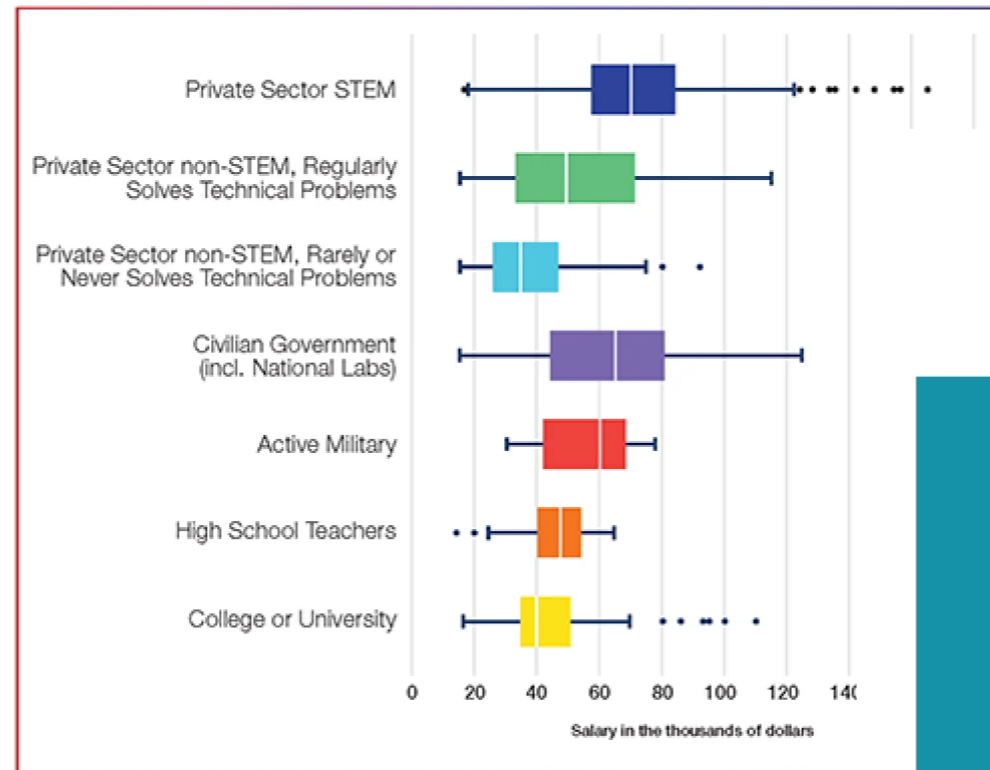**• Skills, Resources, Expectations**

My Lesson's Learned

Physics to Industry

Where New Physics Bachelors Work

Other 10%
Civilian Gov't National Lab 9%
Active Military 4%
High School 6%
College & University 11%
Private Sector 60%

Source: AIP Physics Bachelor's Follow-up Survey, classes of 2021 and 2022 combined.

Starting Salaries for Physics Bachelors

Private Sector STEM
Private Sector non-STEM, Regularly Solves Technical Problems
Private Sector non-STEM, Rarely or Never Solves Technical Problems
Civilian Government (incl. National Labs)
Active Military
High School Teachers
College or University

0 20 40 60 80 100 120 140

Salary in the thousands of dollars

Physics PhDs
Physics Masters
Physics Bachelors in STEM Positions
Physics Bachelors in Non-STEM Positions

$0 $20 $40 $60 $80 $100 $120 $140 $160 $180 $200 $220 $240

Salaries in Thousands of Dollars

Common Job Titles for New Physics Bachelors

Engineering
Systems Engineer
Engineering Technician
Electrical Engineer
Project Engineer
Mechanical Engineer
Test Engineer
Process Engineer
Production Engineer
Design Engineer
Manufacturing Engineer
Application Engineer
Data Engineer
Scientist

Research and Technical
Research Assistant
Researcher
Research Technician
Junior Specialist
Patent Examiner
Accelerator Operator
Physicist
Scientist

Education
High School Physics Teacher
High School Math Teacher
Middle School Science Teacher
Tutor

Programming/Software
Software Engineer
Software Developer
Application Developer
Data Engineer
Data Analyst
Data Scientist
Machine Learning Engineer
Consultant

Finance/Business
Data Analyst
Research Analyst
Project Manager
Investment Banker

3

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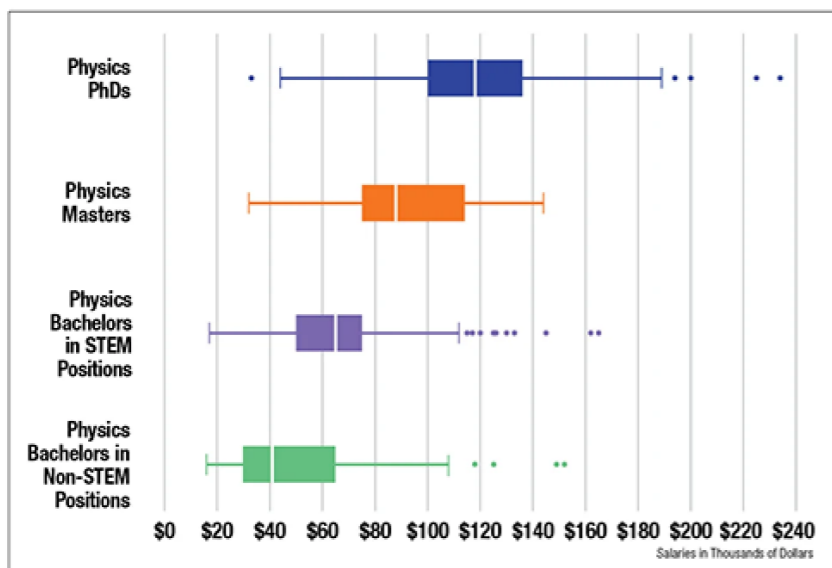
Physics to Industry

Who's hiring physics Bachelors
  • https://ww2.aip.org/statistics/whos-hiring-physics-bachelors
Who's hiring physics PhDs
  • https://ww2.aip.org/statistics/whos-hiring-physics-phds

Common Themes in Private Sector:
• Medical physics
• Microchip and electronics engineering
• System/Process/Project Engineer
• Data Science/Analytics/Engineering
• Software Engineering

Top skills:
  • Technical Writing, really technical communication in general
  • Programming
  • Critical Thinking / Sanity Checking

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What is Data Science

Data Science Traditional Definition:
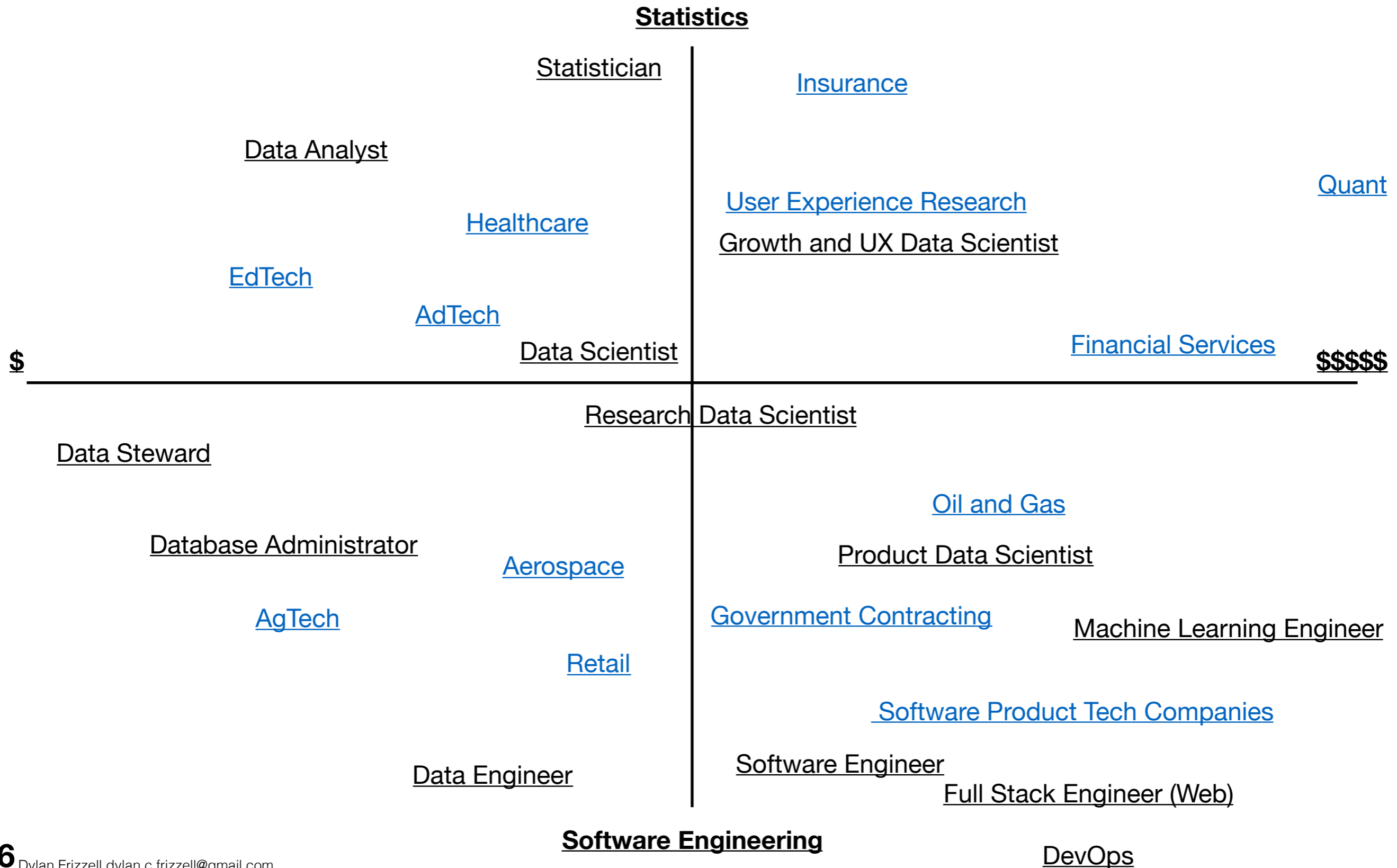The use of advanced analytics to derive insights from data.

Data Science new Definition:
You know everything about data from creation, storage, movement, formatting, processing, machine learning, analytics, designing experiments, how it applies to business, application integration, and more.

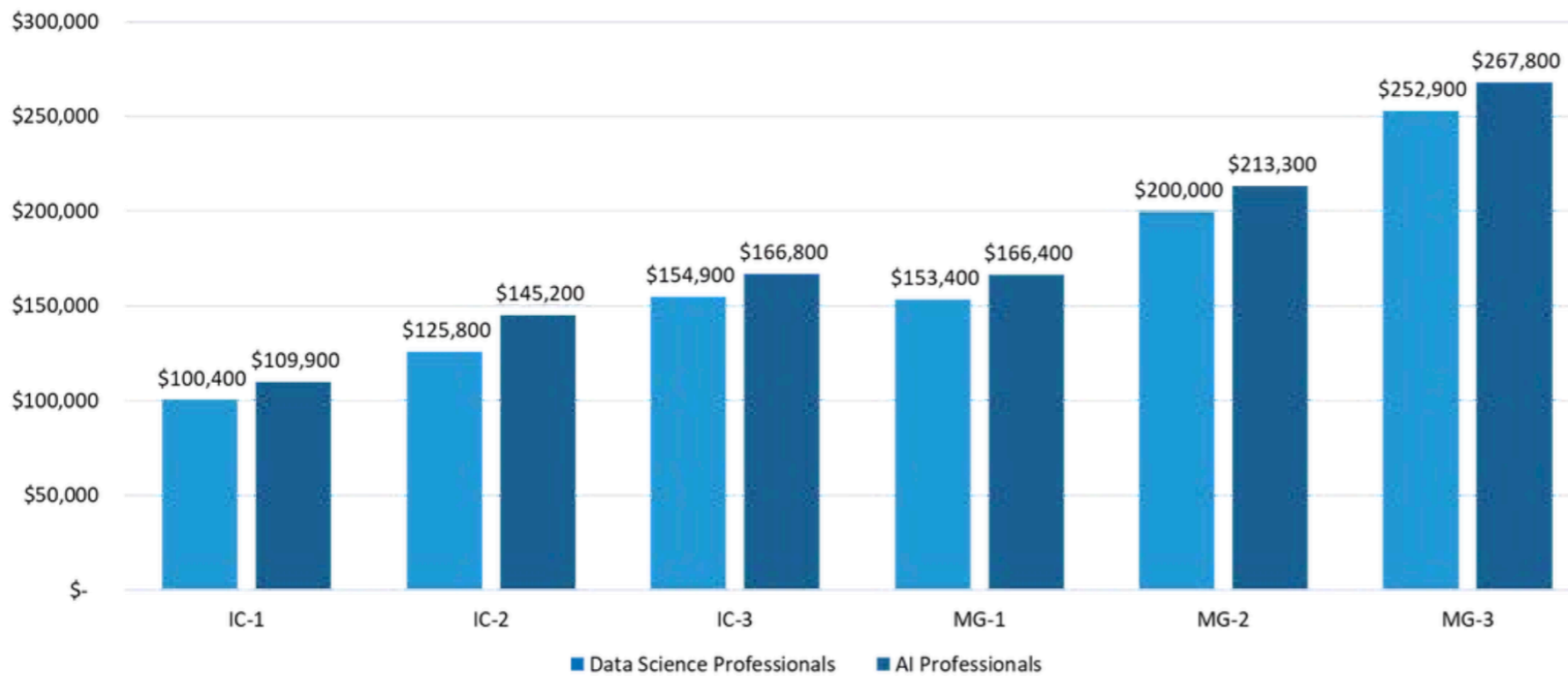Data Science is not an easy transition anymore.
- Lots of solved problems. There's a *right* way to do things
- Lots of hype to navigate
- Lots of BI tools to give laymen more power
- Need to learn how DS fits into products
- Most sectors require Software Engineer + Data Scientist

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Data Science Landscape

Statistics

Statistician

Insurance

Data Analyst

Quant

User Experience Research

Healthcare

Growth and UX Data Scientist

EdTech

AdTech

Financial Services

$**   Data Scientist   **$$$$$

Research Data Scientist

Data Steward

Oil and Gas

Database Administrator

Product Data Scientist

Aerospace

AgTech

Government Contracting

Machine Learning Engineer

Retail

Software Product Tech Companies

Software Engineer

Data Engineer

Full Stack Engineer (Web)

Software Engineering

DevOps

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Data Science Salary Progression

2023 Mean Base Salaries

Data from https://www.burtchworks.com/salary-2023

Individual Contributors

Level	Responsibility	Typical Years of Experience
IC-1	Learning the job, hands-on analytics & modeling	0-3 years
IC-2	Hands-on, advanced problems, may help train analysts	4-8 years
IC-3	Analytics SMEs, mentors and trains analysts	9+ years

Managers

Level	Responsibility	Typical No. of Reports
MG-1	Tactical, leads a small team w/in a function, project execution responsibility	1-3 reports (direct or matrixed)
MG-2	Leads a function, moderately sized team, executes strategy	4-15 reports (direct or matrixed)
MG-3	Senior/executive management, determine strategy, large team	15+ reports (direct or matrixed)

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Data Science Salary Progression

Base Salaries by Degree Level for Data Science Individual Contributors

Job Level	Education	Base Salary			
		25%	Median	Mean	75%
IC-1	Bachelor's	$75,300	$88,300	$93,693	$110,000
	Master's	$80,200	$100,000	$100,883	$120,000
	PhD	$100,000	$119,000	$121,623	$137,600
IC-2	Bachelor's	$95,150	$110,200	$115,176	$130,200
	Master's	$106,650	$130,000	$127,637	$150,000
	PhD	$122,500	$150,000	$144,755	$170,000
IC-3	Bachelor's	$120,000	$150,000	$150,205	$170,000
	Master's	$130,000	$158,000	$156,078	$180,000
	PhD	$133,600	$160,000	$159,357	$180,050

Job Level	Region	Base Salary			
		25%	Median	Mean	75%
IC-1	Midwest	$75,300	$85,300	$90,343	$100,000
	Mountain	$95,000	$105,000	$110,195	$123,750
	Northeast	$83,500	$105,000	$106,050	$130,000
	Southeast	$80,000	$90,000	$92,877	$105,300
	West Coast	$100,000	$110,100	$115,431	$130,000
IC-2	Midwest	$90,000	$108,000	$114,231	$135,300
	Mountain	$110,000	$130,000	$128,308	$150,000
	Northeast	$110,150	$130,200	$131,374	$150,000
	Southeast	$95,225	$117,650	$120,133	$146,475
	West Coast	$107,750	$130,000	$129,726	$140,000
IC-3	Midwest	$110,300	$140,000	$139,568	$160,000
	Mountain	$125,150	$150,000	$145,593	$165,100
	Northeast	$137,300	$160,200	$161,502	$180,000
	Southeast	$140,000	$145,100	$152,918	$175,000
	West Coast	$150,000	$175,000	$171,705	$200,000

Job Level	Industry*	Base Salary			
		25%	Median	Mean	75%
IC-1	Advertising/Marketing	$72,650	$80,000	$84,878	$95,000
	Consulting	$80,250	$100,000	$102,718	$120,050
	Financial Services	$85,000	$108,000	$106,783	$125,150
	Healthcare/Pharma	$85,300	$100,000	$100,517	$112,500
	Retail & CPG	$75,200	$90,300	$91,455	$100,000
	Tech/Telecom/Gaming	$95,300	$110,000	$114,729	$133,950
	Corporate – Other	$83,500	$100,000	$102,116	$120,000

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A Typical Career Progression

1. Figure out what **sector** and job type to target
2. Get first job
   1. Can take 6-12 months, assuming you already have basic skills
   2. Interview a lot, even jobs you don't want ("Sorry, it's not a good fit")
   3. Build portfolio project with half the time you are applying
3. Spend 2-3 years learning the industry and up-skilling
   1. Maybe +2 if low technical skills like programming
4. Change jobs or get promotion
5. Work 1 year at new position to learn and understand it
6. Re-evaluate career goals. Maybe return to step 4/5.
7. Spend 2-5 years learning industry from new perspective and *larger context*
8. Get promoted to senior or change jobs to senior
9. Decide if you want to chill, go staff > principle IC, or Management > Drive Revenue

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Tips for getting the first job

1. Identify and learn necessary skills
    1. For data science this is SQL, Python, Linux, ETL, datalake/warehouse tools (Databricks, etc.)
2. Use back channels
    1. Find job you like
    2. Find recruiter for that company on linkedin, send message and resume
    3. They will ask you to apply if you are worth an interview
3. Look into paid internships
4. Build a project while job hunting. Showcase on resume
5. Make resumes short, let them fill in the blanks they want, **sell yourself**

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Resources For study

Online Resources for Data Science:

SQL Zoo
Leetcode*
AWS Fundamentals of Cloud Computing
Miguel Grinberg: Flask Mega Tutorial**

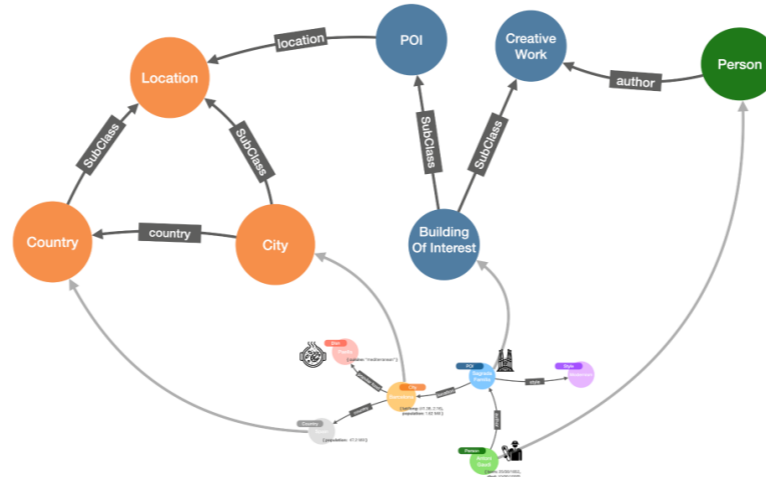Dylan Frizzell dylan.c.frizzell@gmail.com
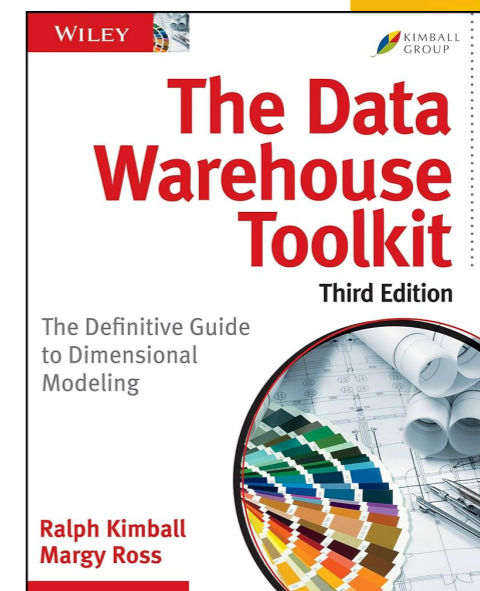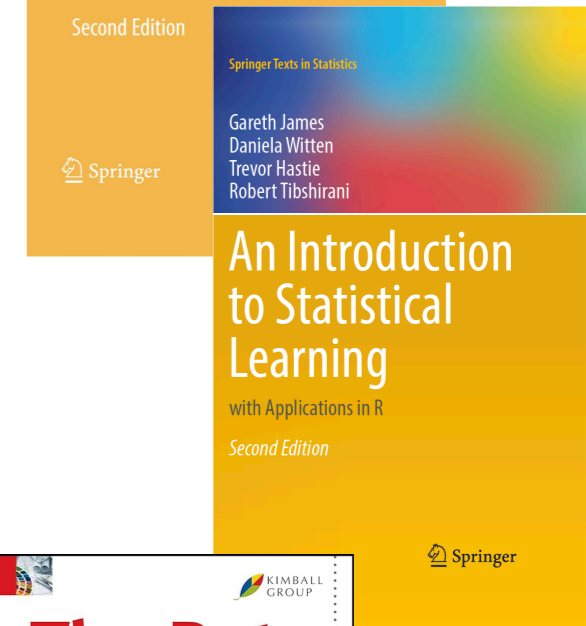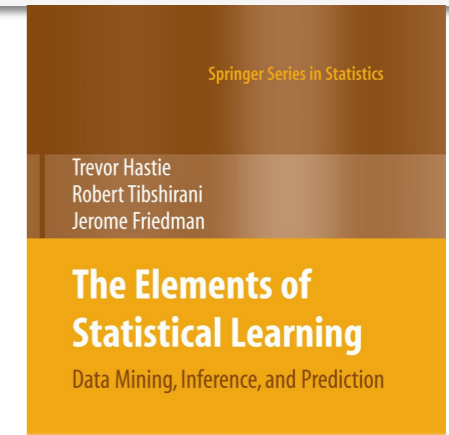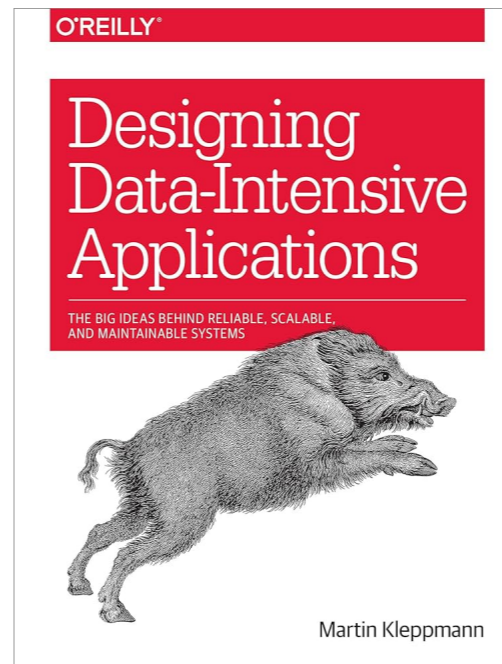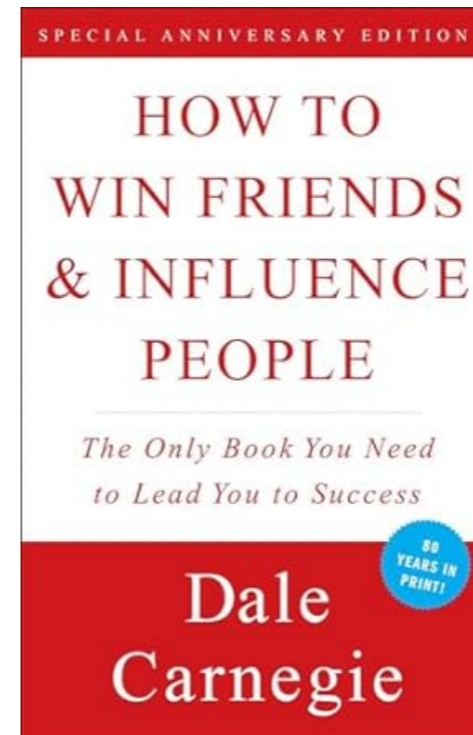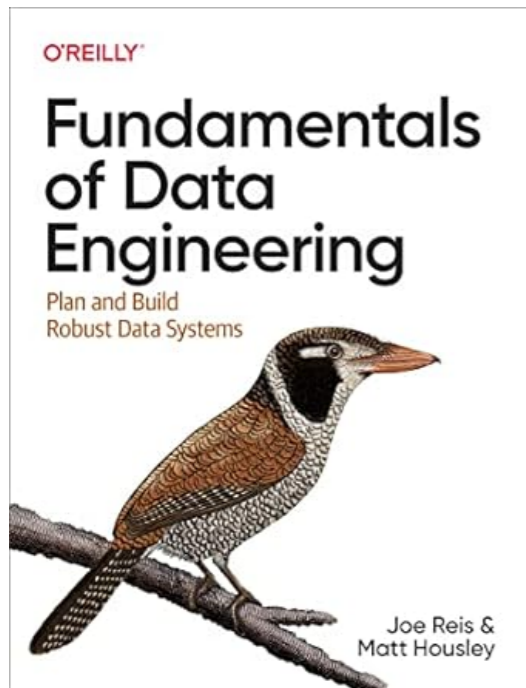
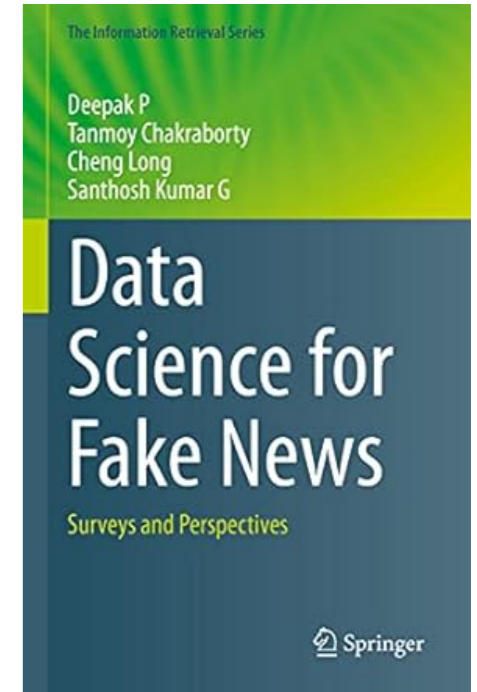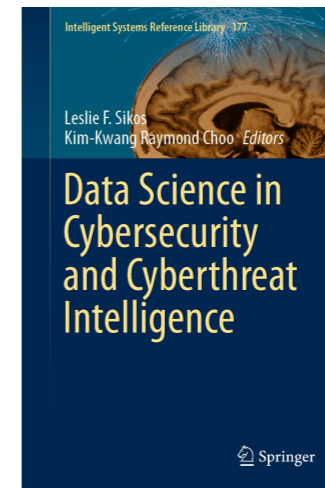# Current Hot Topics in Data Science

ChatGPT

GenAI

Network Analytics, knowledge graphs, and Ontologies

Hate Speech and PsyOp

CyberSec

Healthcare
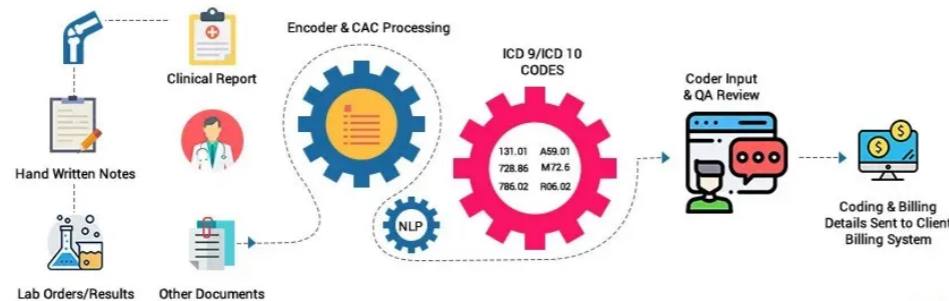
IoT
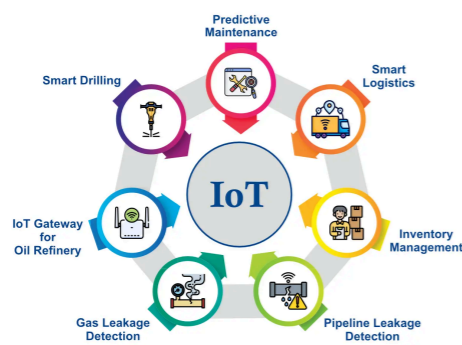
Information Embeddings

(image from https://www.mdpi.com/2313-433X/7/8/125)
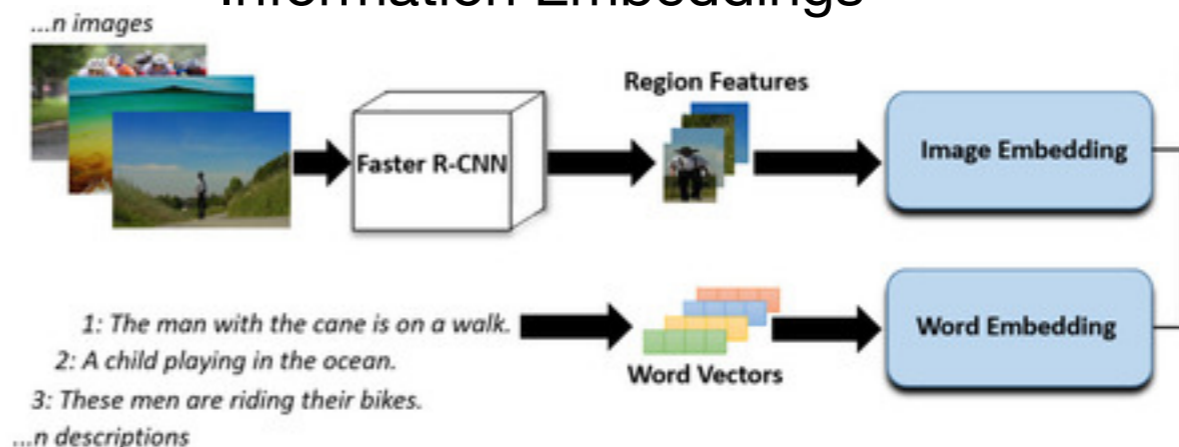
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Key Advice From My Perspective

- Data Science is not as much about deep understanding of underlying phenomenon
- ALWAYS have a mentor
- Company size will play a HUGE factor
- Salary Negotiations (all negotiations) are all about alternatives
- Data Science, and other high paying jobs are surrounded in hype and shills
- Be honest with yourself on your skillset, how much you want to work, and salary goals
- Don't go too fast
- Don't bring your frustrations to work. Toxic employees will get canned.
- Remove "I" and "You" from vocabulary. It is "We" and "Us". All things are done as teams
- Know how your business makes money. Who is the customer (real customer)? How does what you do make $?
- Learn "Sales". Single most important "missing" skill from physics
- Industry culture is more pressure, much faster paced (company size dependent).
- Remote work has pros and cons.

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Questions

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General Data Science Antipatterns

- Know where to be on the "fast and loose" versus "overly structured" spectrum
- Don't start a data science model building effort without knowing the resolution needed and estimated what is possible from the data
- Don't neglect data collection and quality
- Look at the data distributions
- Consider the effect of time on covariance of data and out of sample errors

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