Computing skills for a career post-PhD

Dr. Egidijus Kukstas, Research Fellow in Data Intensive Science

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Motivation

- By now, you (hopefully) have a CV and a basic understanding of how to sell your skills as a future PhD holder

- If you've decided that a career in academia isn't for you, it can feel like a step into the unknown

- This session is aimed at covering the basics of what possible (far from comprehensive list) careers are out there for your skillset and what skills are required for these careers

- How useful this session is depends on your prior knowledge; if you take away even one useful idea – I'll be happy!

- **Please interrupt to contribute your own perspective and ask questions!**

Contents

- What tech careers are a natural progression from a PhD in Physics/STEM sciences?

- What skills do you need to be able to demonstrate to successfully get a position?

- Lay of the land in tech: what tools/skills are popular and rising?

- Interview process

- Conclusions

A lot of what I'm going to talk about is based on Oreilly's annual trends report, AI in the enterprise survey results, StackOverflow user survey, and the UK government's data skills gap report.

I'm finishing my PhD, where do I go next?

- Postdoctoral researcher
- Software engineer
- App/game developer
- Web developer
- Systems engineer
- Digital marketing (SEO) coordinator
- Account manager
- Scientific writer
- Business analyst

- Data Scientist/Analyst
- Data engineer
- Data architect
- ML engineer
- MLops engineer
- Business intelligence analyst
- Etc. etc…

Required skills

Data Scientist

- Python / R / SQL
- Version control
- Machine learning
- Modelling
- Statistics
- Numeracy
- Problem solving
- Communication

Software developer

- Programming (various languages)
- Version control
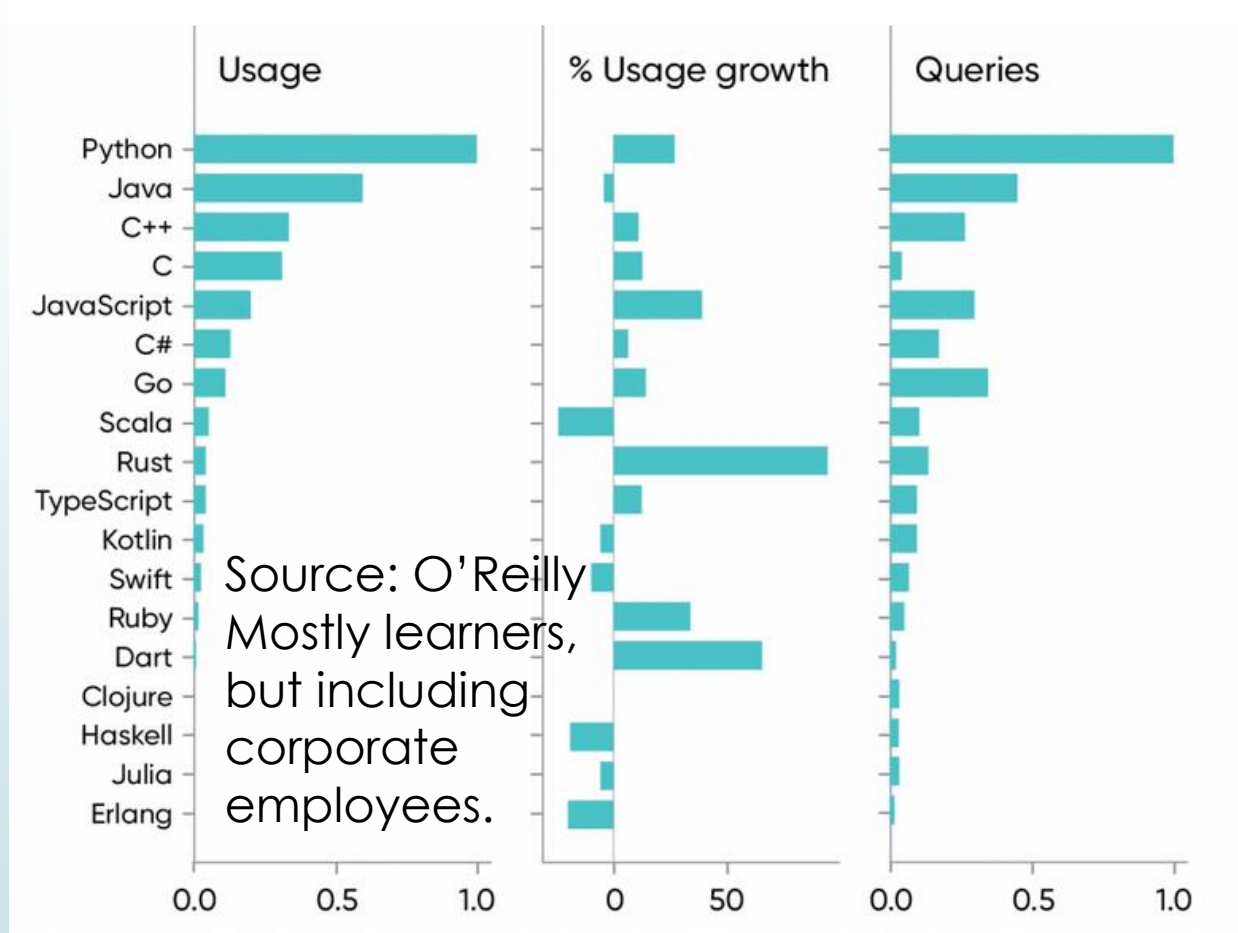- Numeracy
- Problem solving
- Communication

Project manager

- Project management methodologies (Agile, Waterfall, etc.)
- Organisation
- Communication
- Time management
- Excel/Word/Powerpoint
- Eye for detail
- Ability to collaborate
- Accountability and responsibility
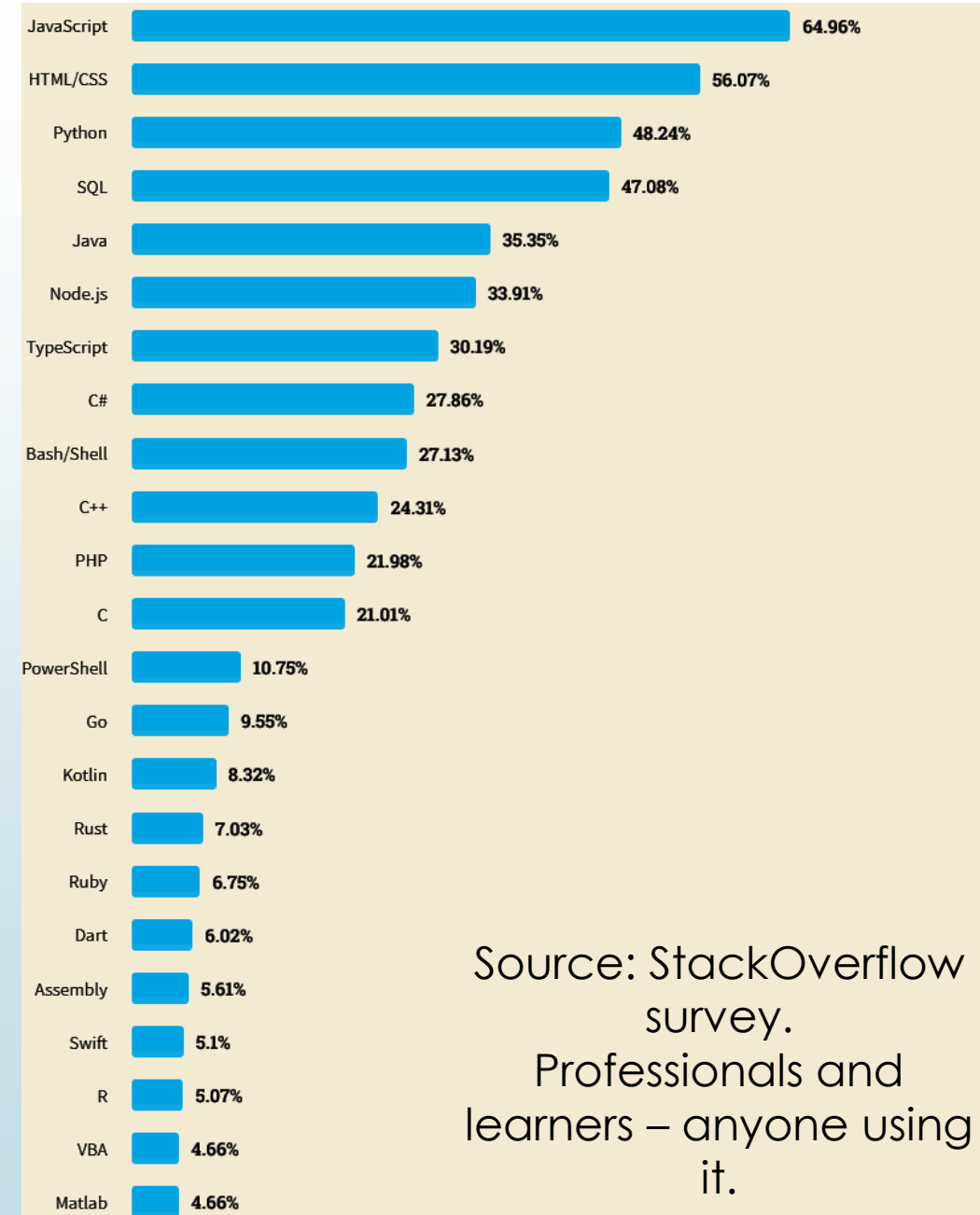- Communication

Not a complete list in any category. Every role is slightly different.

Main point: there is a lot of overlap and you have most of them.

The best way to demonstrate your ability is by having a **portfolio of projects** to talk about in detail.

# What technologies are popular and rising?

Programming languages

Source: O'Reilly
Mostly learners, but including corporate employees.

Note: MATLAB appears low down if at all.

|	
JavaScript	64.96%
HTML/CSS	56.07%
Python	48.24%
SQL	47.08%
Java	35.35%
Node.js	33.91%
TypeScript	30.19%
C#	27.86%
Bash/Shell	27.13%
C++	24.31%
PHP	21.98%
C	21.01%
PowerShell	10.75%
Go	9.55%
Kotlin	8.32%
Rust	7.03%
Ruby	6.75%
Dart	6.02%
Assembly	5.61%
Swift	5.1%
R	5.07%
VBA	4.66%
Matlab	4.66%

Source: StackOverflow survey.
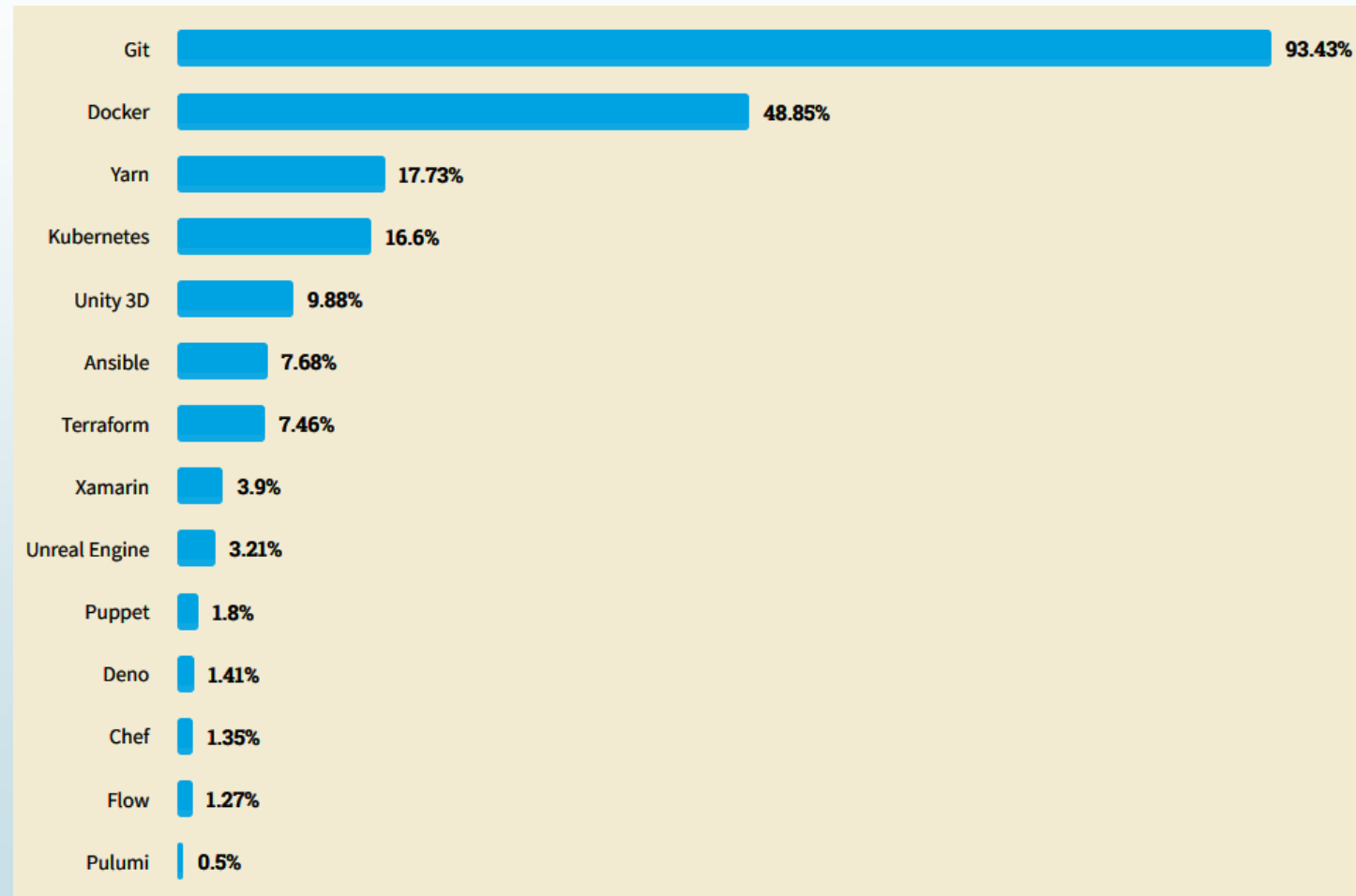Professionals and learners – anyone using it.

Databases

- All the flavours of SQL!
- A common requirement for DS roles – rarely specific on the flavour.
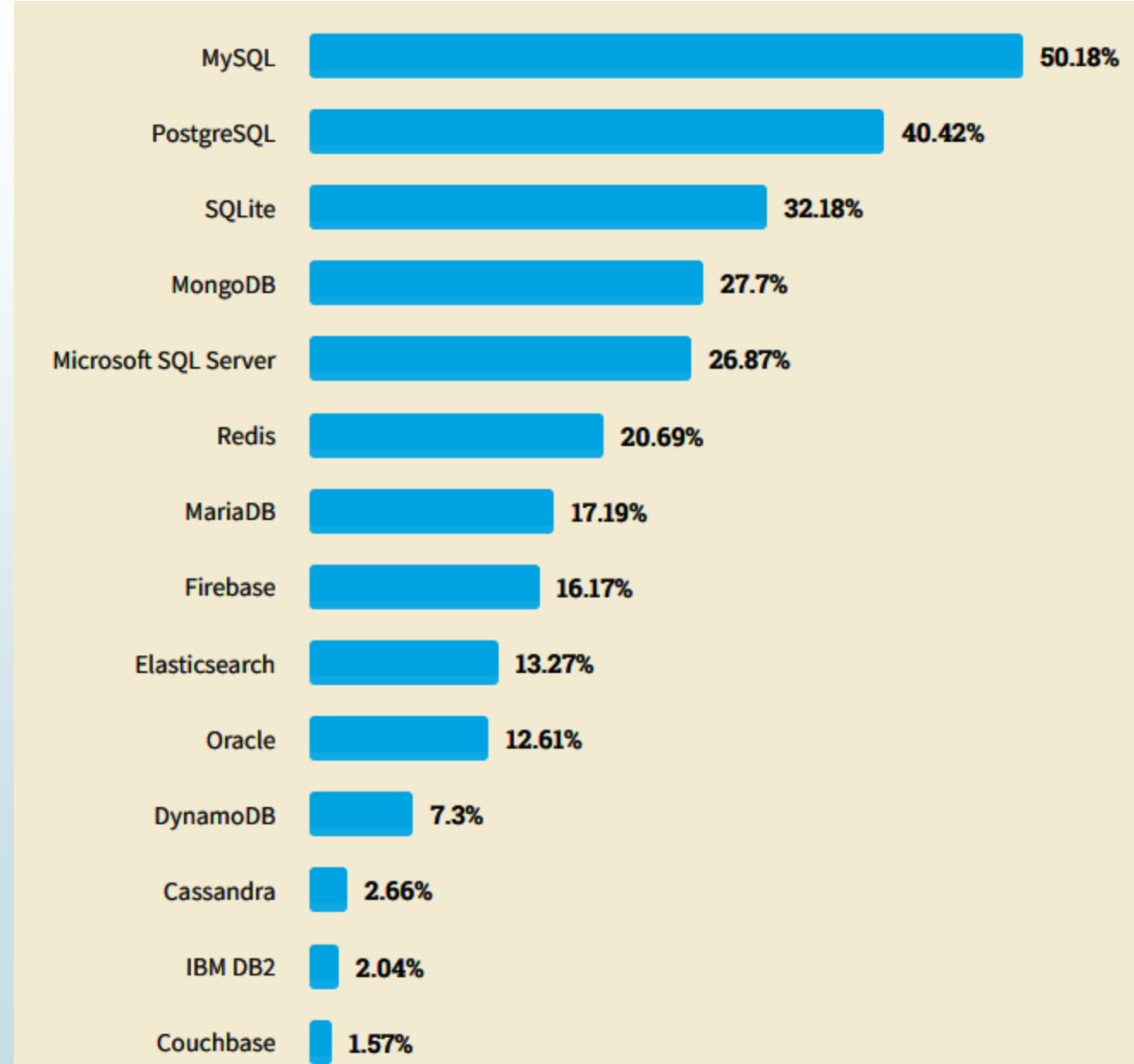
Deployment
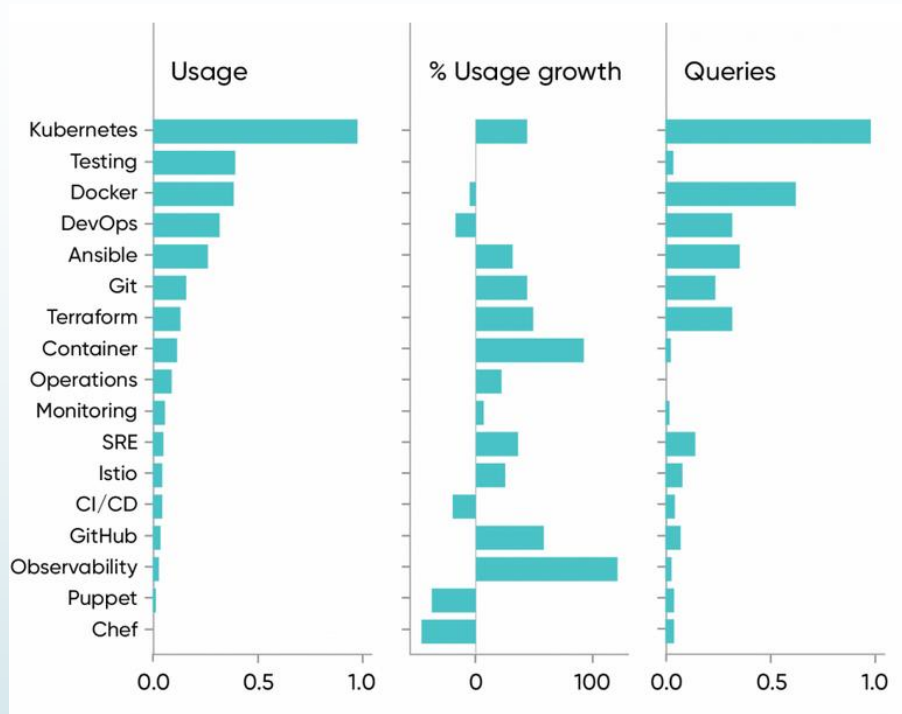
Cloud computing and 'Function as a Service' has changed IT operations over the last decade. Deploying software involves containerisation and management still, just in a different way.
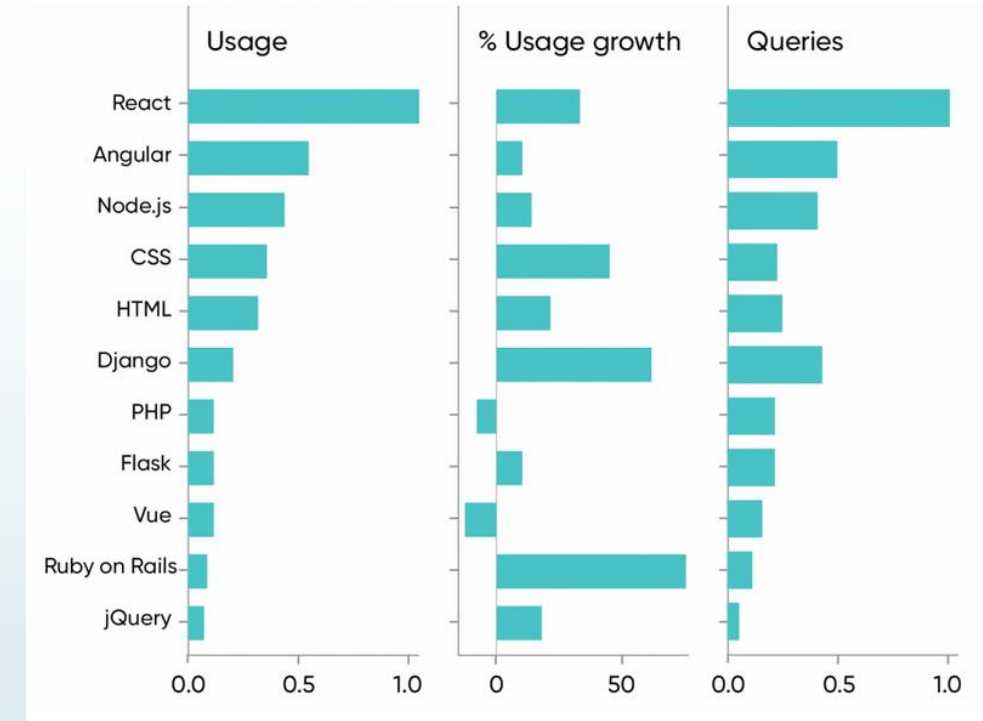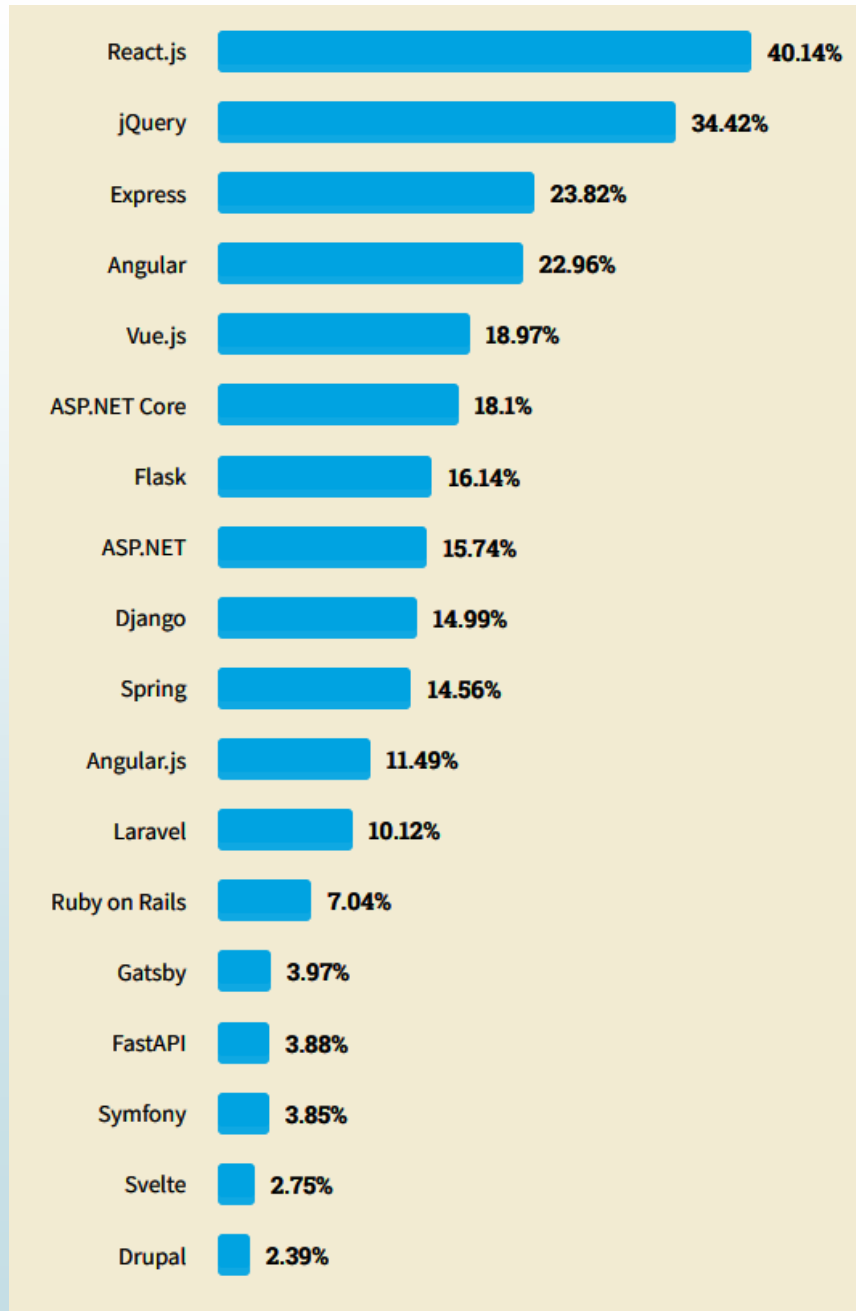
Machine Learning

AI = ML in this instance.
To quote O'reilly: "ML is the part of AI that works"

The field is maturing: focus is shifting from basic applications to more advanced techniques.
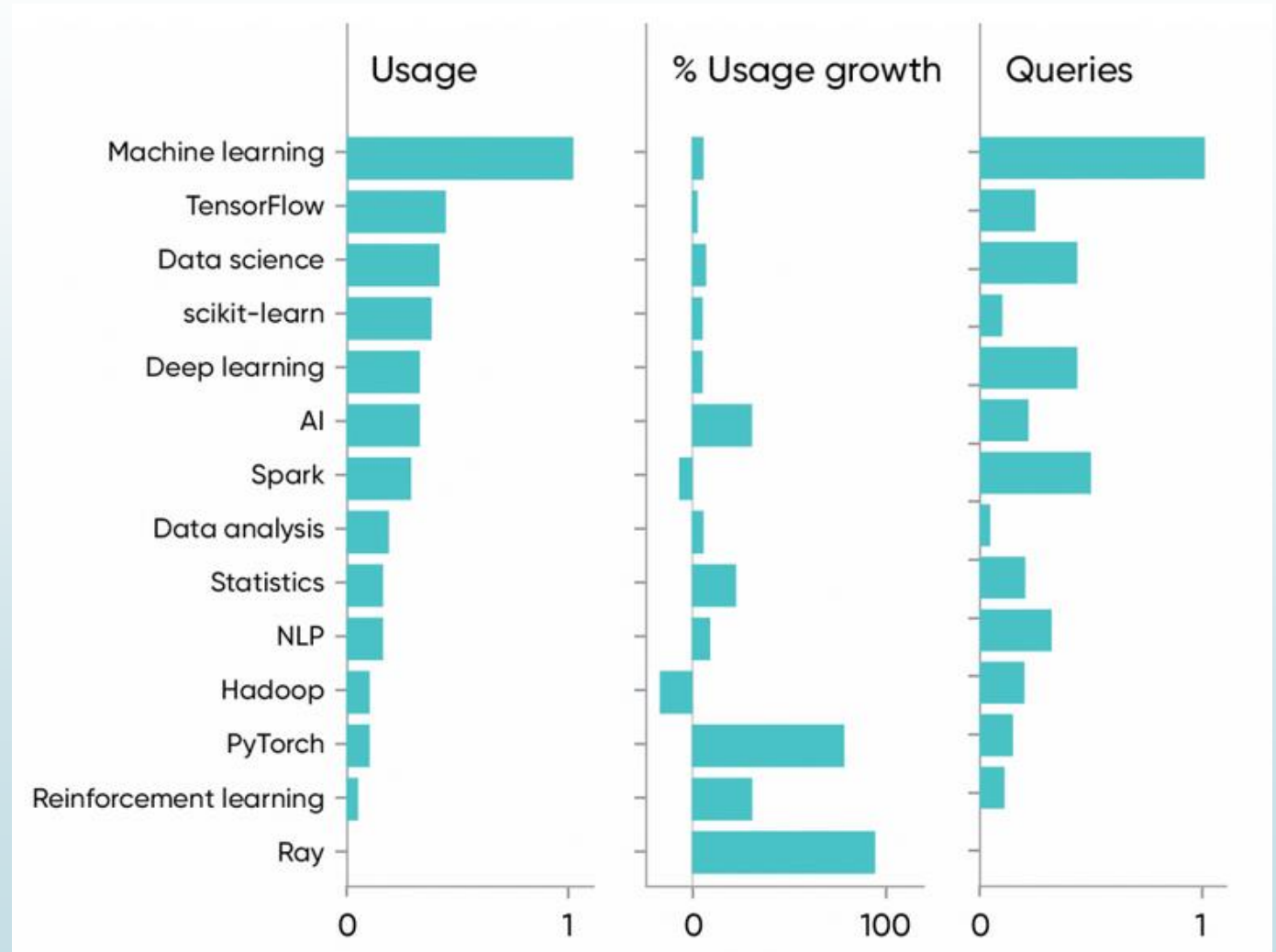
Web development

Frameworks are growing more in popularity, while languages themselves are holding steady growth. Application development for a wide range of platforms is here to stay.

Cloud computing

- AWS is the main player but Azure and Google cloud are catching up.

- Whatever happens, cloud computing is the new norm and everyone in tech will need some familiarity with it.
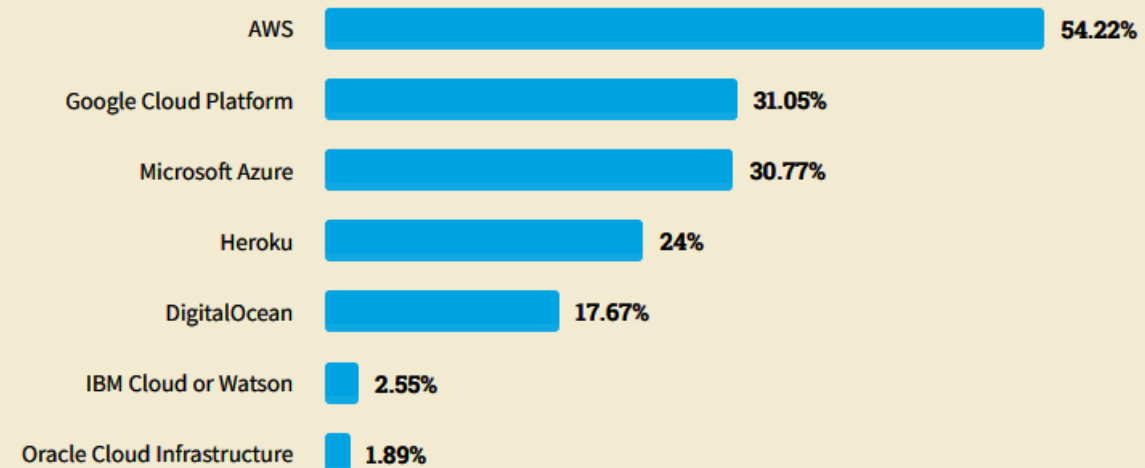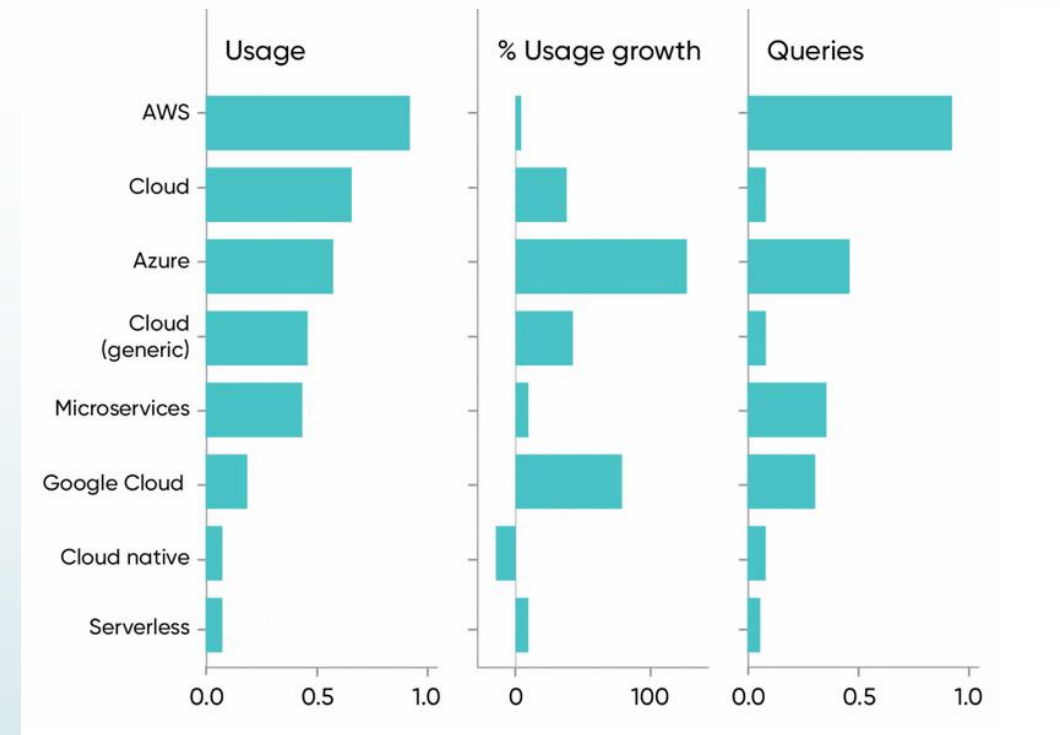
Machine learning: here to stay or a fad?

- The hype associated with ML/AI has been immense the last couple of years

- Will this last or is it just a fad?

- Nobody really knows!

- My take: the hype will fade but there is some genuinely useful applications that will not go away any time soon. ML applications will stay where they deliver genuine value whereas ML for ML's sake will fade as companies learn how useful it is to them. The number of practitioners will likely decline, accordingly.

- Let's look at some current trends to get a better picture of what it's like right now.

- The following comes from O'Reilly's "AI adoption in the enterprise" survey which was sent out to their newsletter subscribers.

Machine learning: industries
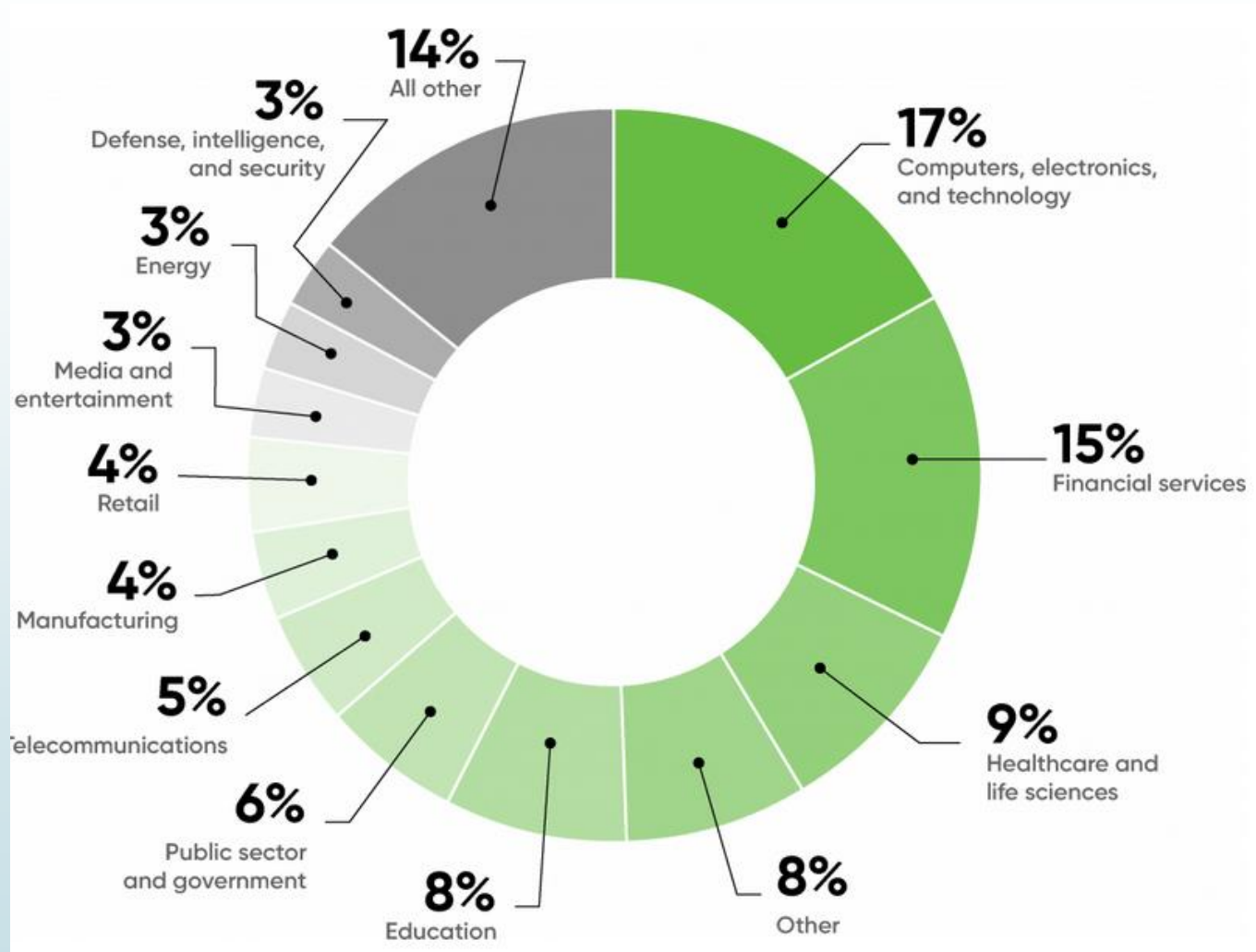
The use of ML is becoming widespread. Size is correlated with early adoption.

Machine learning: Maturity
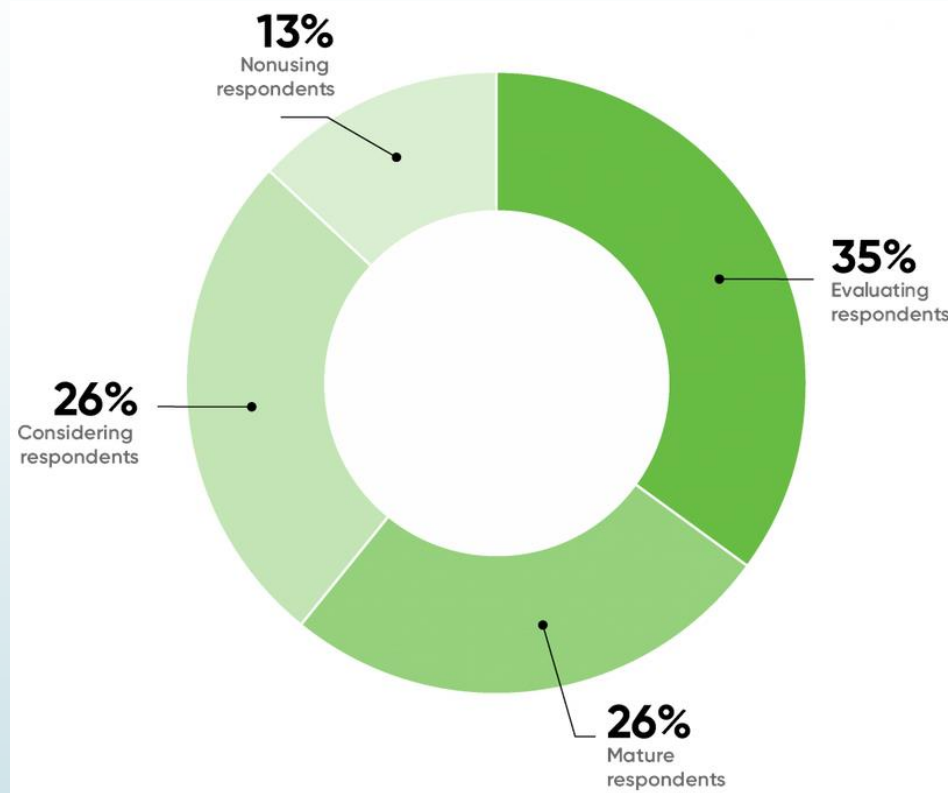
Mature means that companies are extracting real, tangible value from their ML models. This requires teams of Data engineers, scientists, MLOps, and so on.
The demographic in this survey is skewed towards the US, which appears to be ahead of the curve in DS.

Machine Learning: Bottlenecks
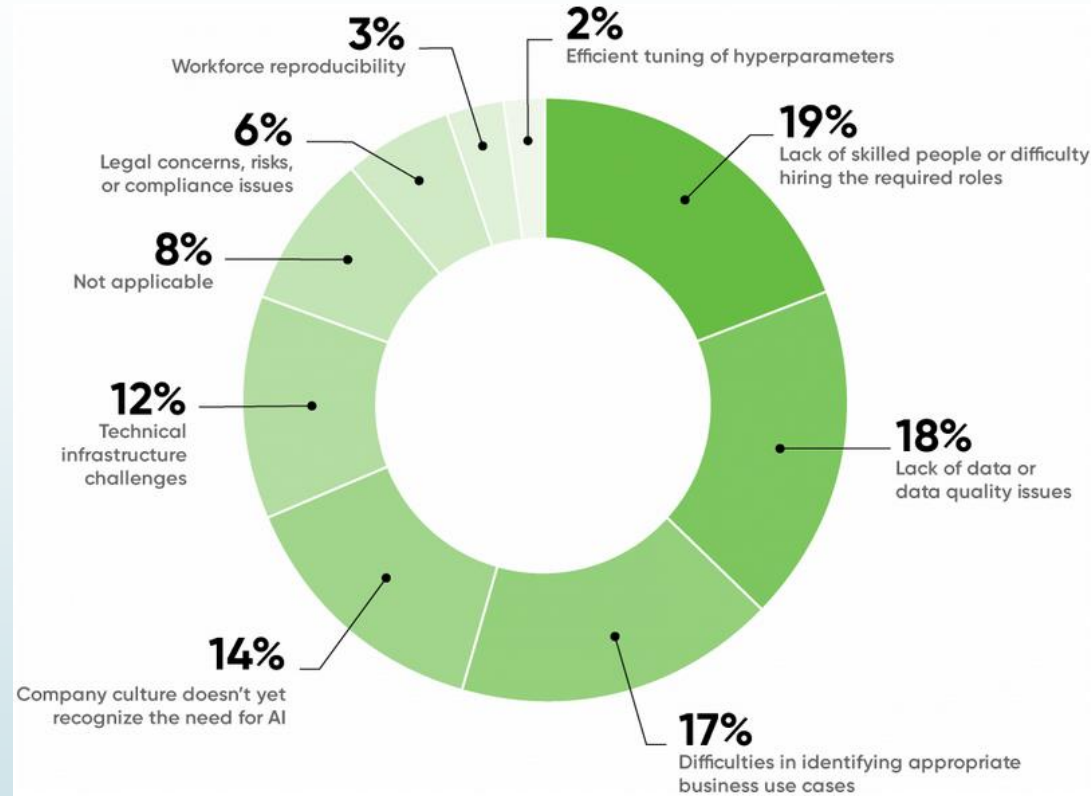
'Lack of skilled people' overtook 'lack of data' for the first time last year.

Machine Learning: Methods and Data
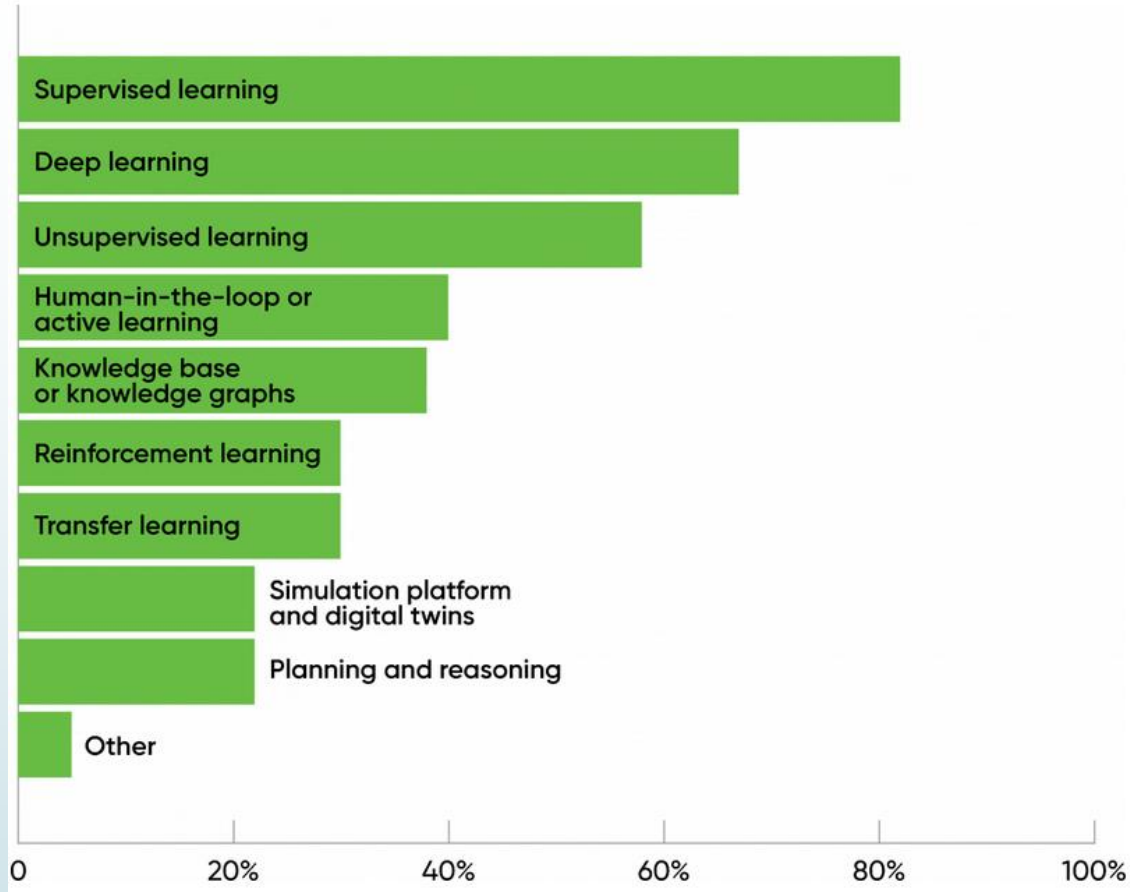
Answers from respondents who are in the 'mature' stage of ML adoption.
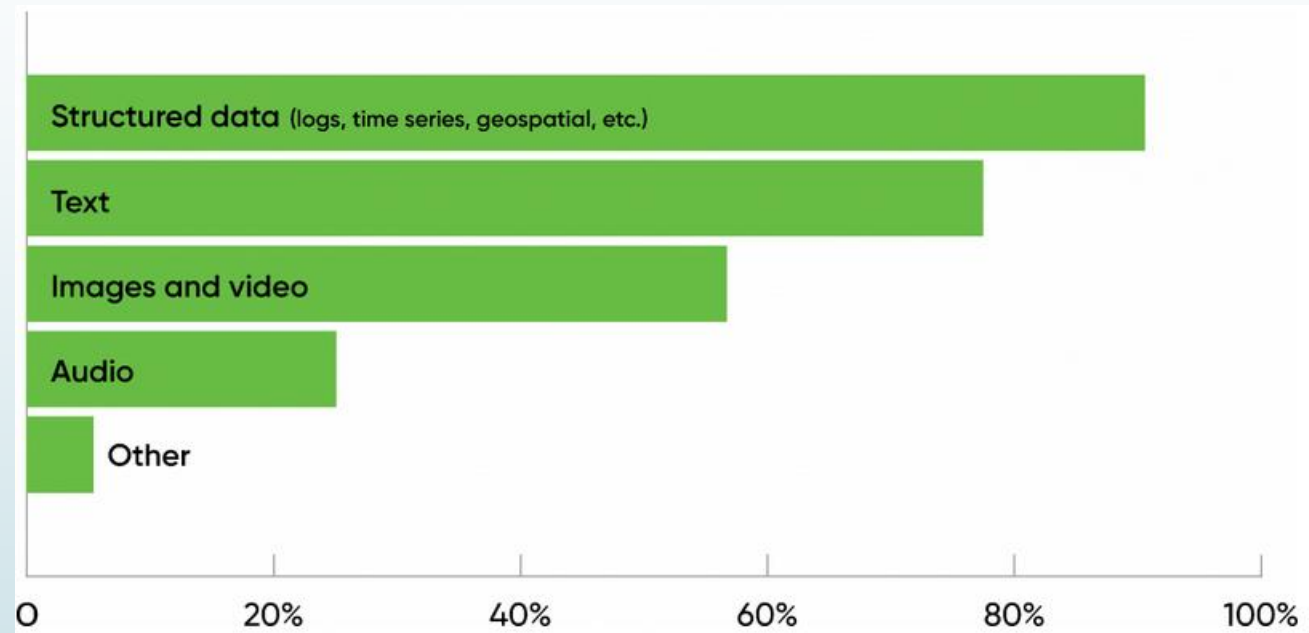Even there, relatively simple algorithms on structured data (logs, time series, geospatial data) dominate.
Deployment, monitoring, version control of the models is still in early stages (compared to code) but a real concern for the practitioners and leadership alike.

Interviews

- Tech interviews tend to be multi-stage, extended ordeals (but application process normally as simple as uploading a CV)
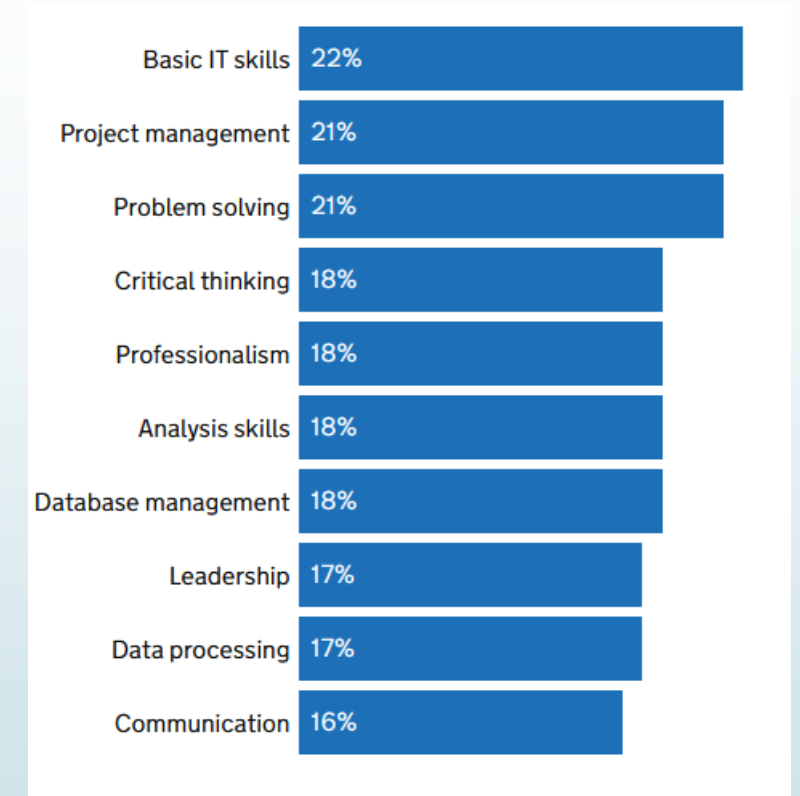
  - Stage 1: a 'chat' with the recruiter/talent acquisition staff to gauge suitability (e.g. motivation, location, salary expectations)

  - Stage 2: a technical interview with mid-ranking staff to gauge your technical skills. This will mostly involve you talking about your experience (usually a project) in detail.

  - Stage 3: a technical interview where you solve a case study/do live programming/perform a take-home assignment

  - Stage 4: final interview by senior staff/hiring manager. This is usually where you negotiation your salary.

  Stages 2 and 3 can often be combined into one. There is quite a bit of variation.

- Advice:

  - prepare to discuss one of your projects in good detail.

  - Give yourself enough time if possible: one interview process can easily take over a month. If you have further constraints (e.g. geographical) then it will take even longer due to fewer options.

  - Rule-of-thumb: give yourself 6 months to find your next job

Conclusion

- As job prospects go, you are all in a great position to have successful careers in academia or industry:
  - You're highly educated
  - Have many skills that are in demand
  - Have practical experience
  - The economy's doing alright
- Getting a job you want is all about 'selling' what you have to offer: make the employers see that you're more than just a title

Skill	%
Basic IT skills	22%
Project management	21%
Problem solving	21%
Critical thinking	18%
Professionalism	18%
Analysis skills	18%
Database management	18%
Leadership	17%
Data processing	17%
Communication	16%

Top 10 skills UK business are in need of

■ Discussion forums can be good at finding info. I find r/datascience/, r/cscareerquestions/ informative (exercise caution – it's the internet, afterall!); others are available – have a search, you are not the first or last!

Data Science Job Search UK

Applied: 59 → Initial Screen: 25 → Technical Interview: 10 → Final Interview: 4 → Offer: 1 / No Offer: 3

Notes
1. This job search took place over 5 months from July 2021 to December 2021.
2. I dropped out of some roles at various stages due having the luxury of being picky.
3. I did about 5 take home tasks and was due to do more.
4. I was in several interview processes that I dropped out of once I got an offer.
5. Most of the jobs were Data Scientist but some were a form of Data/Analytics/ML Engineer.
6. Assume a +/-5 jobs uncertainty on "Applied" and "Initial Screen" as I didn't always track every job.

Links to the resources used to make this presentation

- https://www.oreilly.com/radar/where-programming-ops-ai-and-the-cloud-are-headed-in-2021/

- https://www.oreilly.com/radar/ai-adoption-in-the-enterprise-2021/

- https://insights.stackoverflow.com/survey/2021#most-popular-technologies-language

- https://www.gov.uk/government/publications/quantifying-the-uk-data-skills-gap/quantifying-the-uk-data-skills-gap-full-report#executive-summary