Introduction to Data Science

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Contents

What is Data Science?

What is Data Science?

Mathematics and
Statistics / Operational Research

Computing and
Software Engineering

Visualisation and
Communication Skills

Domain expertise

What is Data Science?

A problem-solving approach
based on the scientific method

What does Data Science deal with?

Problems!

Can we improve…

- The quality of offers we send to our customers?
- Road safety?
- How we identify people at high risk of cancer?

What does Data Science deal with?

Predictions?

How likely…

- Is a customer to respond to some offer?
- Are traffic accidents to occur in a certain area?
- Is a person to develop cancer in the next 10 years?

What does Data Science deal with?

Mechanisms?

Why…

- Does a customer decide to respond to some offer?
- Do traffic accidents occur regularly in certain areas?
- Do people develop cancer?

What is Data Science?

Statistics

- Predates computers
- Understand why something happens in the face of uncertainty

Machine Learning

- ‘Algorithmic modelling’ (L. Breiman)
- Computers can learn rules without explicit programming

Deep Learning

- Less structured inputs
- Computers can learn structure without explicit programming

What is Data Science?

	Predictions	Mechanisms
Analysis	**Descriptive** What's happening?	**Diagnostic** Why is it happening?
Building	**Predictive** What's likely to happen?	**Prescriptive** What do I need to do?

Recap

Data Science is…

- Evidence-based problem solving and decision-making
- Multidisciplinary but domain-driven
- Analysis-focused or building-focused

Who is a Data Scientist?

Who is a Data Scientist?

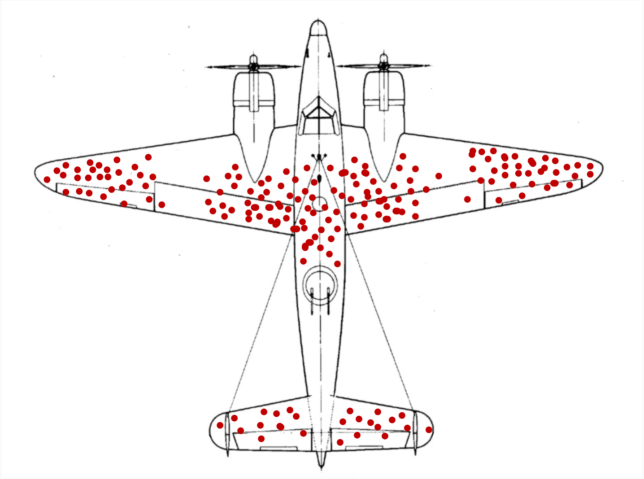
Someone who can…

- Get a ‘feel’ for the data
- Communicate effectively
- Work well in a team

What's this 'feel' for the data?

- Passion for the domain
- Curiosity about the data
- Intuition and creativity
- Common sense
- Rigour and accuracy
- Relevance

What's this 'feel' for the data?

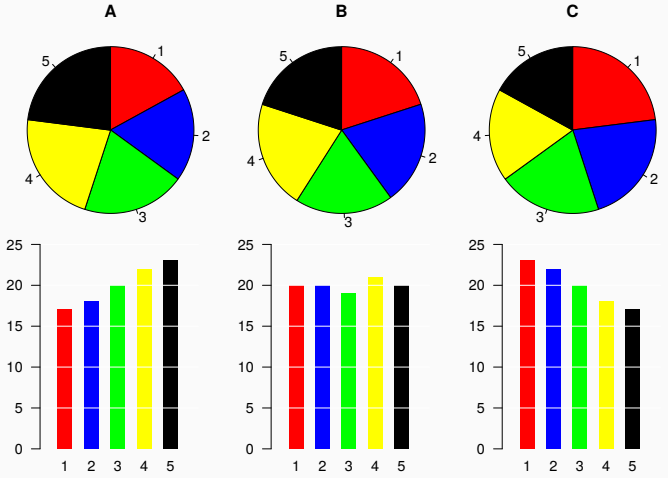


Via *Wikimedia Commons*

How do I communicate effectively?

- Condense findings into recommendations
- Use storytelling techniques and visual aids
- Understand limitations and don’t overstate results

How do I communicate effectively?



Via *Wikimedia Commons*

The ‘PR problem’ of Data Science

Inevitably the data are…

- Not quite what you need to solve your problem
- Too limited, too large, too inaccurate, too expensive to obtain…

But (eventually) you…

- End up with a ‘nice’ dataset
- Apply some models

…and it looks incredibly easy from the outside!

What's it like to be a Data Scientist?

Data Science workflow

1. Define the problem
2. Obtain the data
3. Clean and explore the data
4. Model the data
5. Summarise the results

Time allocation

Which takes longer?

Time allocation

In decreasing order…

1. Defining the problem
2. Obtaining the data
3. Cleaning and exploring the data
4. Managing expectations
5. Summarising the results
6. Learning new things
7. Modelling

Modelling misconceptions

Most well-executed data science projects don't…

- Use complicated tools
- Fit complicated models

Instead, they do…

- Focus on solving the problem
- Use appropriate — not necessarily big! — data
- Use relatively standard models
- Interpret results sceptically

The 80—20 rule of modelling

- The first reasonable thing you can do goes 80% of the way
- Everything after that is to get the remaining 20%…
  often at additional cost!

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Is it worth it?

Caveat

The Data Science workflow is

non-linear and iterative

Recap

A successful Data Scientist…

- Is insatiably curious — and a bit stubborn!
- Never stops learning
- Is a practical, impact-driven, dependable person
- Can tell a story
- Knows the limitations of Data Science