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Tools of the Trade

Session 1

Session Outline

Understanding Big Data
The Five V's
Developing The Future
How It Works
Using Big Data in your Role
Advantages and Disadvantages
Big Data Products
Data Platforms
Platforms vs Coding Yourself
Recap

Learning Objectives

- Understand fundamental concepts of **Big Data**
- **Justify** the use (or lack of) Big Data technologies in your analysis
- Critically evaluate the differences in using a **Data Platform** and **Coding it Yourself**

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Understanding Big Data

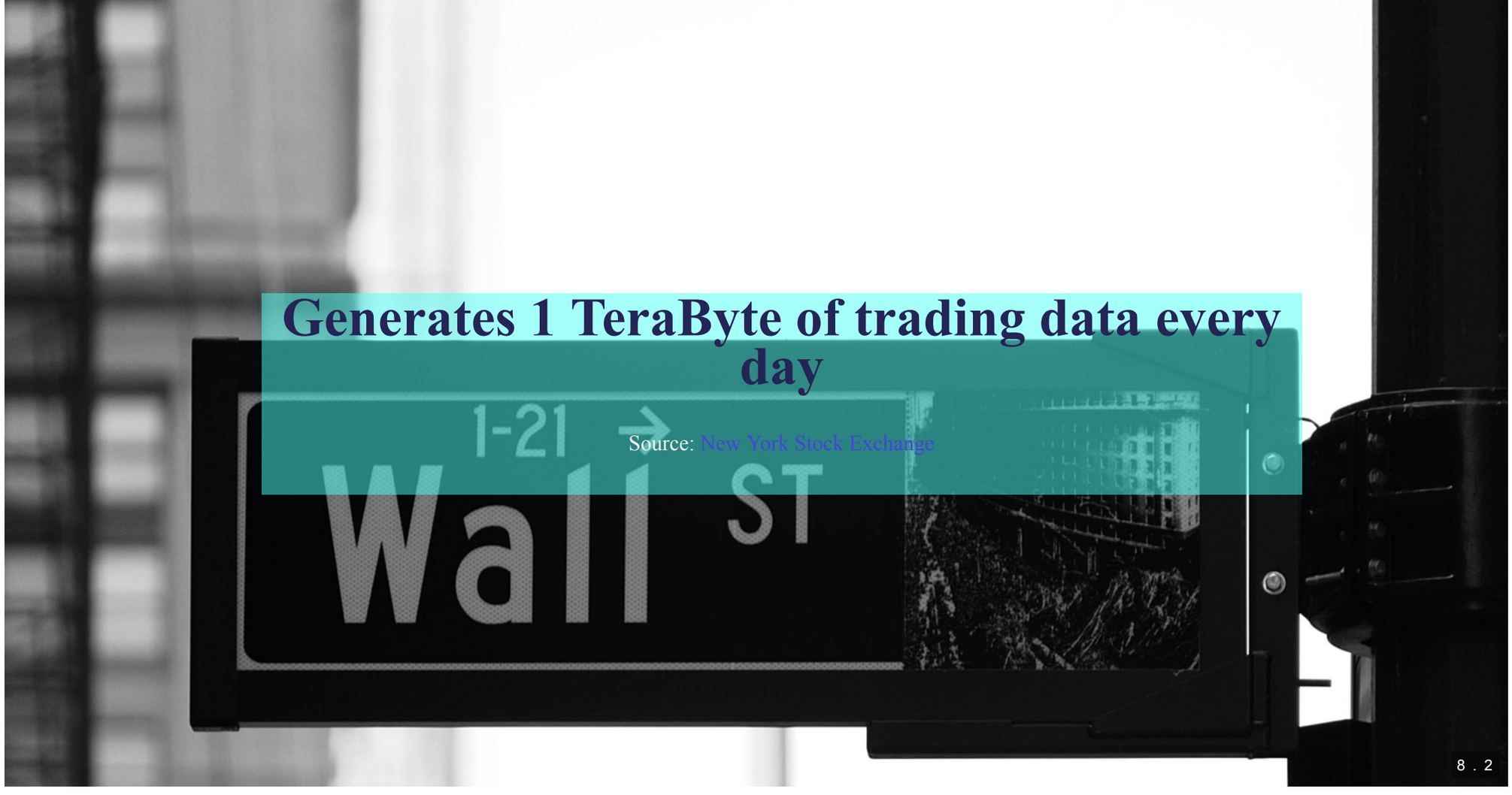
What is Big Data?

Big Data is data whose scale, distribution, diversity and or timeliness require the use of new technical architectures and analytics to enable insights that unlock new sources of business value.

McKinsey & Co.; Big Data: The Next Frontier for Innovation, Competition, and Productivity

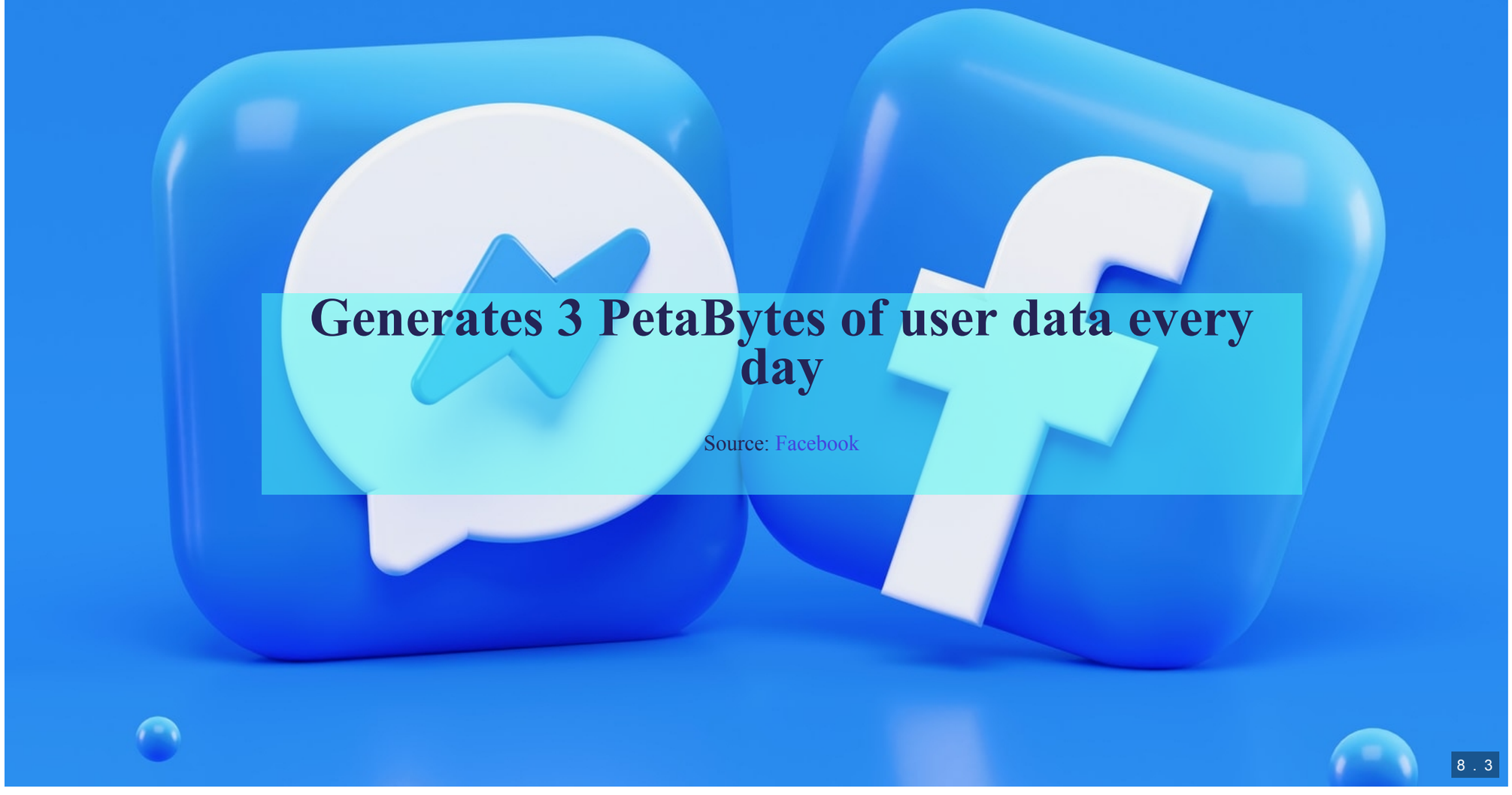
Generates 500 million Tweets every day

Source: Internet Live Stats



Generates 1 TeraByte of trading data every day

Source: New York Stock Exchange



Generates 3 PetaBytes of user data every day

Source: Facebook

79% of enterprise executives agree that companies that do not embrace Big Data will lose their competitive position and face extinction

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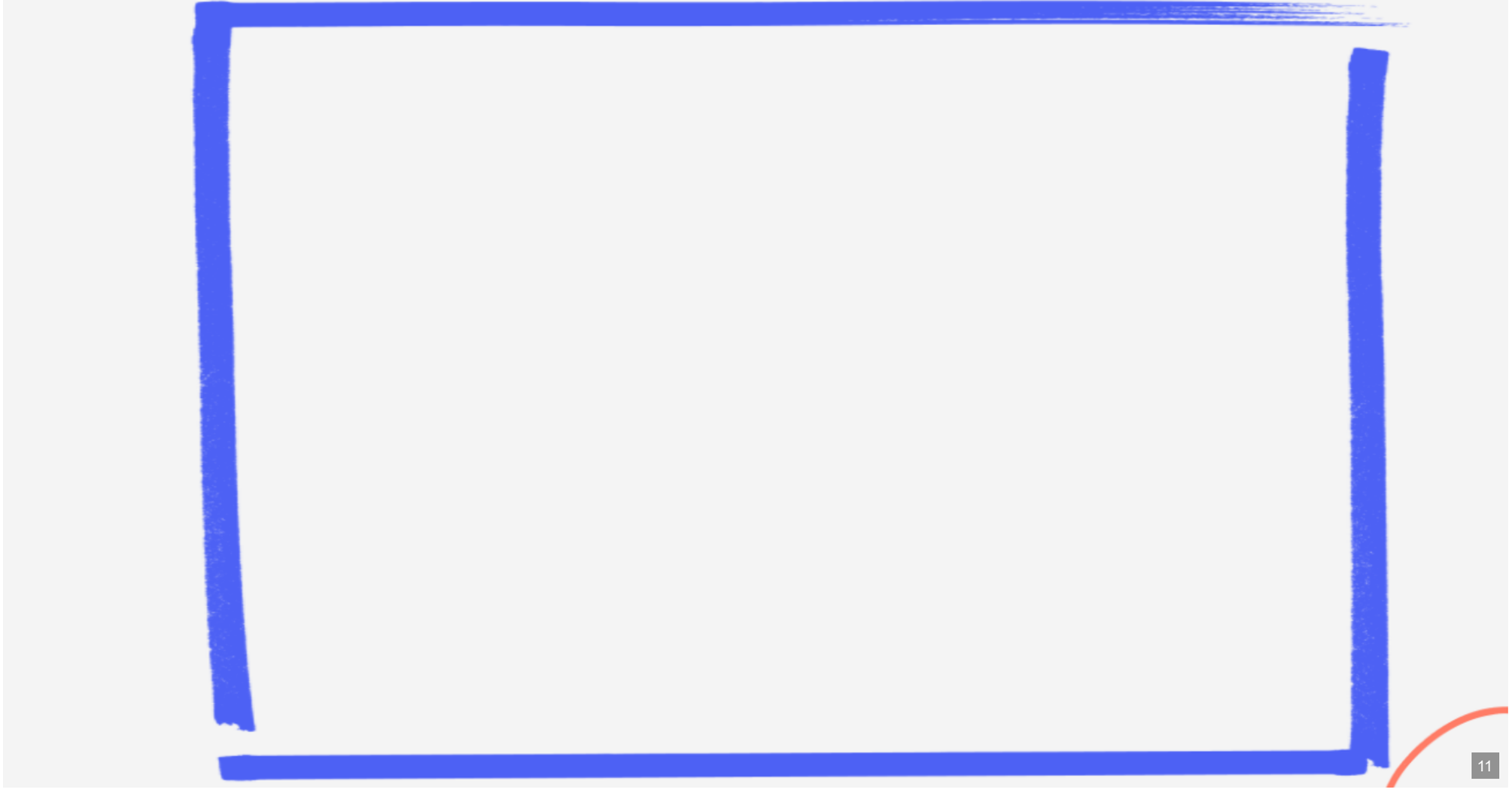
The Five V's



Volume

Volume
Velocity

Volume
Velocity
Variety

Volume
Velocity
Variety
Veracity

Volume
Velocity
Variety
Veracity
Value

Volume

- Refers to the size of the data
- Whether a dataset is considered 'big' or not is dependent on the volume
- Data is considered Big when it is too voluminous for traditional data storage methods
- Big Data platforms provide a way to store incredibly large amounts of data as well the ability to process it efficiently

Velocity

- Refers to the speed of data generation
- For example, how fast data flows in from sources such as application logs, networks and social media sites
- Typically the flow will be massive and continuous

Velocity

- Increasingly companies are looking to stream analytics and data so it available at the right time to make appropriate business decisions
- Big Data platforms offer solutions to dealing with fast flowing data in terms of storage and processing

Variety

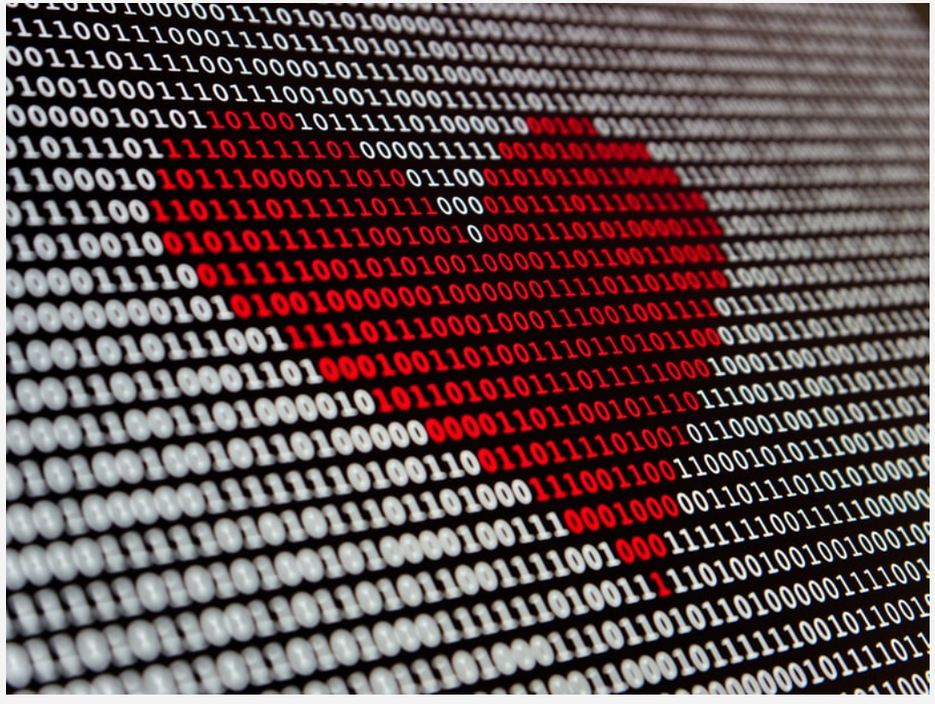
- Refers to the heterogeniety of the data sources
- In other words, how different the data sources are (unstructured vs structured etc)
- With large flows of data from several of sources it is possible that there will be a variety of data types and structures

Variety

- Big Data platforms can handle a variety of sources, structures and data types
- Different types of data require different strategies which you will need to consider as part of your analysis

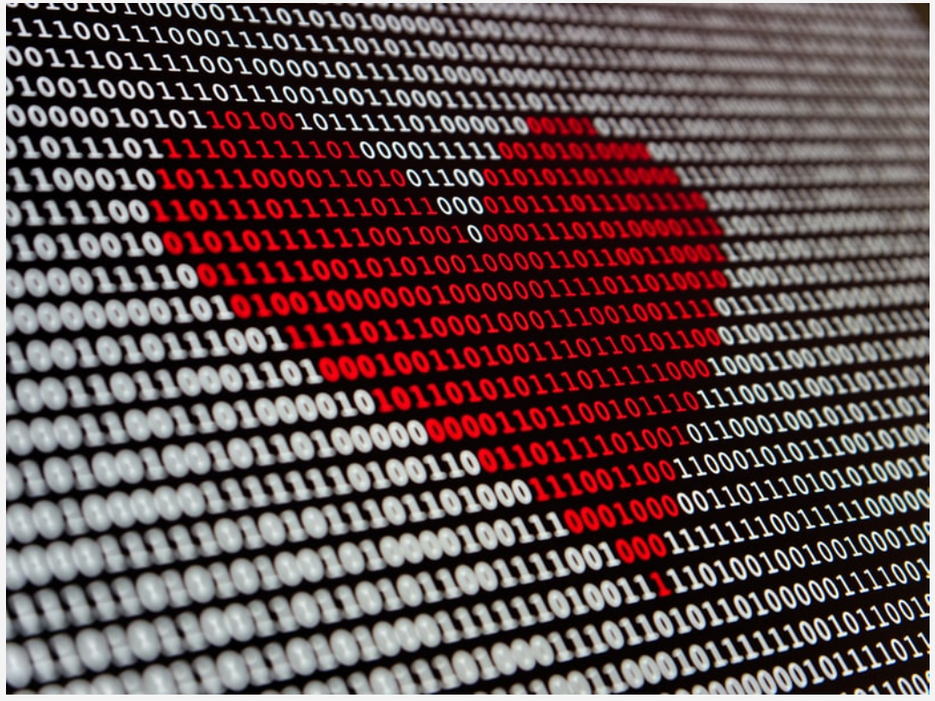
Veracity

- Refers to the quality of the data
- Checking the veracity of data sources is always challenging- **never trust data as given**
- Enquire about the data preparation- has it been normalised already? Has it been subject to statistical manipulation (i.e. outliers removed)?
- Where possible you should always ask to look at raw data



Veracity

- Determining veracity can be challenging to an organisations policies as well as externally determining authorship/ownership



Value

- Refers to the business value of the data
- Having access to vast amounts of fast flowing data is useless unless it can leveraged into something of value
- How does this data add value to your business? What is the ROI?

Activity

- Think about some of the data you use regularly, how does it stack up against the 5 V's?
- Share your thoughts with your group and be prepared to feedback to the rest of the class

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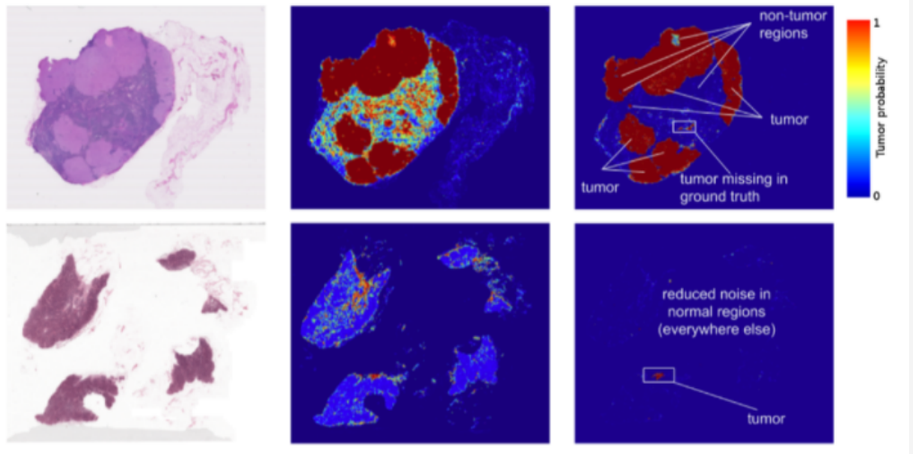
Developing the Future

How has Big Data affected medical science?



Left: Images from two lymph node biopsies. **Middle**: earlier results of our deep learning tumor detection. **Right**: our current results. Notice the visibly reduced noise (potential false positives) between the two versions.

Genetic sequencing and human genome mapping provide a detailed understanding of genetic makeup and lineage.

- The healthcare industry is looking toward these advances to help predict which illnesses a person is likely to get in their lifetime.
- While data has grown, the cost to perform this work has fallen dramatically.
- The cost to sequence one human genome fell from $100m in 2001 to $10k in 2011.
- Today it costs around $1k.
- A 2017 report showed it was possible to train a model to detect tumour in breast cancer patients that either matched or exceeded the performance of a pathologist who had unlimited time to examine the slides.

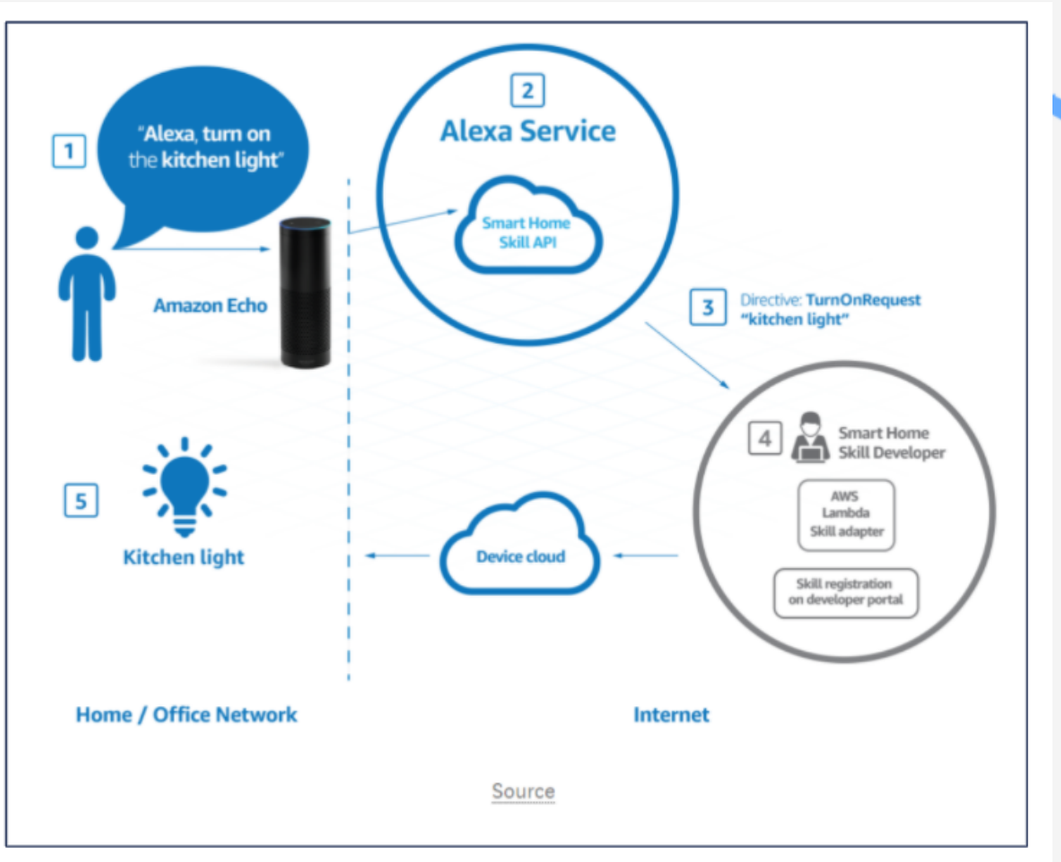
Natural Language Processing

A powerful tool that allows the analysis of human languages, e.g. sentiment analysis and key word idenfitication. Companies like Google and Amazon make use of NLP and other technologies to give us a virtual assisstant experience.

Read more about this story

Activity

- In groups, discuss and sketch out the process you think Alexa would follow to provide a user with a recommendation


1
"Alexa, turn on the kitchen light"
Amazon Echo
2
Alexa Service
Smart Home Skill API
3
Directive: TurnOnRequest
"kitchen light"
4
Smart Home Skill Developer
AWS Lambda Skill adapter
Skill registration on developer portal
Device cloud
5
Kitchen light
Home / Office Network
Internet
Source

1. Your words are recorded
2. The recording is sent to Amazon's server to be analysed (due to interpreting sounds taking up alot of computational power
3. Important words are identified and corresponding functions are carried out (e.g. 'basketball' would open a sports app)
4. The server then sends the information back to your device. If Alexa needs to say something it will follow a reverse process (identify the words it wants to give and convert them to the correct sounds)

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How it Works

Divide and Conquer

Most Big Data softwares use an approach called 'Divide and Conquer' where the data will be split into smaller 'chunks' and processed simultaneously across different nodes and the results combined. This process happens over several servers so if one fails the analysis can continue and the remaining can pick up the slack.

Which is Faster?

1 TB

A @ 1000 MB per Second B

One 2TB Intermediate Hard Drive

Ten 128GB USB Drives

One 2TB Harddrive

SOLUTION

Ten 128GB USB drives

SOLUTION

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Using Big Data in your Role

Activity

- In groups, discuss how you think Big Data technologies can be used to enhance your role

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Advantages and Disadvantages

Advantages

- Ability to access and process large volumes of data quickly
- Analysis run on larger datasets will be more reliable, representative and accurate as taking samples from data will not be necessary
- Faster analysis leads to a reduction in human utilisation, meaning more projects can be undertaken or better resourcing of analysts
- Projects finished in shorter time frames can lead to increased reputation amongst customers and products being brought to market

Disdvantages

- It is expensive
- Big Data technologies only provide a small amount of free processing before charging and costs can rack up quickly
- Therefore you do not have time to play around or make mistakes- time is money
- Big Data still requires a degree of competency from the user, it is not something that can just be picked up by anybody
- The nature of Big Data means you are exporting data externally, potentially bringing in cybersecurity risks
- It can be challenging to integrate Big Data output into your system

Activity

In breakout rooms read and discuss this article .

- Do you agree with what has been written?
- How do you think Big Data will personally affect your role?
- Can you find other articles which support or argue against the use of Big Data technologies?

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Big Data Products

Which products are you aware of?

Which products are you aware of?

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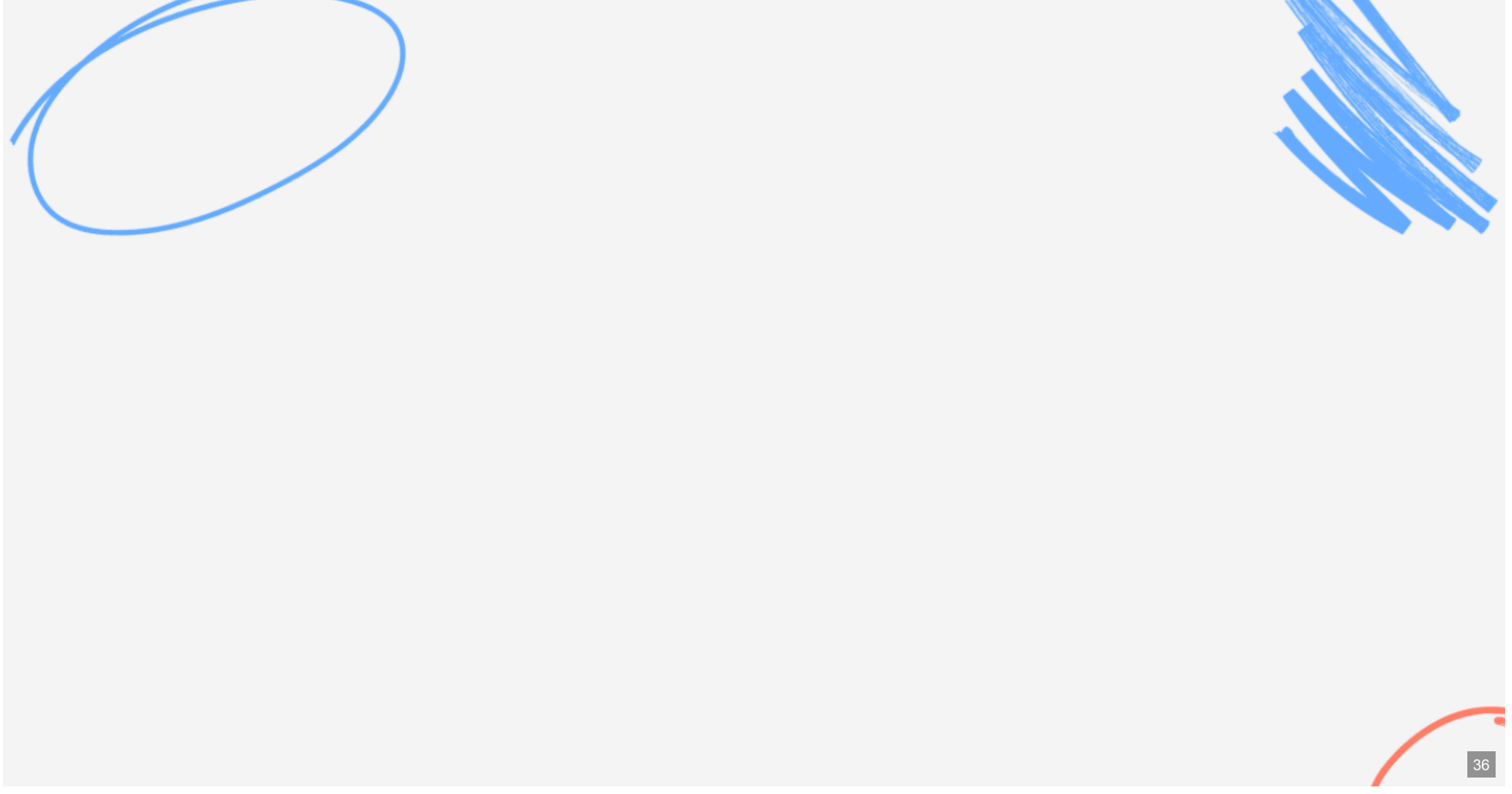
Data Platforms



Visualisation Software

Data Management

Statistics Platforms

What do you use?

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Platforms vs Coding Yourself

Advantages

Advantages

Platforms

- Easy to use and do not require technical knowledge or skills
- More agile as 'drag and drop' options allow for quicker building of functions/models/visualisations
- Greater agility leads to lower costs as less time is spent on development
- Relatively simple to edit what you have built
- Often tech support available
- Accessible to stakeholders who do not have technical coding background

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Coding

- You have complete control over the whole process and can customise colour scheme and functionality in almost any way imaginable
- Data entry can be faster and more accurate (particularly when automated)
- Common coding langauges (R, Python, etc) are free to install and use
- You own the source code
- Most languages have active communities where you can ask for help

Disadvantages

Disadvantages

Platforms

- Can be a steep learning curve and training will be required for each different software you use
- While platforms often have a wide variety of functions, they are still limited to whatever was built in by the developer
- Security and reliability issues around you not having complete control over your code/data

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Coding

- Learning to code is a daunting and long process
- Coding is constantly evolving and it is up to you to keep up with trends- which you may not have time to do
- Complicated codes take a long time to produce and require constant error checking and validation

Disadvantages (Cont)

Disadvantages (Cont)

Platforms

- If you want to change product it can be difficult to migrate your models/visualisations
- Licenses can be expensive
- You do not own the source code

Disadvantages (Cont)

Platforms

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Coding

- Complicated codes take a long time to produce and require constant error checking and validation
- Easy to make mistakes but can be difficult to find the error
- Making small changes to large scripts not always simple and can lea to side effects
- Code is harder to understand for non-technical colleagues

Activity

Mr Jones works in a data analytics department and has been given a project to complete. He must design a dashboard that displays daily KPIs for his stakeholders. In teams you will be each be assigned a different product (Tableau, Python, etc) and will come up with arguments to convince Mr Jones to use your product. Each team will then be given 1 minute to pitch their product.

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Additional Resources

Big Query Webinar

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Complete Session Attendance Log and Update Your OTJ