B1.3 Big Data

The term "data" is a frequent topic today, we encounter it and the term "big data" every day. Both concepts are also found in this study text, so we will get to know them more closely.

What is Data?

Data can be described as the quantities, *characters*, or *symbols* on which operations are performed by a man or computer, and which are stored and/or transmitted to written form or in the form of electrical signals and recorded on magnetic, optical, or mechanical recording media.

Examples: numbers 2, −4, 0.257, 3.14, √274 , ⋯ , letters b, xyz, a^2, A+B, …, symbols ⏲, ♈, ✈, words "To be or not to be?", "I don't like it anymore", … , .

What is Big Data?

The collection of data that is huge in volume and size and growing exponentially with time. Data is so large and complex that none of the traditional data management tools can store it or process it efficiently.

„Freepig.com"

Examples:

The "Stock Exchanges" are examples of Big Data that generates about one terabyte of new trade data per day.

More than 500+terabytes of new data pass through the databases of social media sites every day, generated in terms of photo and video uploads, messages, etc.

Big Data are data sets whose size or type is beyond the ability of traditional relational databases to capture, manage and process the data with low latency. Characteristics of big data include high volume, high velocity and high variety. Sources of data are becoming more complex than those for traditional data because they are being driven by artificial intelligence (AI), mobile devices, social media and the Internet of Things (IoT). For example, the different types of data originate from sensors, devices, video/audio, networks, log files, transactional applications, web and social media — much of it generated in real time and at a very large scale.

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With big data analytics, you can ultimately fuel better and faster decision-making, modelling and predicting of future outcomes and enhanced business intelligence. Businesses can access a large volume of data and analyse a large variety of data to gain new insights and take action.

Analysing data from sensors, devices, video, logs, transactional applications, web, and social media empowers an organisation to be *data driven*.

Types of Big Data

There are three types of big data: structured, unstructured, and semi structured.

Structured data: Any data that can be stored, accessed, and processed in the form of a fixed format. Nowadays, the size of such data grows to a huge extent with typical sizes being in the range of multiple zettabytes (one billion terabytes forms a zettabyte).

> Examples: Data stored in a relational database management system is one example of a 'structured' data. Data in tables e.g., timetable, pay tables, list of keywords at the end of the publication, etc.
>
> An 'employee' table in a database is an example of structured data.

Unstructured data: Any data with unknown form or the structure is classified as unstructured data. In addition to the size being huge, unstructured data poses multiple challenges in terms of its processing for deriving value out of it.

> Example: A heterogeneous data source containing a combination of text files, images, videos etc.

Nowadays organisations have a wealth of unstructured data with interesting information available, but they don't know how to derive hidden values out of it since this data is in its raw form or unstructured format.

Semi-structured data: can contain both the forms of data.

> Examples: Personal web pages: contain texts, images, videos, links to social networks, links to communicate with friends, etc. Another example is the web pages of online shops with advertising, payment terminals.

The characteristics of Big Data are commonly referred to as the ***four volumes of Big Data***.

The ***Volume of Data*** refers to the size of the data sets that need to be analysed and processed, which are now frequently larger than terabytes[1] and petabytes[2]. The sheer volume of the data requires distinct and different processing technologies than traditional storage and processing capabilities.

[1] Terabyte: A bit (binary digit) has a single binary value of either 0 or 1, is the smallest unit of data in a computer system. A terabyte is one of the largest units of storage media that products on the market use today. There are units larger than a terabyte: petabyte, exabyte, zettabyte, yottabyte and brontobyte. A geopbyte refers to 10^{30} bytes. In practical terms, a terabyte of data is equivalent to: 728.177 floppy disks, 40 single-layer Blu-ray discs, 85.899.345 pages of Word documents, 500 hours of movies, 310,000 photos, 17,000 hours of music.

[2] Petabyte: 1 PB = 1.000 TB, e.g., 1 PB is equal to over 1 quadrillion bytes.

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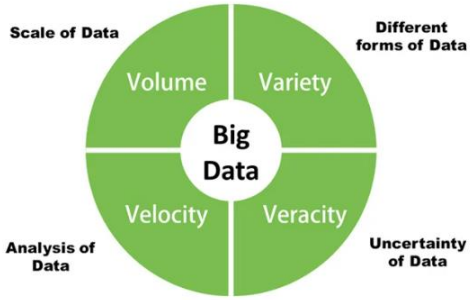
This means that the data sets in Big Data are too large to process with a regular laptop or desktop processor.

The Velocity of Big Data refers to the speed with which data is generated. High velocity data is generated with such a pace that it requires distinct (distributed) processing techniques. An example of that is generated with high velocity would be Twitter messages or Facebook communication.



The Variety of Big Data makes Big Data really big. Big Data comes from a great variety of sources and generally is one out of three types: structured, semi structured and unstructured data. The variety in data types frequently requires distinct processing capabilities and specialist algorithms. An example of high variety data sets would be the audio and video files that are generated at various locations in a city.

The Veracity of Big Data refers to the quality of the data that is being analysed. High veracity data has many records that are valuable to analyse and that contribute in a meaningful way to the overall results. Low veracity data, on the other hand, contains a high percentage of meaningless data. The non-valuable in these data sets is referred to as noise. An example of a high veracity data set would be data from a medical experiment or trial.

Data that is high volume, high velocity and high variety must be processed with advanced tools (analytics and algorithms) to reveal meaningful information. Because of these characteristics of the data, the knowledge domain that deals with the storage, processing, and analysis of these data sets has been labelled Big Data.

Advantages of Big Data processing

- Businesses can utilise outside intelligence while making decisions.
- Access to social data from search engines and sites like Facebook or Twitter are enabling organisations to fine tune their business strategies.
- Improved customer service.
- Early identification of risk to the product/services, if any.
- Better operational efficiency.
- Big Data technologies can be used for creating data warehouses.

Summary

Big Data is a term used to describe a collection of data that is huge in size and yet growing exponentially with time. Big Data can be 1) structured, 2) unstructured, 3) semi-structured. The velocity of Big Data refers to the speed with which data is generated. High velocity data is generated with such a pace that it requires distinct processing techniques. The variety of Big Data comes from a great variety of sources and generally is one out of three types: structured, semi structured and

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unstructured data. The variety in data types frequently requires distinct processing capabilities and specialist algorithms. The veracity of Big Data refers to the quality of the data that is being analysed: we distinguish between high veracity data and low veracity data. Volume, variety, velocity, and variability are the four Big Data characteristics. Improved customer service, better operational efficiency, better decision making are few advantages of Big Data.

Links to relevant topics

https://en.wikipedia.org/wiki/Big_data

https://www.guru99.com/what-is-big-data.html

https://www.gartner.com/en/information-technology/glossary/big-data

Key words

quantities
characters
symbols
Big Data
artificial intelligence
mobile devices
social media
Internet of Things
data driven
structured data
unstructured data
semi-structured data
four volumes of Big Data
velocity of Big Data
variety of Big Data
veracity of Big Data

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