Basic Concepts of Big Data (20 Hours)

- **Session 1-4:**

o Concept and characteristics of Big Data
o History of Big Data
o Jobs in Big Data
o Types of Big data (structured, semi-structured, unstructured)

- **Session 5-9:**

o Big Data Frameworks
o Big Data Programming Paradigms
o Big Data Programming Languages

- **Session 10-11:**

o Introduction to Data Science and Skillset required for working with Big Data

- **Session 12-15:**

o Simplified Overview of Machine Learning Algorithms and Neural Networks
o Types of Machine Learning (Supervised, Un-Supervised, Reinforcement)

- **Session 16-18:**

ACTS, Head Quarters, Pune
o Examples of Big Data and Data Science in Practice (Healthcare, Logistics & Transportation, Manufacturing etc.

- **Session 19-20:**

o Application Examples and Real –World Use Cases (e.g., Healthcare, finance, marketing, etc.)

Types of Big Data Technologies (+ Management Tools)

1. Data storage

- Apache Hadoop
- Apache Spark
- Apache Hive
- Apache Flume
- ElasticSearch
- MongoDB

2. Data mining

- Rapidminer
- Presto

3. Data analytics

- Apache Spark
- Splunk
- KNIME

4. Data visualization

- Tableau
- Power BI

Apache Hadoop

The Apache Hadoop software library is a framework that allows for the distributed processing of large data sets across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage.

MongoDB

MongoDB is a source-available cross-platform document-oriented database program.

Classified as a NoSQL database program, MongoDB uses JSON-like documents with optional schemas

Rapidminer

pros:

1. Multiple deployment options based on our preference.
2. Strong visualization.
3. Accurate Preprocessing.
4. Multiple interfaces.
5. Java API available that can be used in programs.

cons:

1. It takes too much memory and so slows down your system.
2. Less forums for support.

Presto

A single Presto query can process data from multiple sources like HDFS, MySQL, Cassandra, Hive and many more data sources. Presto is built in Java and easy to integrate with other data infrastructure components. Presto is powerful, and leading companies like Airbnb, DropBox, Groupon, Netflix are adopting it.

Apache Spark

Apache Spark is an open-source unified analytics engine for large-scale data processing. Spark provides an interface for programming clusters with implicit data parallelism and fault tolerance

Splunk

Splunk is a program that enables the search and analysis of computer data. It analyzes semi-structured data and logs generated by various processes with proper data modeling as per the need of the IT companies. The user produces the data by means of any device like- web apps, sensors, or computers. It has built-in functionality for defining data types, field separators, and search process optimization. For the searched result, it also provides visualization of data.

Tableau can handle huge columns of data and still offer better performance.	Power BI is best for a limited volume of data.
Tableau has better data visualization.	Power BI offers many data points for data visualization.
Tableau works best with huge data.	Power BI is suboptimal with huge data.
Experts and experienced users use Tableau.	Power BI is used by beginners and experienced alike.

8. HPCC Systems

1. Airflow

9. Hudi

10. Iceberg

2. Delta Lake

19. MongoDB

3. Drill

11. Kafka

4. Druid

18. Trino

12. Kylin

5. Flink

17. Storm

13. Pinot

6. Hadoop

7. Hive

16. Spark

14. Presto

15. Samza

1. Data storage

- Apache Hadoop
- Hortonworks
- Data lake
- Apache Spark
- MongoDB
- Apache Cassandra
- P r e s t o
- Cloudera
- Cloud storage
- Elastic search
- Hybrid storage

Cloud Service Providers

Microsoft Azure

Google Cloud Platform

Amazon Web Service (AWS)

Oracle Cloud

IBM Cloud Services

Rackspace

Adobe Creative Cloud

Red Hat

SAP

Kamatera

Salesforce

Verizon Cloud

VMware

1. Airflow

Airflow in Apache is a popularly used tool to manage the automation of tasks and their workflows. They are also primarily used for scheduling various tasks. Consider that you are working as a data engineer or an analyst and we might need to continuously repeat a task that needs the same effort and time every time. The kind of such tasks might consist of **extracting, loading,** or **transforming data** that need a regular analytical report. We can simply automate such tasks using Airflow in Apache by training your machine learning model to serve these kinds of tasks on a regular interval specified while training it

2. Delta Lake

What is Big Data

Data which are very large in size is called Big Data. Normally we work on data of size MB(WordDoc ,Excel) or maximum GB(Movies, Codes) but data in Peta bytes i.e. 10^15 byte size is called Big Data. It is stated that almost 90% of today's data has been generated in the past 3 years.

Sources of Big Data

These data come from many sources like

- **Social networking sites:** Facebook, Google, LinkedIn all these sites generates huge amount of data on a day to day basis as they have billions of users worldwide.

- **E-commerce site:** Sites like Amazon, Flipkart, Alibaba generates huge amount of logs from which users buying trends can be traced.

- **Weather Station:** All the weather station and satellite gives very huge data which are stored and manipulated to forecast weather.

- **Telecom company:** Telecom giants like Airtel, Vodafone study the user trends and accordingly publish their plans and for this they store the data of its million users.

- **Share Market:** Stock exchange across the world generates huge amount of data through its daily transaction.

3V's of Big Data

1.Velocity: The data is increasing at a very fast rate. It is estimated that the volume of data will double in every 2 years.

2.Variety: Now a days data are not stored in rows and column. Data is structured as well as unstructured. Log file, CCTV footage is unstructured data. Data which can be saved in tables are structured data like the transaction data of the bank.

3.Volume: The amount of data which we deal with is of very large size of Peta bytes.

Use case

An e-commerce site XYZ (having 100 million users) wants to offer a gift voucher of 100$ to its top 10 customers who have spent the most in the previous year.Moreover, they want to find the buying trend of these customers so that company can suggest more items related to them.

Issues

Huge amount of unstructured data which needs to be stored, processed and analyzed.

Solution

Storage: This huge amount of data, Hadoop uses HDFS (Hadoop Distributed File System) which uses commodity hardware to form clusters and store data in a distributed fashion. It works on Write once, read many times principle.

Processing: Map Reduce paradigm is applied to data distributed over network to find the required output.

Analyze: Pig, Hive can be used to analyze the data.

Cost: Hadoop is open source so the cost is no more an issue.

What is Hadoop

Hadoop is an open source framework from Apache and is used to store process and analyze data which are very huge in volume. Hadoop is written in Java and is not OLAP (online analytical processing). It is used for batch/offline processing.It is being used by Facebook, Yahoo, Google, Twitter, LinkedIn and many more. Moreover it can be scaled up just by adding nodes in the cluster.

Modules of Hadoop

1.HDFS: Hadoop Distributed File System. Google published its paper GFS and on the basis of that HDFS was developed. It states that the files will be broken into blocks and stored in nodes over the distributed architecture.

2.Yarn: Yet another Resource Negotiator is used for job scheduling and manage the cluster.

3.Map Reduce: This is a framework which helps Java programs to do the parallel computation on data using key value pair. The Map task takes input data and converts it into a data set which can be computed in Key value pair. The output of Map task is consumed by reduce task and then the out of reducer gives the desired result.

4.Hadoop Common: These Java libraries are used to start Hadoop and are used by other Hadoop modules.

Hadoop Architecture

The Hadoop architecture is a package of the file system, MapReduce engine and the HDFS (Hadoop Distributed File System). The MapReduce engine can be MapReduce/MR1 or YARN/MR2.

A Hadoop cluster consists of a single master and multiple slave nodes. The master node includes Job Tracker, Task Tracker, NameNode, and DataNode whereas the slave node includes DataNode and TaskTracker.

Using Big Data Analytics Tools

1.Healthcare: Big data analytics technologies and tools are being used in healthcare to predict patient outcomes, identify at-risk patients, and improve population health.

2.Retail: Big data analytics tools are being used by retailers to improve customer experience, target marketing campaigns, and prevent fraud.

3.Manufacturing: Big data analytics tools are being used in manufacturing to improve quality control, reduce downtime, and optimize production processes.

4.Banking: Real time big data analytics tools are being used by banks to detect fraudulent activities, prevent money laundering, and improve customer service.

1.Government: Big data analytics tools are being used by government agencies to improve public services, combat fraud and corruption, and better understand citizen needs.

Limitations of Big Data Analytics Tools

There are several limitations to big data analytics tools, including:

1.They can be expensive and require a lot of resources to implement.

2.They can be complex to use and require skilled staff to get the most out of them.

3.They can require a lot of data to be effective, which can be a challenge to collect.

4.They can be slow and may not be able to keep up with rapidly changing data.

5.They can produce biased results, depending on how they are configured.

Best tool for big data analytics?

Big Data frameworks such as Apache Hadoop are widely used in the market. Clusters of computers can be used to process massive data sets using Hadoop. Scaling up from one server to tens of thousands of commodity computers is one of the best features of this Big Data Tool.

Five types of big data analytics?

The five types of big data analytics are as follows:

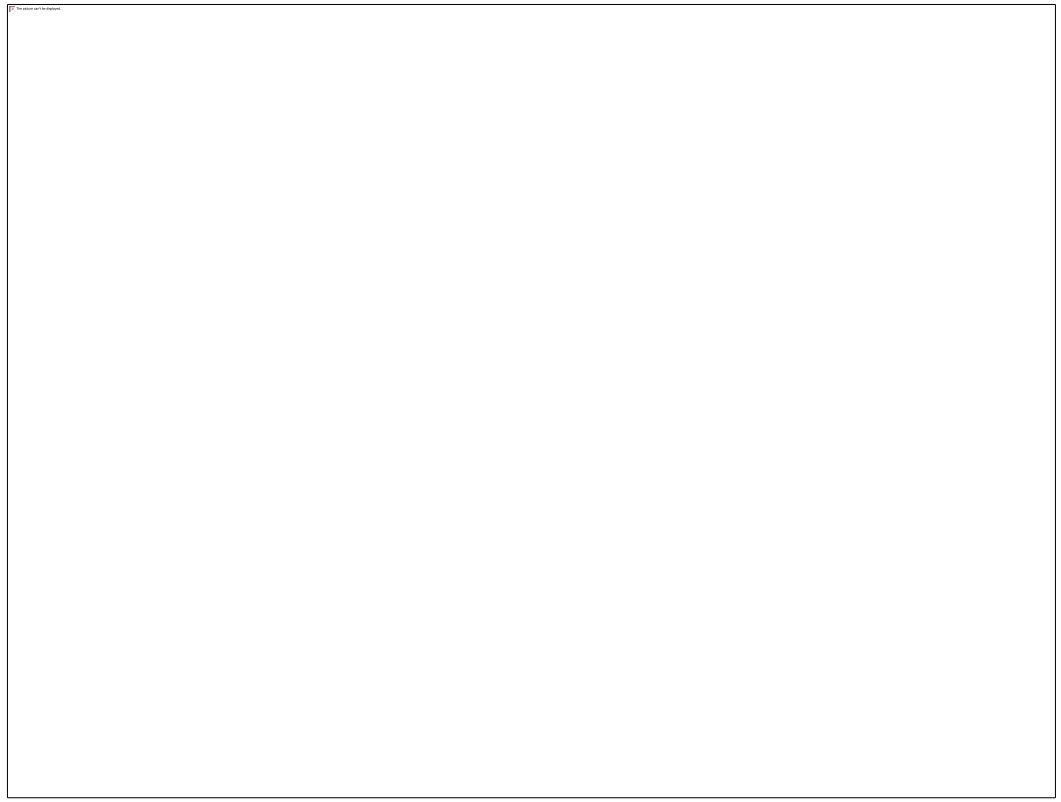
Cyber Analytics
Prescriptive Analytics
Descriptive Analytics
Diagnostic Analytics
Predictive Analytics

Data engineering

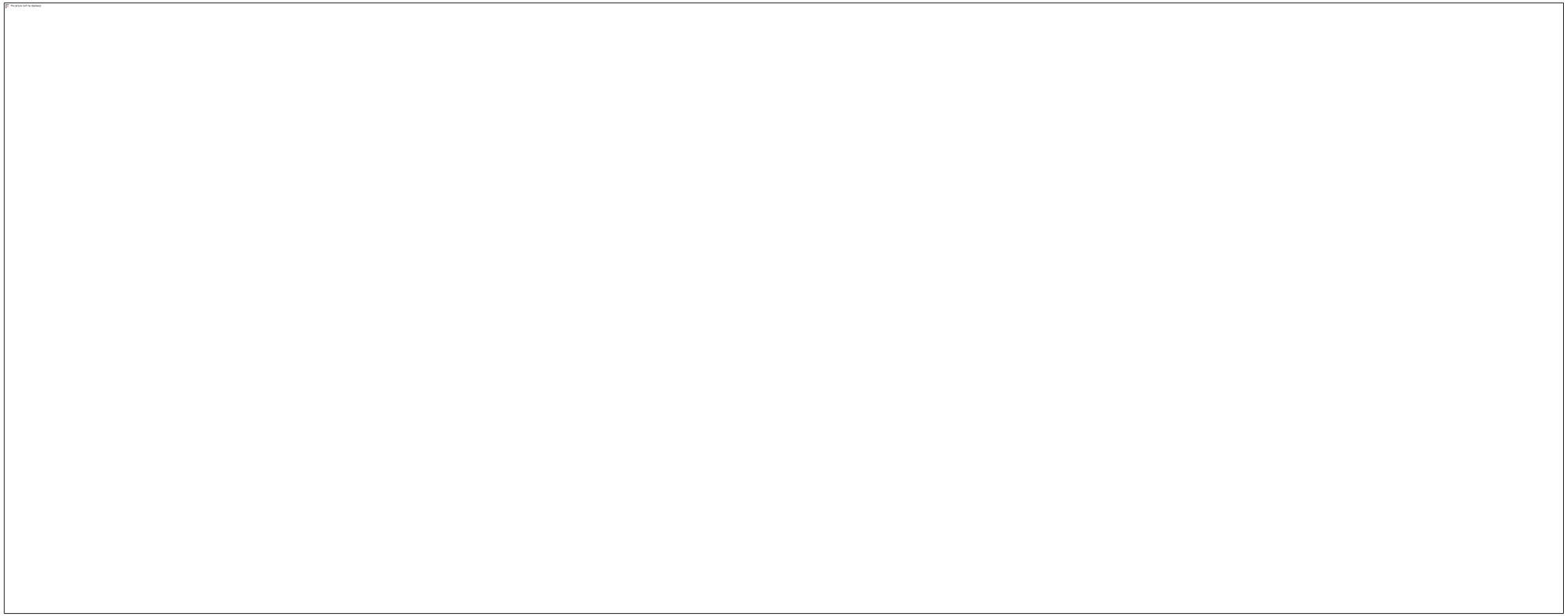
Data engineering is the process of building robust data architecture that allows for data processing. This includes data transfers between databases and building data warehouses for easy accessibility.

Through data engineering, the following question is answered: “How do I make all the data we collect easier for our data analysts and other stakeholders to wade through?” Data engineering makes the data more reliable, accurate, and ingestible through robust data processing systems.

Data Engineer and a Data Analyst?



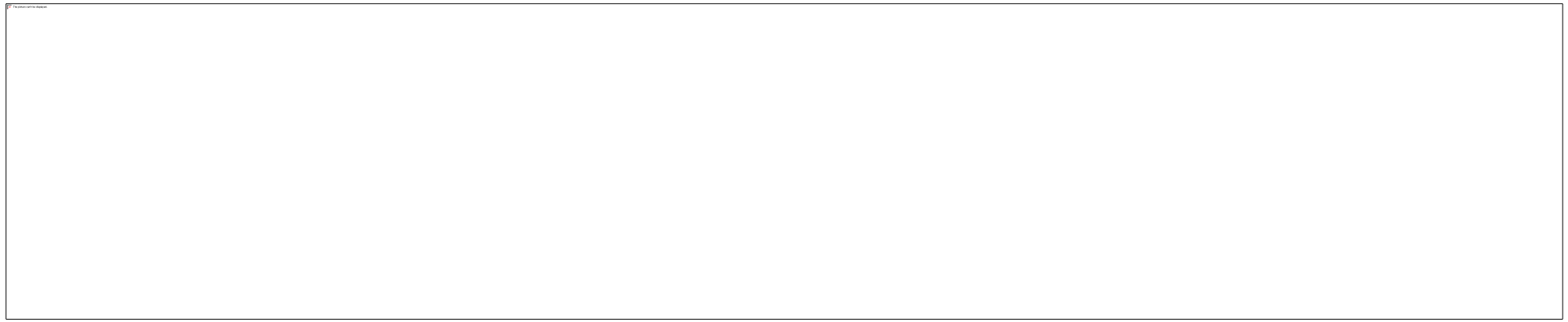
Data Engineering



Requirements To Become a Data Engineer

Requirements To Become a Data Analyst

Data Analyst, Data Engineer and Data Scientist



1. **Data in ____ bytes size is called Big Data.**

Tera
Giga
Peta
Meta

2. **How many V's of Big Data?**

2
3
4
5
Answer: D) 5
Volume, Velocity, Variety, Value and Veracity

3. Unprocessed data or processed data are observations or measurements that can be expressed as text, numbers, or other types of media.

True
False

4. In Big Data environments, Velocity refers –

Data can arrive at fast speed

Enormous datasets can accumulate within very short periods of time

Velocity of data translates into the amount of time it takes for the data to be processed

All of the mentioned above

5. In Big Data environments, Variety of data includes –

Includes multiple formats and types of data

Includes structured data in the form of financial transactions,

Includes semi-structured data in the form of emails and unstructured data in the form of images

All of the mentioned above

6. Which of the following are Benefits of Big Data Processing?

Cost Reduction

Time Reductions

Smarter Business Decisions

All of the mentioned above

7. Data that does not conform to a data model or data schema is known as _____.

Structured data

Unstructured data

Semi-structured data

All of the mentioned above

8. Amongst which of the following is/are not Big Data Technologies?

Apache Hadoop
Apache Spark
Apache Kafka
Apache Pytarch

9._____ involves the simultaneous execution of multiple sub-tasks that collectively comprise a larger task.

Parallel data processing

Single channel processing

Multi data processing

None of the mentioned above

10 Amongst which of the following can be considered as the main source of unstructured data.

Twitter

Facebook

Webpages

All of the mentioned above

11. Amongst which of the following shows an example of unstructured data,

Students roll number, age

Videos

Audio files

Both B and C

12 Scalability, elasticity, resource pooling, self-service, low cost and fault tolerance are the features of,

Cloud computing

Power BI

System development

None of the mentioned above

Big data is a field that treats ways to analyze and systematically extract information from or otherwise deal with data sets. Data can be large or complex to be dealt with by traditional data processing applications software

A large amount of data
It is a popular term used to express the exponential growth of data.
Big data is difficult to store, collect, maintain, analyze and visualize.

Distributed file system: A distributed file system is a file system in which data is stored on a server. The data is accessed and processed as if it were stored on the local client machine. The following are the Characteristics of distributed file system:

Transparency
user mobility
Performance
simplicity and ease of use
Scalability
high availability
high reliability
Big data tools: Apache Hadoop, Apache Storm, Cassandra, Mongo DB, Neo4j. Learn More.

Big data sources:

Amazon, Redshift, Mongo DB

Challenges of big data:

Uncertainty of data management
The talent gap in big data
Getting data into a big data structure
Synchronizing across data sources
Integration

Benefits of big data:

Cost
Time reduction
Speeding up decision-making
Analyze in real-time
Model and Test variation

Characteristics of big data:

Volume
Velocity
Variety

Types of big data:

Structured
unstructured
Semi-structured
hybrid

Use cases of big data:

Recommendation engine
Analyzing call detail records
Fraud detection
sentiment analysis

What is Structured Data?

Structured data is information that has been formatted and transformed into a well-defined data model. The raw data is mapped into predesigned fields that can then be extracted and read through SQL easily. SQL relational databases, consisting of tables with rows and columns, are the perfect example of structured data.

The relational model of this data format utilizes memory since it minimizes data redundancy. However, this also means that structured data is more inter-dependent and less flexible. Now let's look at more examples of structured data.

Examples of Structured Data

This type of data is generated by both humans and machines. There are numerous examples of structured data from machines, such as POS data like quantity, barcodes, and weblog statistics. Similarly, anyone who works on data would have used spreadsheets once in their lifetime, which is a classic case of structured data generated by humans. Due to the organization of structured data, it is easier to analyze than both semi-structured and unstructured data.

What is Semi-Structured Data

We may not always find your data sets to be structured or unstructured. Semi-structured data or partially structured data is another category between structured and unstructured data. Semi-structured data is a type of data that has some consistent and definite characteristics.
It does not confine into a rigid structure such as that needed for relational databases. Businesses use organizational properties like metadata or semantics tags with semi-structured data to make it more manageable. However, it still contains some variability and inconsistency.

Examples of Semi-Structured Data

An example of data in a semi-structured format is delimited files. It contains elements that can break down the data into separate hierarchies. Similarly, in digital photographs, the image does not have a pre-defined structure itself but has certain structural attributes making them semi-structured. F or instance, if you take a photo from a smartphone, it would have some structured attributes like geotag, device ID, and DateTime stamp. After you save them, we can assign tags to images such as ‘pet’ or ‘dog’ to provide a structure. On some occasions, unstructured data is classified as semi-structured data because it has one or more classifying attributes.

What is Unstructured Data?

Unstructured data is defined as data present in absolute raw form. This data is difficult to process due to its complex arrangement and formatting.

Unstructured data includes social media posts, chats, satellite imagery, IoT sensor data, emails, and presentations. Unstructured data management takes this data to organize it in a logical, predefined manner in data storage. Natural language processing (NLP) tools help understand unstructured data that exists in a written format.

In contrast, the meaning of structured data is data that follows predefined data models and is easy to analyze. Structured data examples would include alphabetically arranged names of customers and properly organized credit card numbers. After understanding the definition of unstructured data, let’s look at some examples.

Big Data includes huge volume, high velocity, and extensible variety of data. There are 3 types: Structured data, Semi-structured data, and Unstructured data.

Structured data –

Structured data is data whose elements are addressable for effective analysis. It has been organized into a formatted repository that is typically a database. It concerns all data which can be stored in database SQL in a table with rows and columns. They have relational keys and can easily be mapped into pre-designed fields. Today, those data are most processed in the development and simplest way to manage information. Example: Relational data.

Semi-Structured data –

Semi-structured data is information that does not reside in a relational database but that has some organizational properties that make it easier to analyze. With some processes, you can store them in the relation database (it could be very hard for some kind of semi-structured data), but Semi-structured exist to ease space. Example: XML data.

Unstructured data –

Unstructured data is a data which is not organized in a predefined manner or does not have a predefined data model, thus it is not a good fit for a mainstream relational database. So for Unstructured data, there are alternative platforms for storing and managing, it is increasingly prevalent in IT systems and is used by organizations in a variety of business intelligence and analytics applications. Example: Word, PDF, Text, Media logs.

Examples of Unstructured Data

Unstructured data can be anything that's not in a specific format. This can be a paragraph from a book with relevant information or a web page. An example of unstructured data could also be Log files that are not easy to separate. Social media comments and posts are also unstructured.
Here is an example of unstructured data from a log file.

38,P-R-38636-6-45,P-R-39105-1-11,P-R-38036-1-5,P-R-35697-1-13,P-R-35087-1-27,P-R-34341-1-9,P-R-33341-1-15,P-R-33110-1-29,P-R-31345-1-693,P-R-29076-1-6,P-R-28767-1-8,P-R-28540-2-8,P-R-28312-1-10,P-R-28069-1-27,P-R-28032-1-9,P-R-26562-1-12,P-R-26527-5-20,P-R-26164-1-11,P-R-25785-1-30,P-R-25095-9-70,P-R-23504-1-15,P-R-19719-5-41203
Wed Sep 23 2020 05:21:01 GMT+0500

Unstructured data is qualitative, not quantitative, so it is mostly categorical and characteristic in nature. For example, data from social media or websites can help predict future buying trends or determine the effectiveness of a marketing campaign. Another unstructured data analytics example is detecting patterns in scam emails and chat, which can be useful for enterprises in monitoring policy compliance. That's why businesses extract and store unstructured data in data warehouses (also called data lakes) for analysis.

1) Artificial Intelligence is about_____.
1.Playing a game on Computer
2.Making a machine Intelligent
3.Programming on Machine with your Own Intelligence
4.Putting your intelligence in Machine

2) Who is known as the -Father of AI"?
1.Fisher Ada
2.Alan Turing
3.John McCarthy
4.Allen Newell

3)Select the most appropriate situation for that a blind search can be used.

1.Real-life situation
2.Small Search Space
3.Complex game
4. All of the above

4. Ways to achieve AI in real-life are_____.
1.Machine Learning
2.Deep Learning
3.Both a & b
4.None of the abov

5. The main tasks of an AI agent are_____.
1.Input and Output
2.Moment and Humanly Actions
3.Perceiving, thinking, and acting on the environment
4.None of the above

Q.6 The best AI agent is one which_____
1.Needs user inputs for solving any problem
2.Can solve a problem on its own without any human intervention
3.Need a similar exemplary problem in its knowledge base
4.All of the above

Q.7 Which of the given element improve the performance of AI agent so that it can make better decisions?
1.Changing Element
2.Performance Element
3.Learning Element
4.None of the above

Q.8 How many types of Machine Learning are there?
1.1
2.2
3.3
4.4

Q.1 Select the type of data that can be Structured easily ?
Date Of Birth
Profile Photo
Screenshots
directions to the shops

Q.2 Select the unstructured data

Name
shipping time
Price of product
Product description

Q.3 Unstructured data can come from which of the following?
Facebook
Twitter
Presentations
All of these are corr

Q.4 What is structured data?

Structured data is a type of data that is huge in number and has many inaccurate values
Structured data is a type of data that is very less in number and can be stored in proper rows and columns
Structured data is a type of data that has inaccurate values but can be stored in rows and columns

Q.5 An example of structured data is ____.
age information
reason for a customer complaint
customer reviews
pictures of the good/serviceect.

Q.6 What is unstructured data?

Unstructured data is a type of data that is huge in number and has many inaccurate values
Unstructured data is a type of data that is very less in number and can be stored in proper rows and columns
Unstructured data is a type of data that has inaccurate values but can be stored in rows and columns

Q.6 What is semi-structured data?

Semi-structured data is a type of data that is huge in number and has many inaccurate values
Semi-structured data is a type of data that is very less in number and can be stored in proper rows and columns
Semi-structured data is a type of data that has inaccurate values but can be stored in rows and columns
Semi-structured data is a type of data which has contained the data of both types i.e., structured data and semi-structured data