Introduction to Data Science

Data Fundamentals

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2026-I

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Outline

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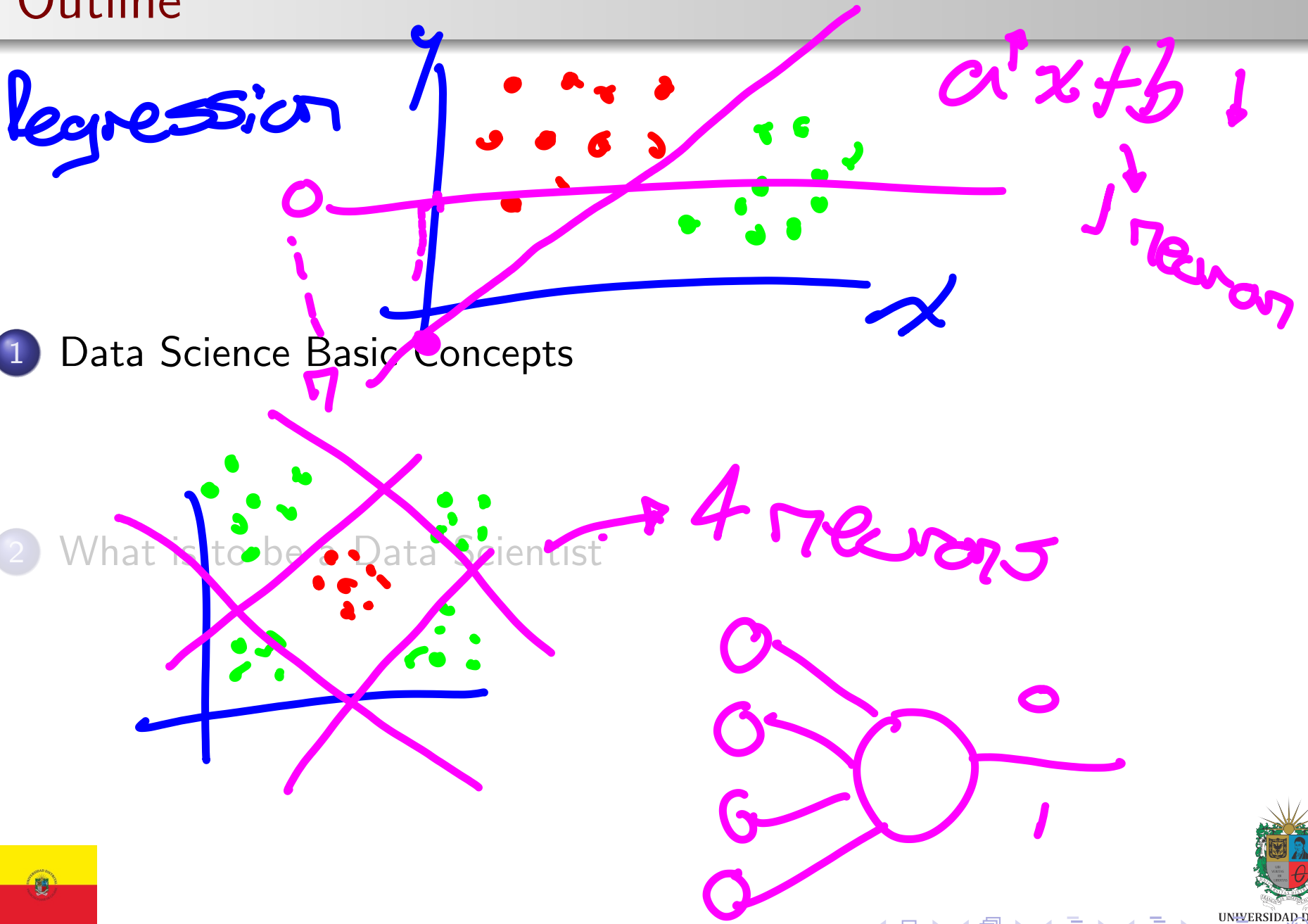
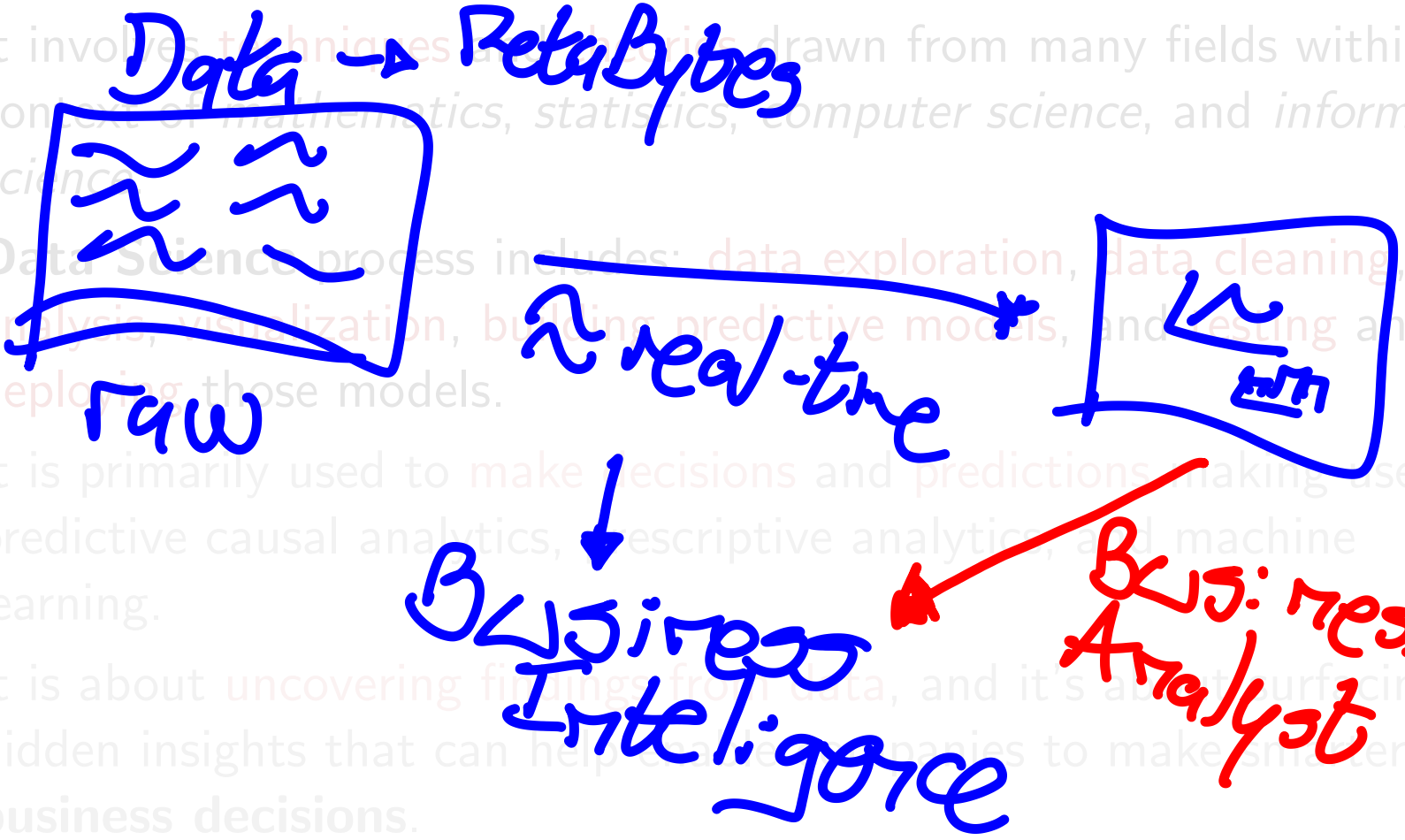


What is Data Science?

- **Data Science** is an interdisciplinary field that uses scientific methods, processes, algorithms, and systems to extract knowledge and insights from structured and unstructured data.
- It involves techniques and theories drawn from many fields within the context of *mathematics*, *statistics*, *computer science*, and *information science*.
- **Data Science** process includes: data exploration, data cleaning, data analysis, visualization, building predictive models, and testing and deploying those models.
- It is primarily used to make decisions and predictions making use of predictive causal analytics, prescriptive analytics, and machine learning.
- It is about uncovering findings from data, and it's about surfacing hidden insights that can help companies to make smarter **business decisions**.



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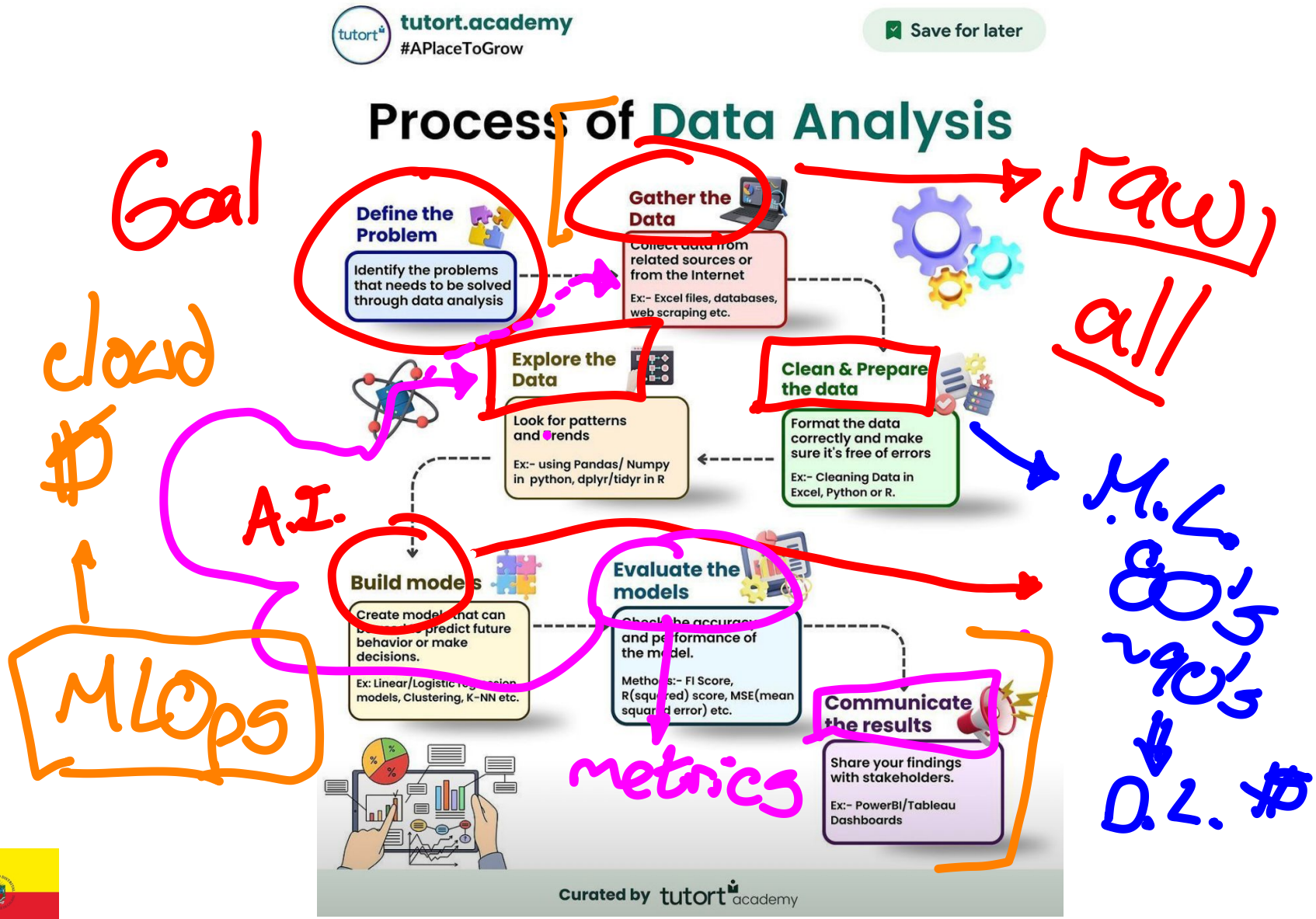
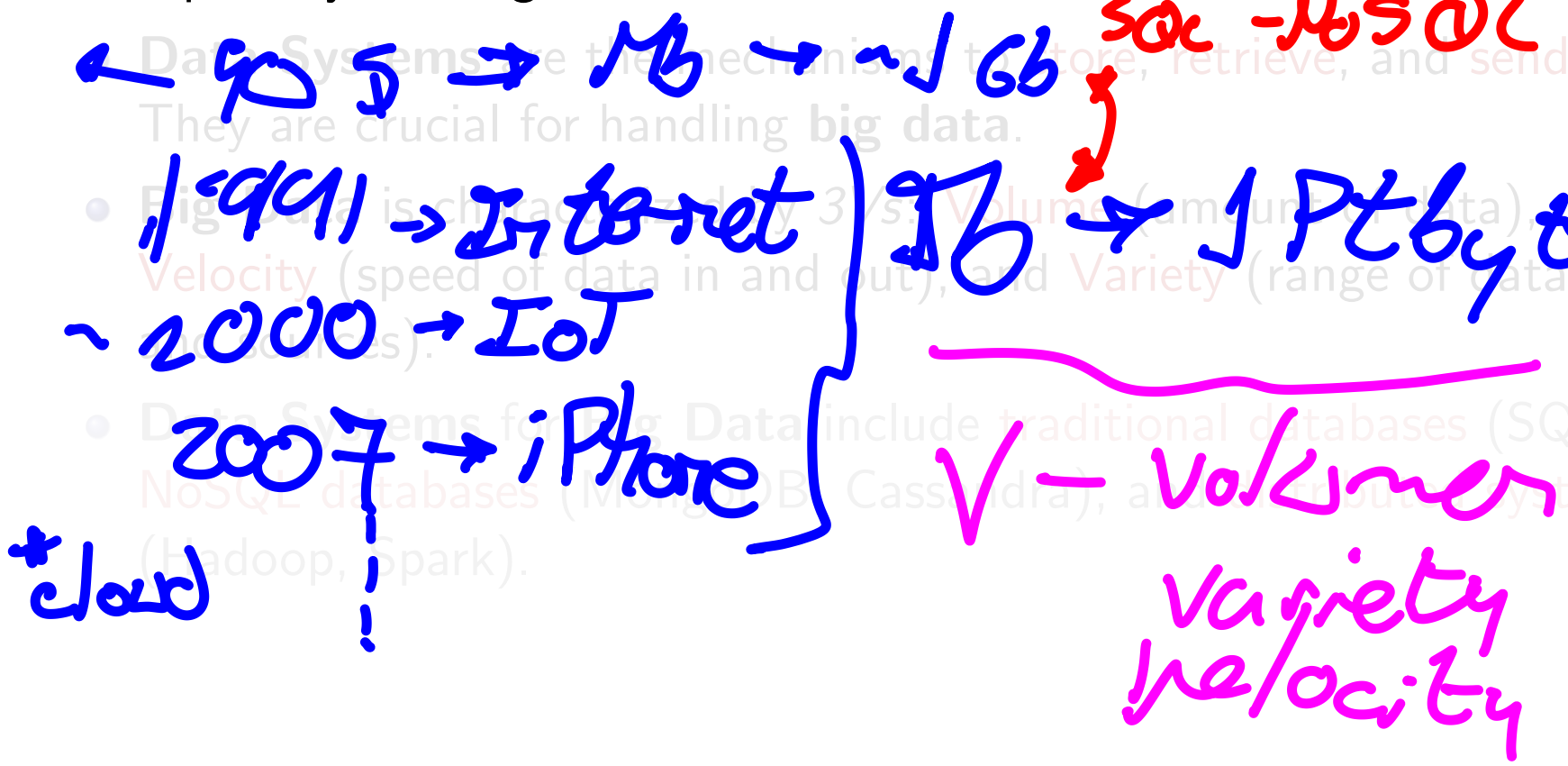
Process of Data Analysis



Types of Data Analysis

Data Systems & Big Data

- **Big Data** refers to extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions.



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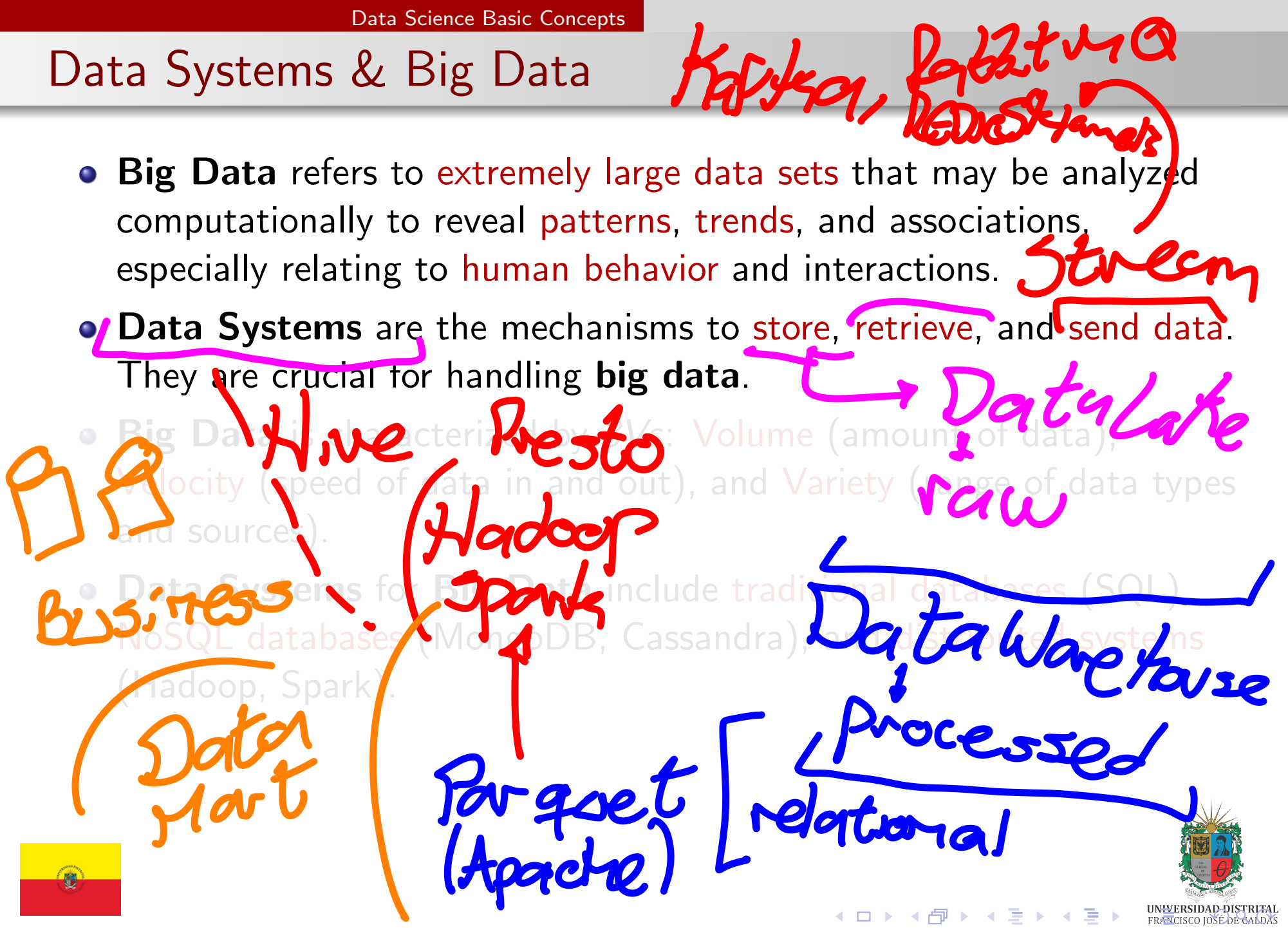

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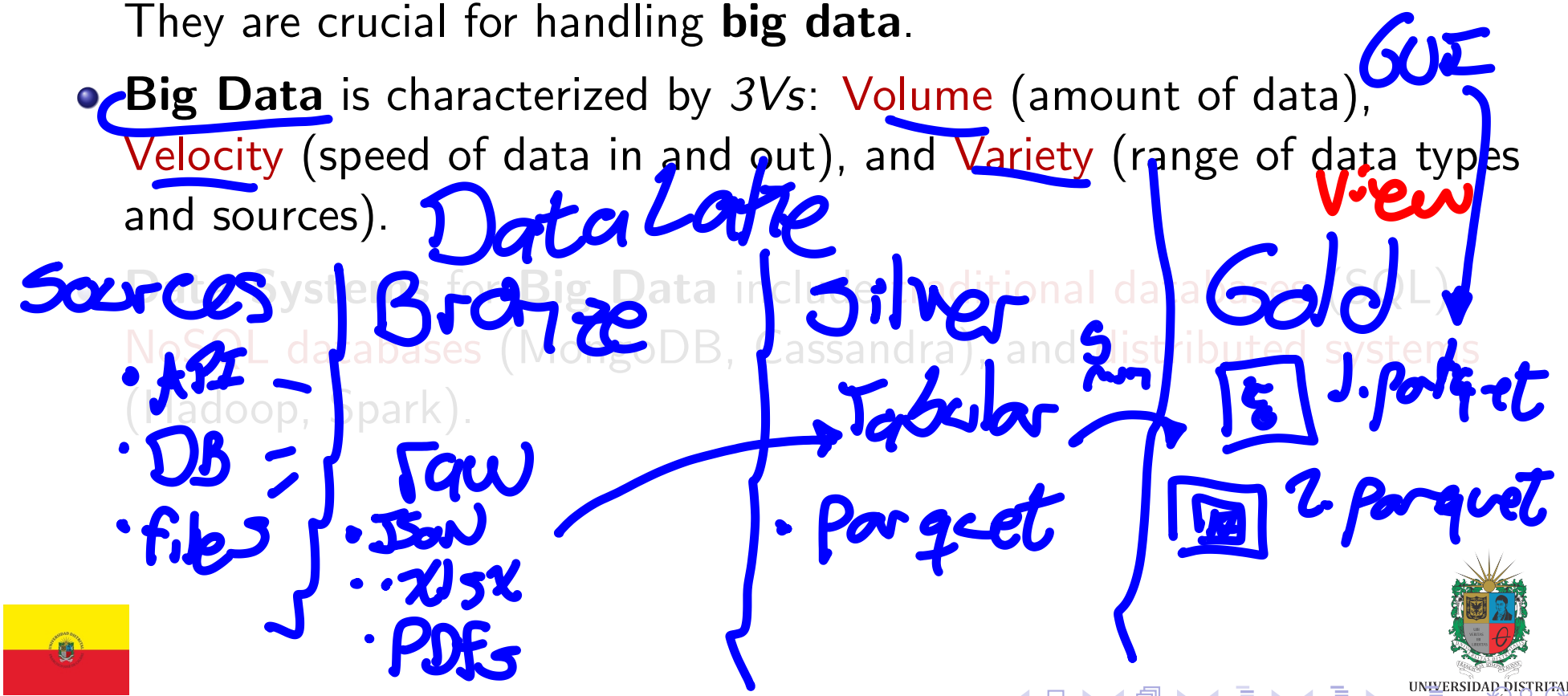

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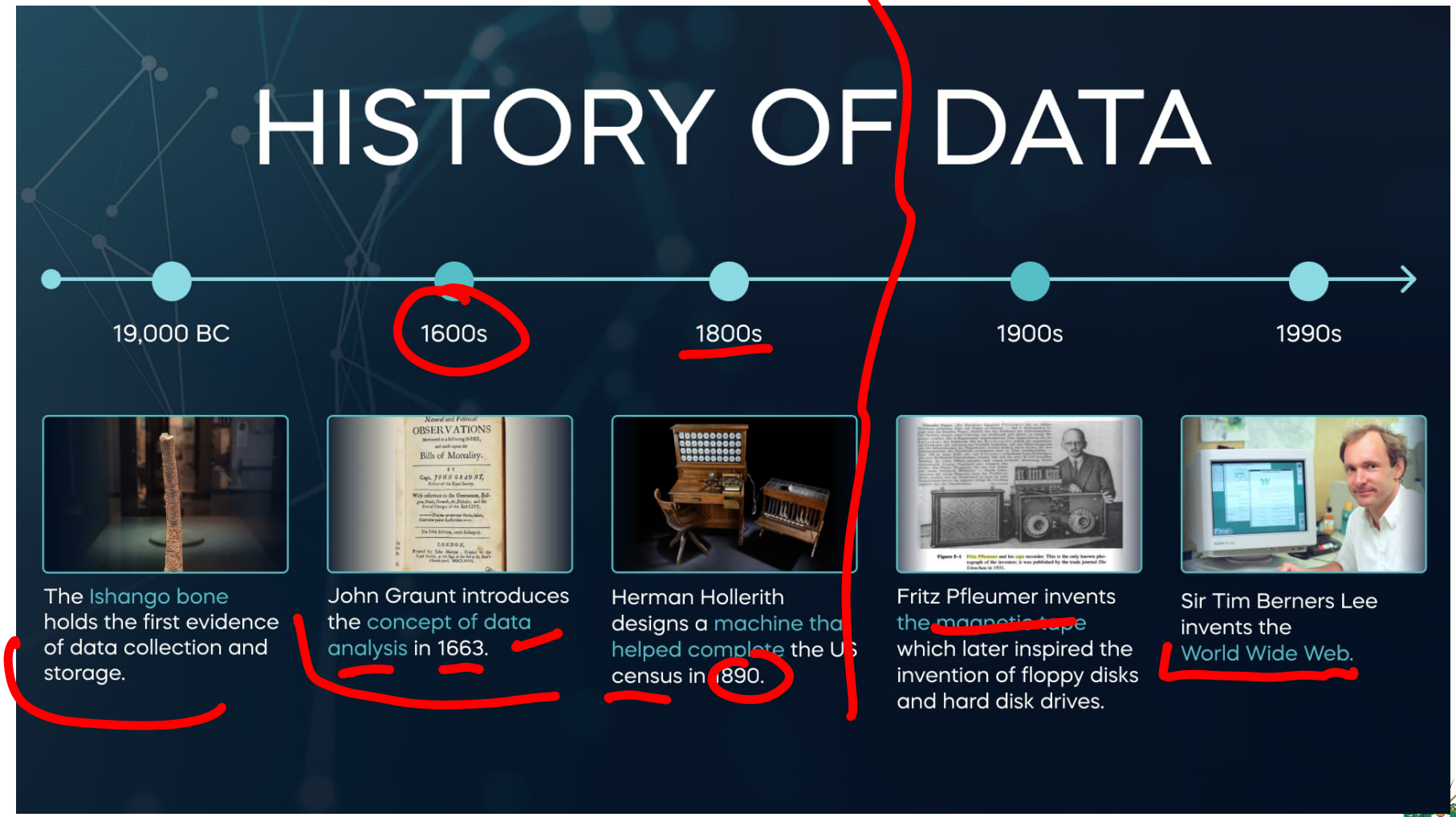
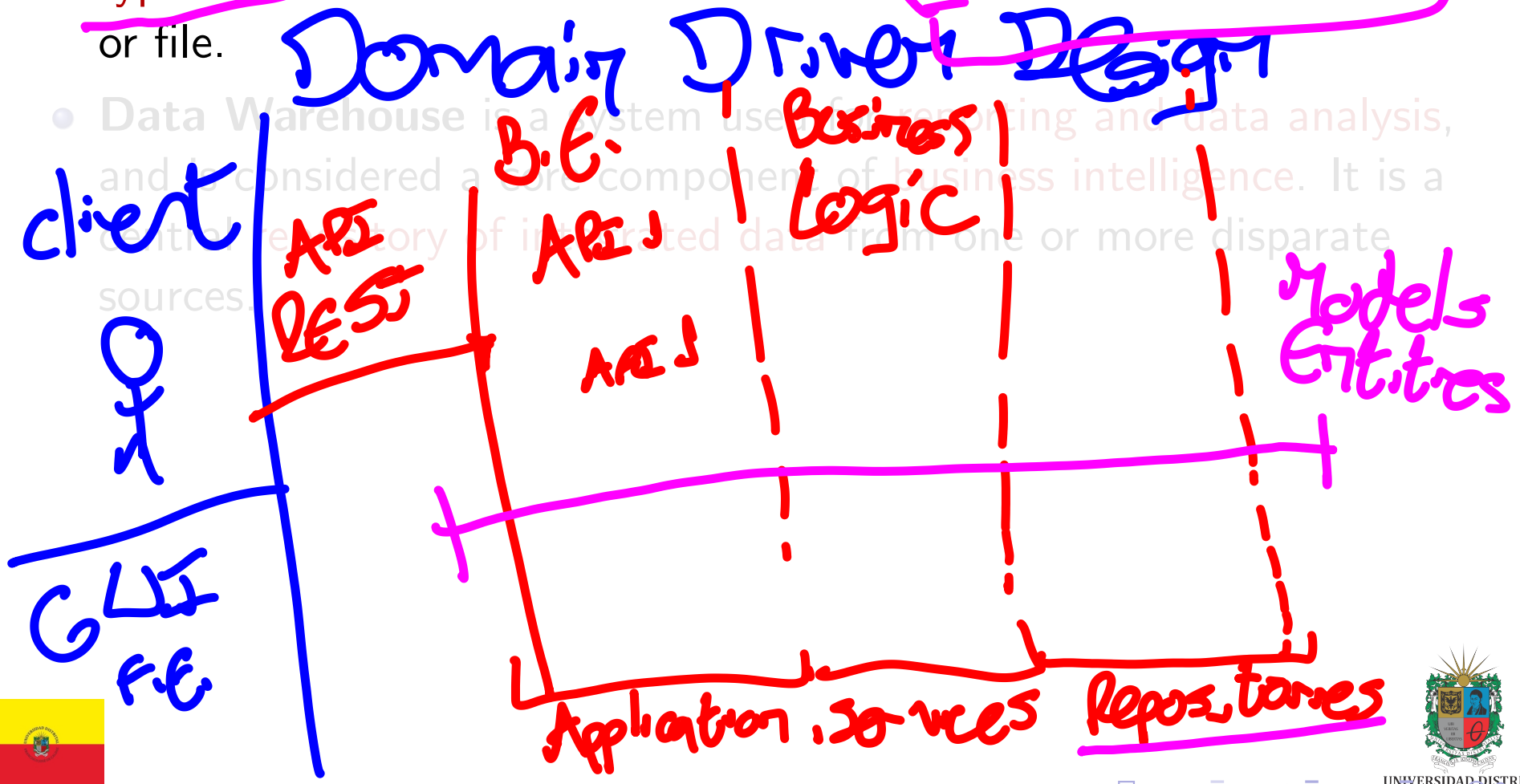
- **Data Systems** for **Big Data** include traditional databases (SQL), NoSQL databases (MongoDB, Cassandra), and distributed systems (Hadoop, Spark).

History of Data



Data Lake Vs. Data WareHouse

- **Data Lake** is a storage repository that holds a vast amount of raw data in its native format until it is needed. It is a place to store every type of data in its native format with no fixed limits on account size or file.
- **Data Warehouse** is a system used for reporting and data analysis, and is considered a core component of business intelligence. It is a central repository of integrated data from one or more disparate sources.



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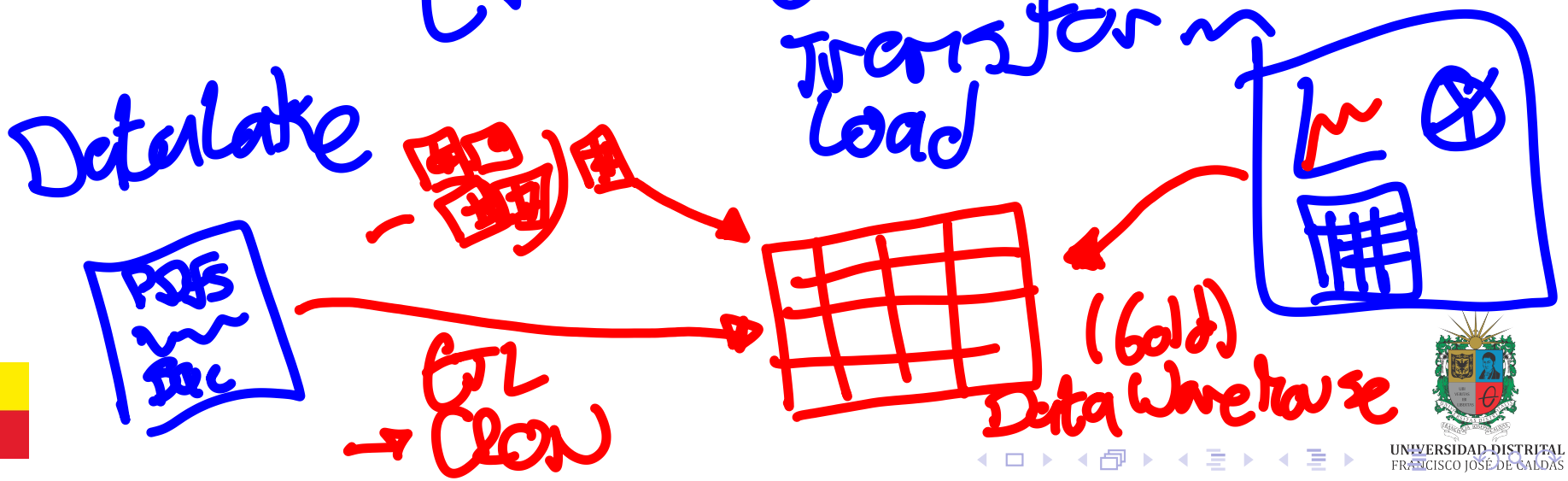
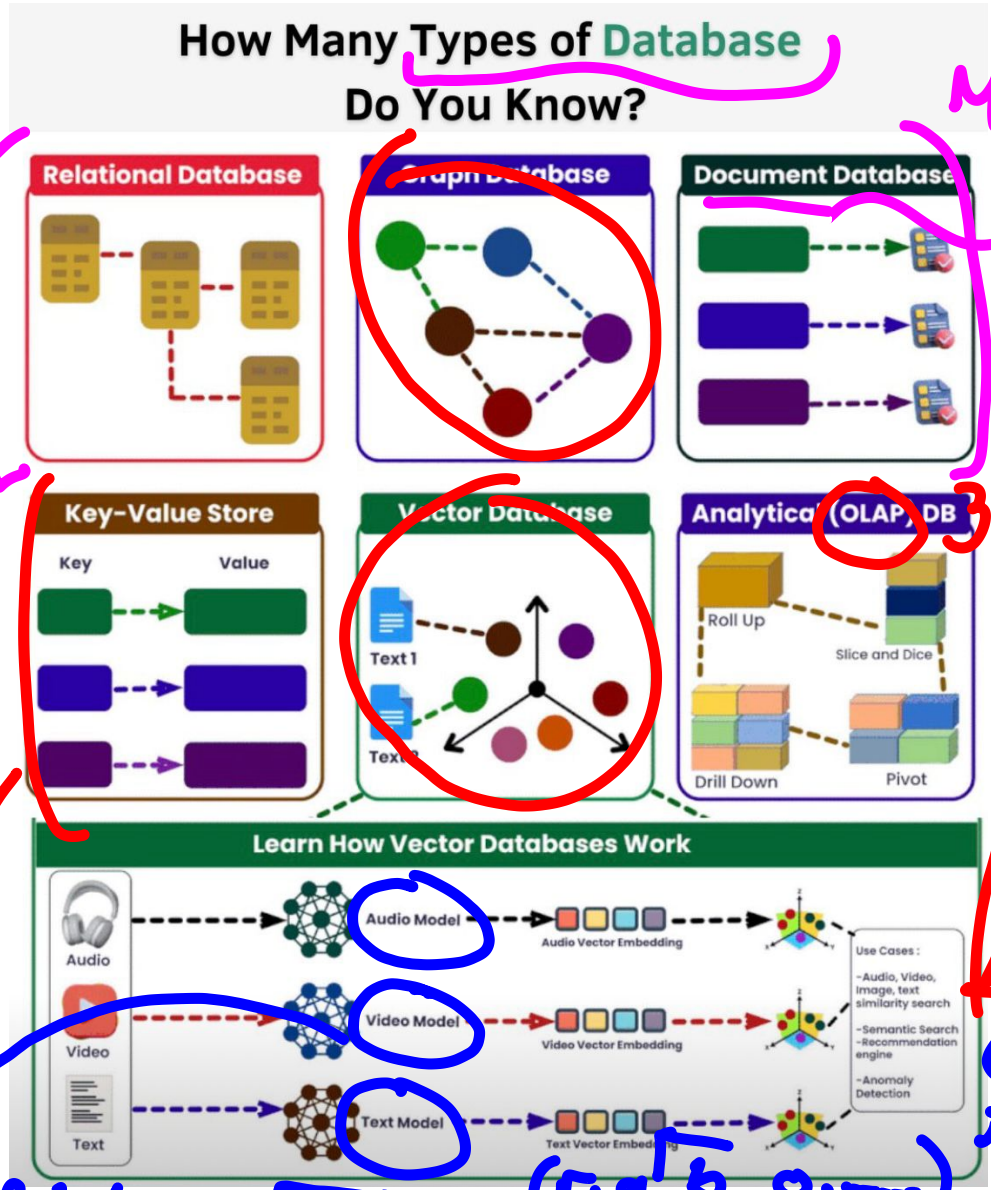
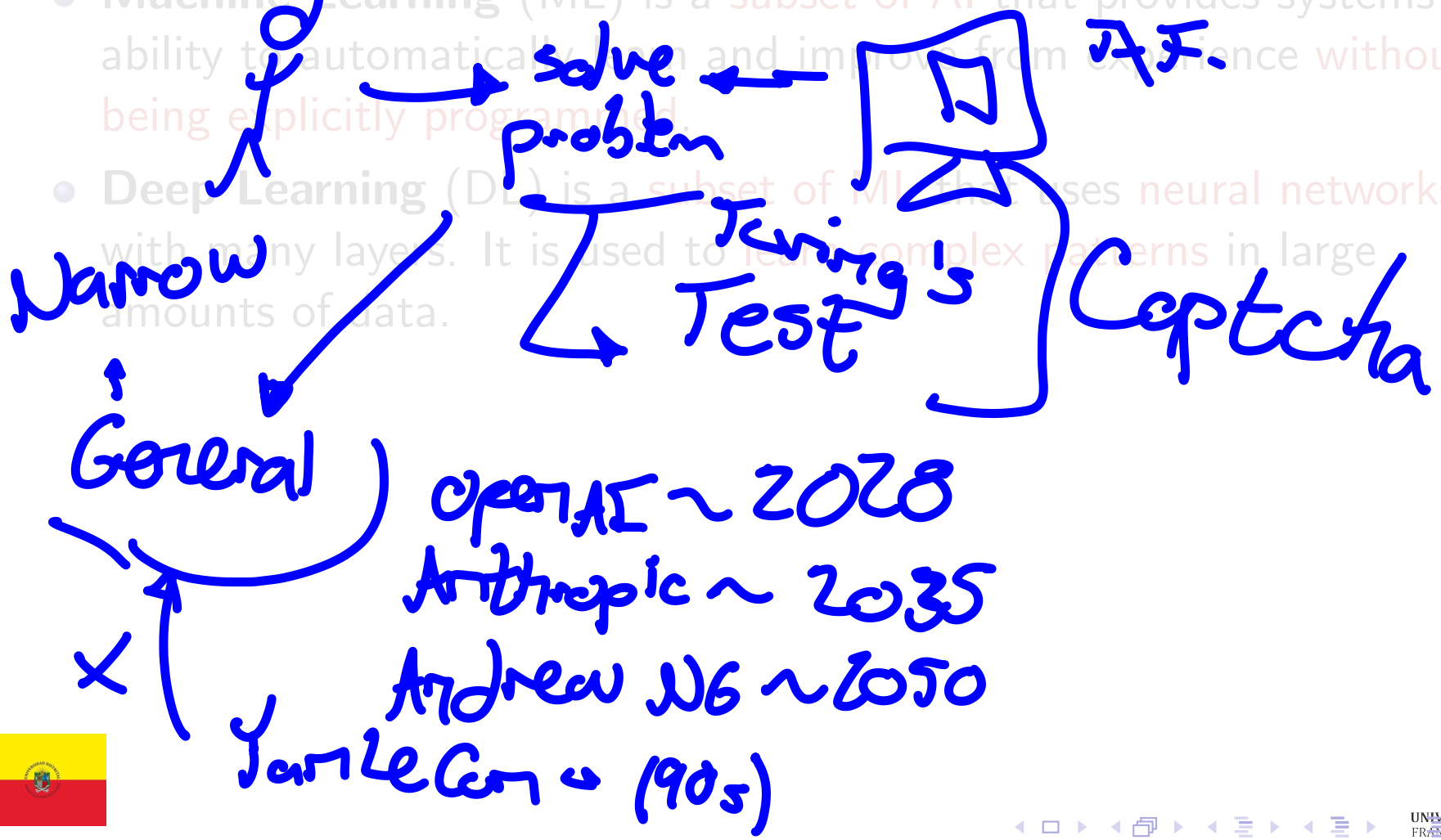


Types of Database



Artficial Inteligence, Machine Learning, Deep Learning

- **Artificial Intelligence** (AI) is the simulation of human intelligence processes by machines, especially computer systems.
- **Machine Learning** (ML) is a subset of AI that provides systems the ability to automatically learn and improve from experience without being explicitly programmed.
- **Deep Learning** (DL) is a subset of ML that uses neural networks with many layers. It is used to learn complex patterns in large amounts of data.



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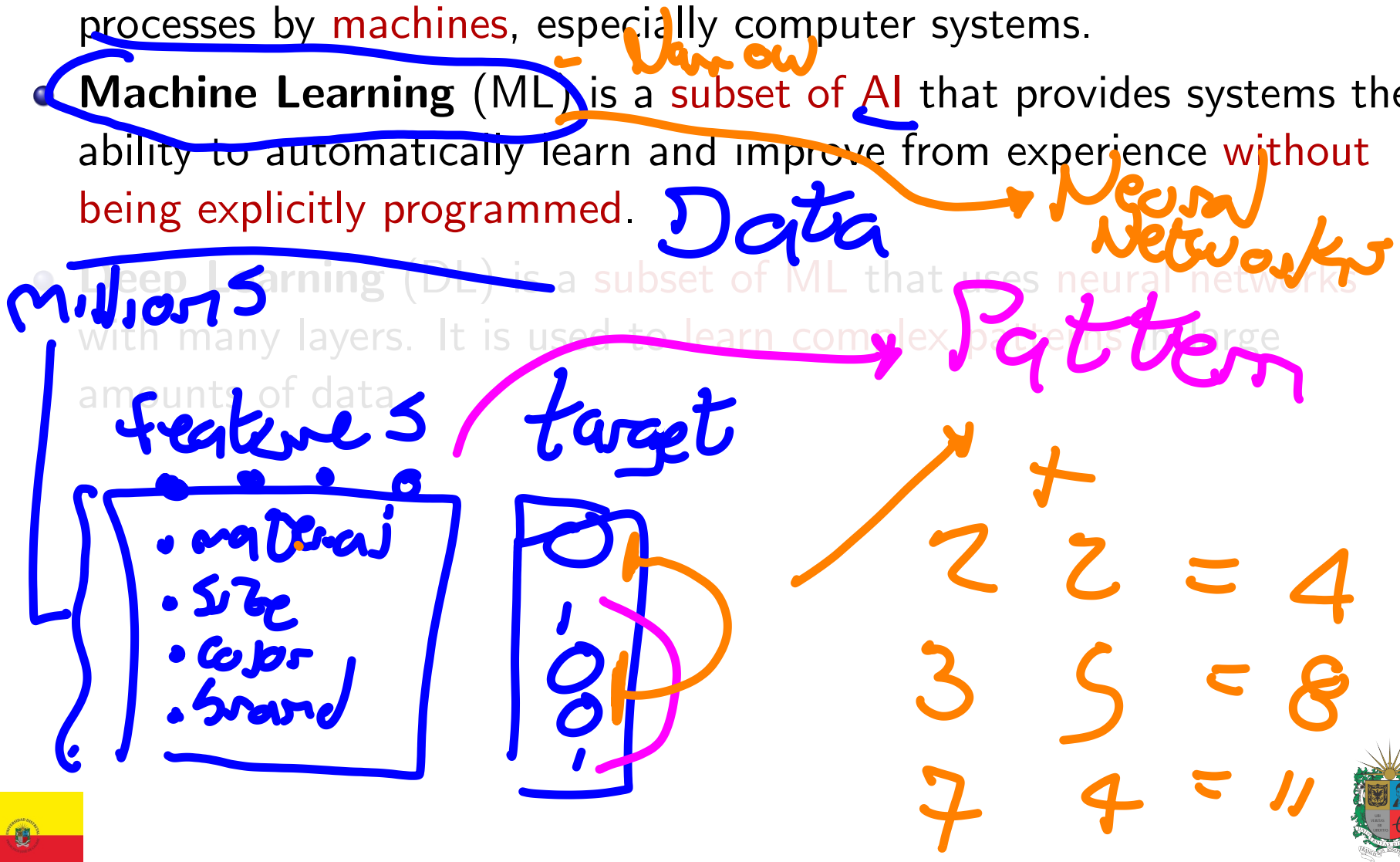

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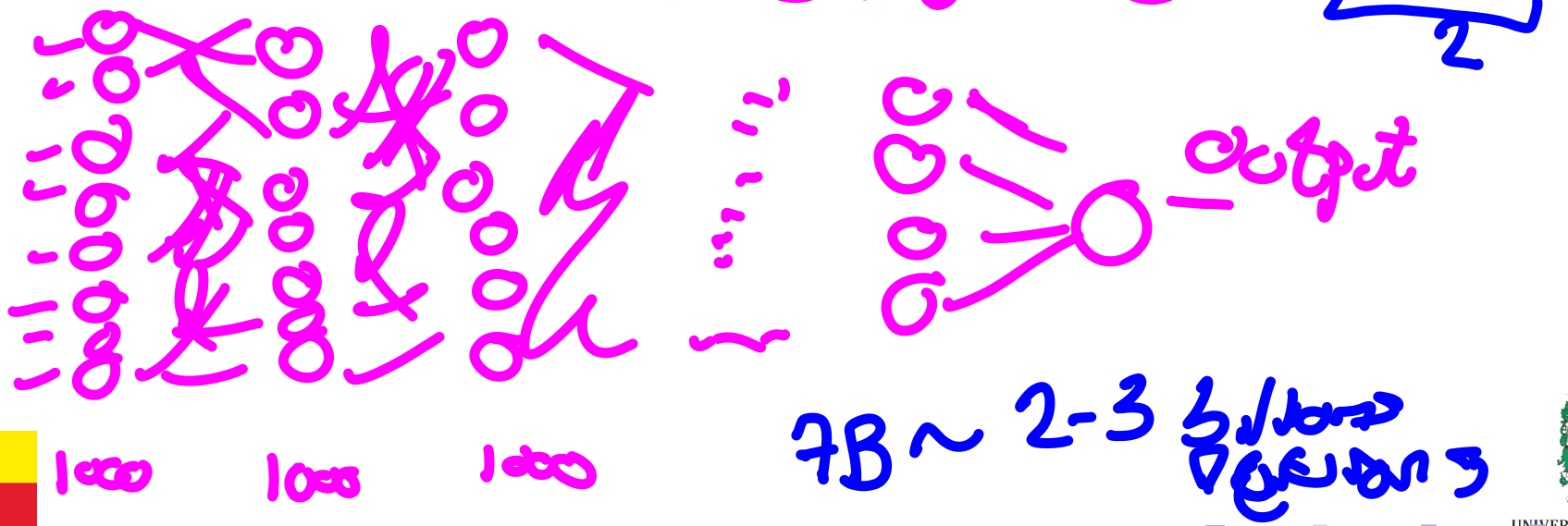
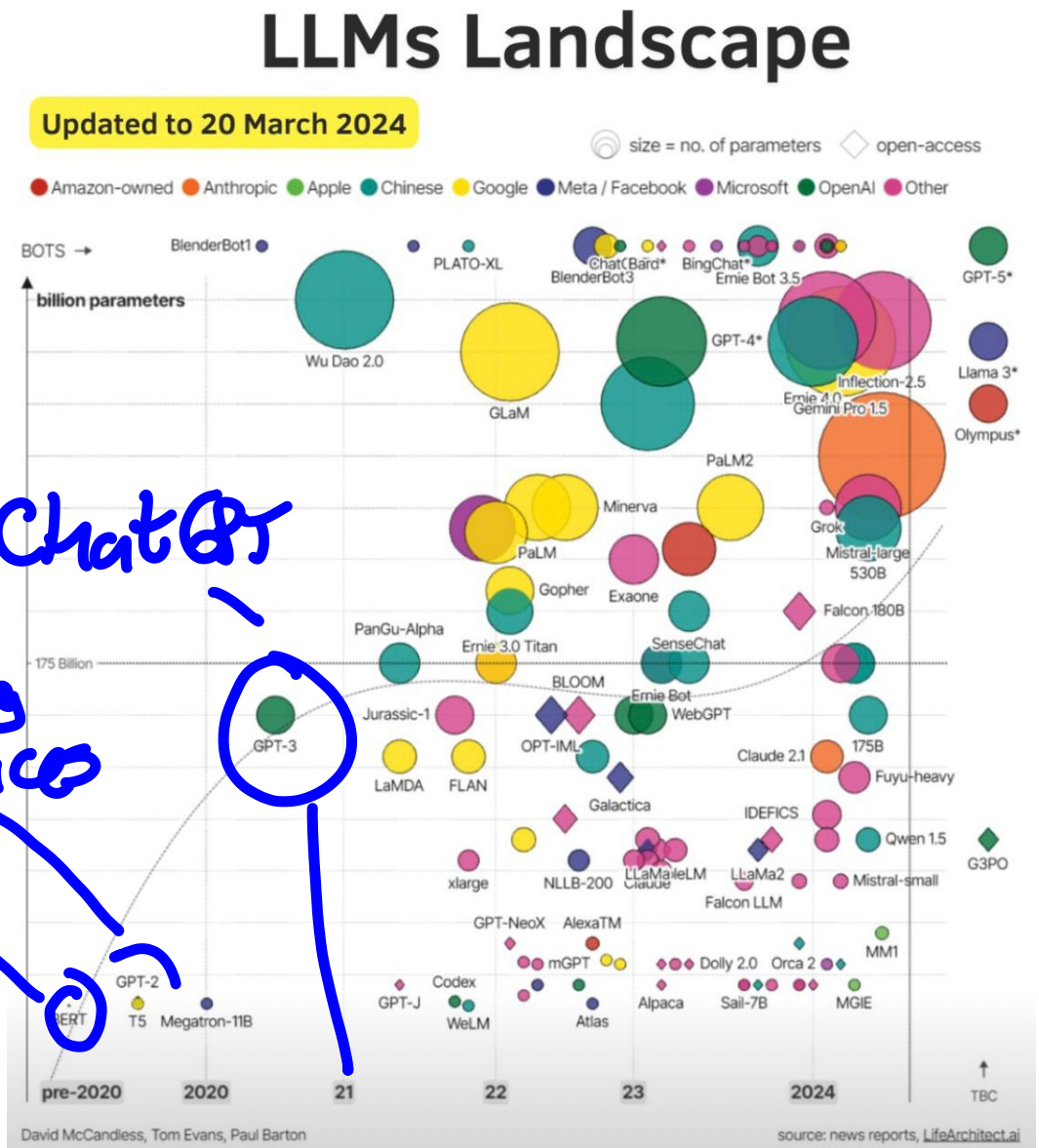


Large Language Models



Data and MetaData

- **Data** refers to raw, unprocessed, and unorganized facts or details that alone might not make much sense or provide context.
- **Metadata** is data about data. It provides the who, what, where, when, why, and how of the data.
- Examples of metadata include file size, creation date, modified date, and file type for a digital file.
- **Metadata** helps in data discovery, organization, and interpretation.
- **Metadata** is crucial in data management practices like data governance, data cataloging, and data lineage.

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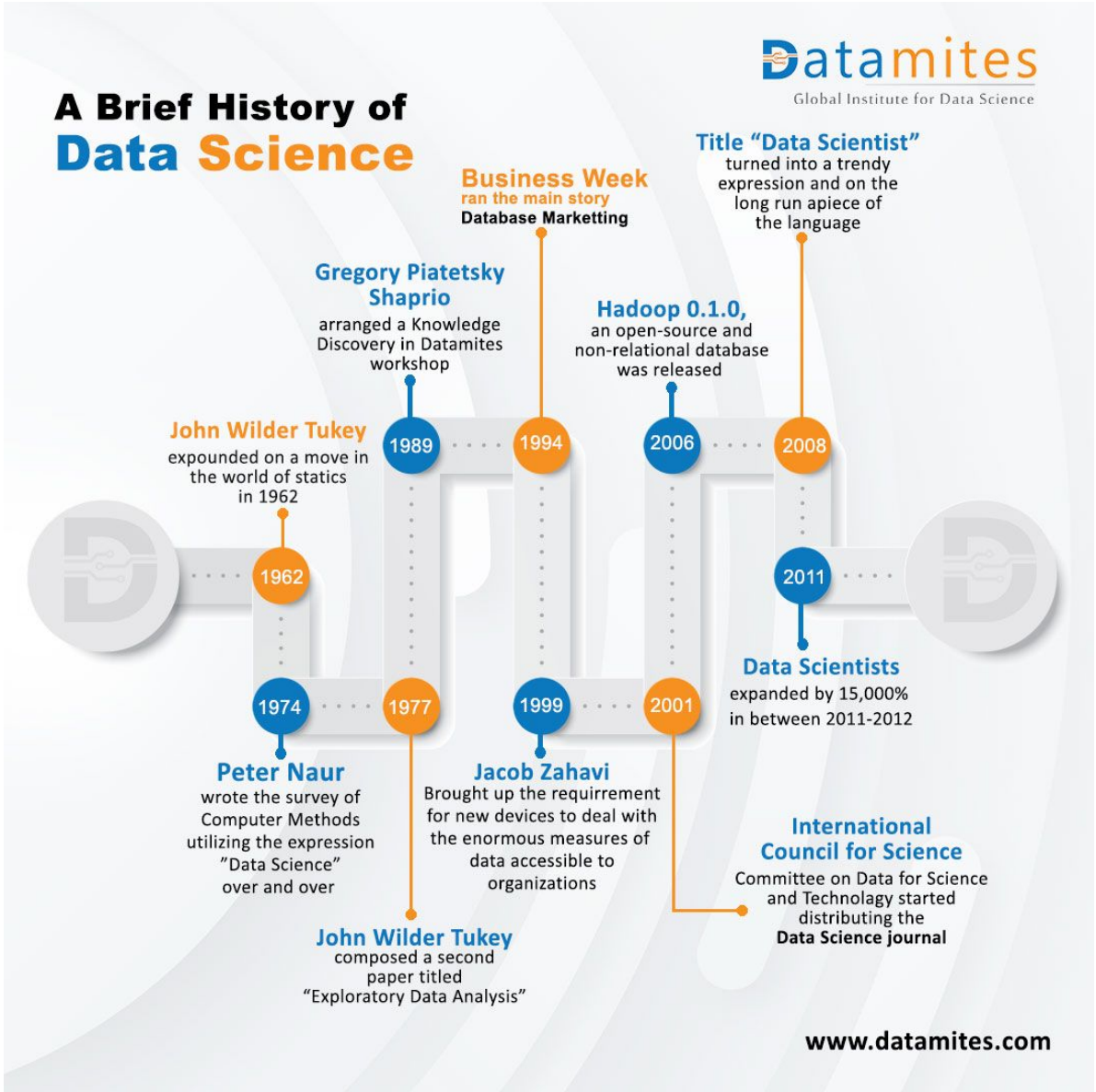
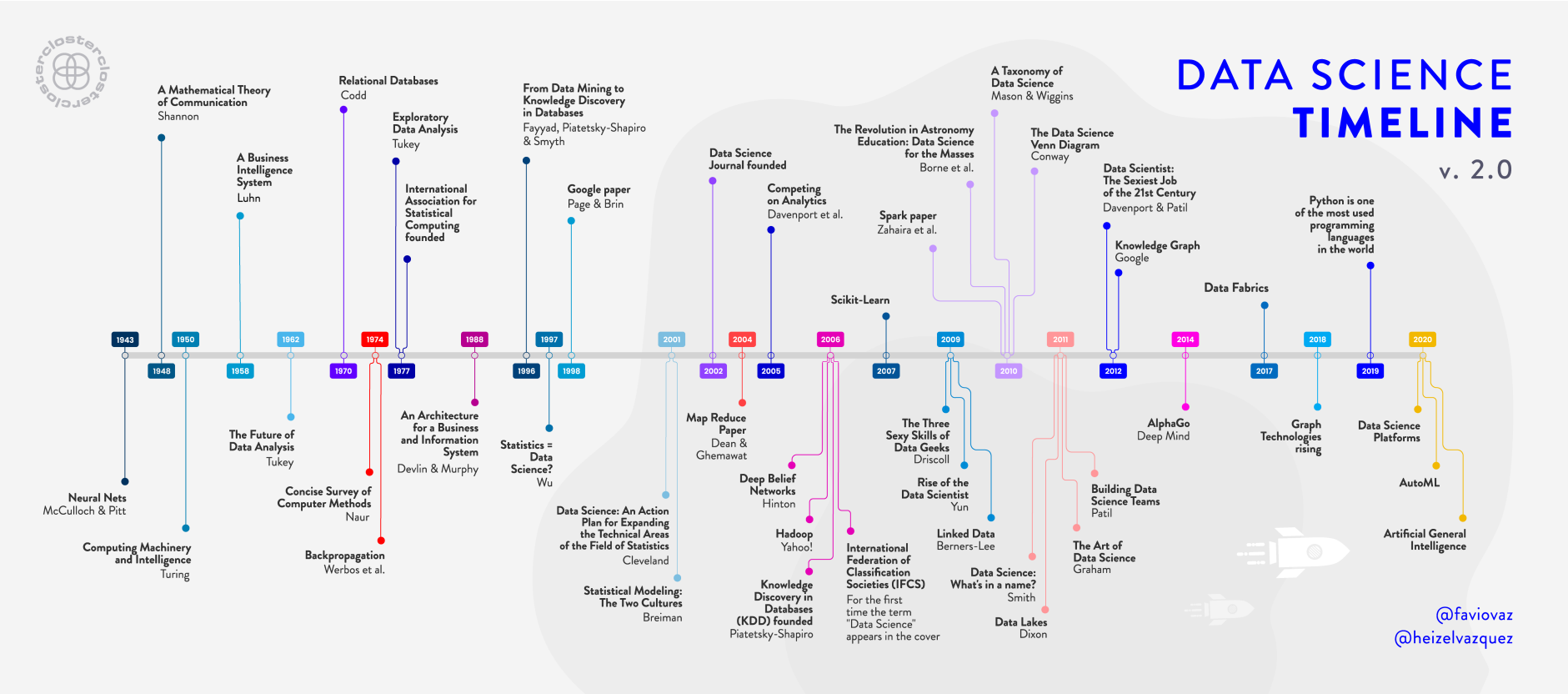
Brief History of Data Science



Data Science Big Timeline



Data Science in Industry

- **Data Science** is used in many industries to make decisions, optimize processes, and increase efficiency.
- **Data Science** is used in healthcare to predict patient outcomes, optimize treatment plans, and personalize medicine.
- **Data Science** is used in finance to detect fraud, predict stock prices, and automate trading.
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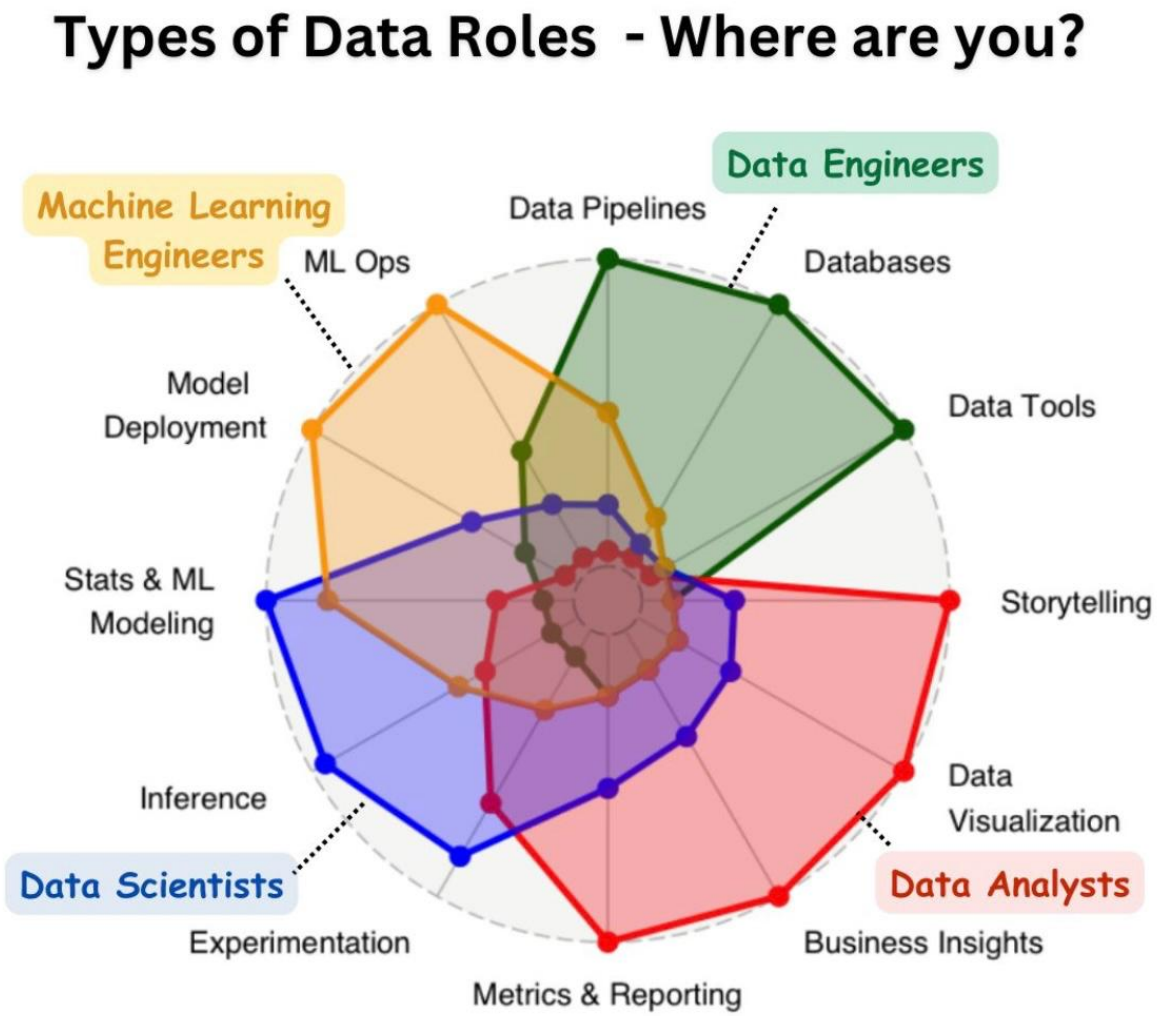
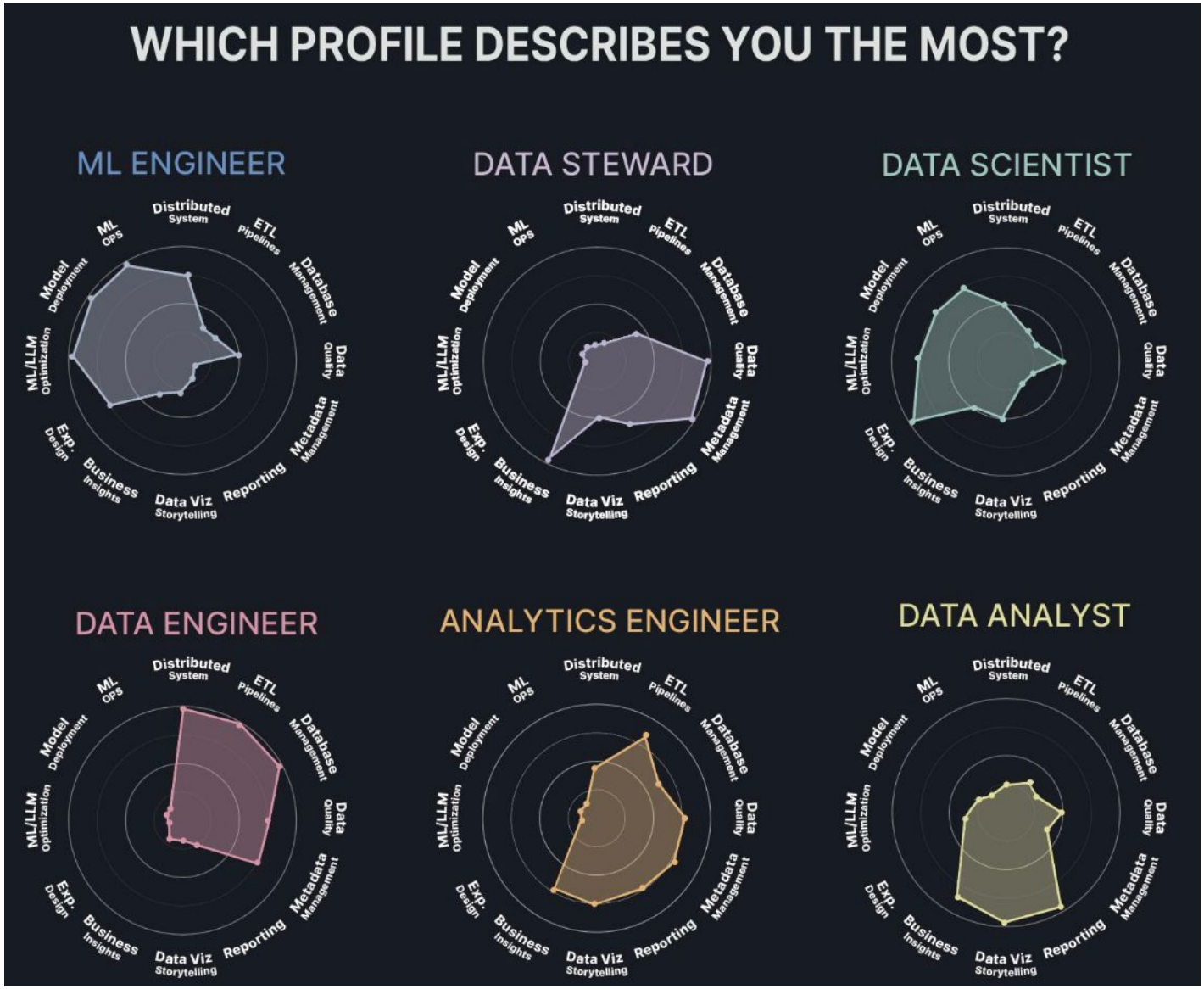
Tech Team — Roles



Tech Team — Data Profiles



Data Scientist Responsabilities

- Collecting large sets of structured and unstructured data from **disparate sources**.
- Cleaning and validating the data to ensure **accuracy**, **completeness**, and uniformity.
- Analyzing the data to identify **patterns** and trends.
- Interpreting the data to discover solutions and **opportunities**.
- Communicating findings to stakeholders using **visualization** and other means.
- Developing, prototyping, and implementing **machine learning models**.
- Staying current on techniques and tools in the field, and continually **improving skills**.

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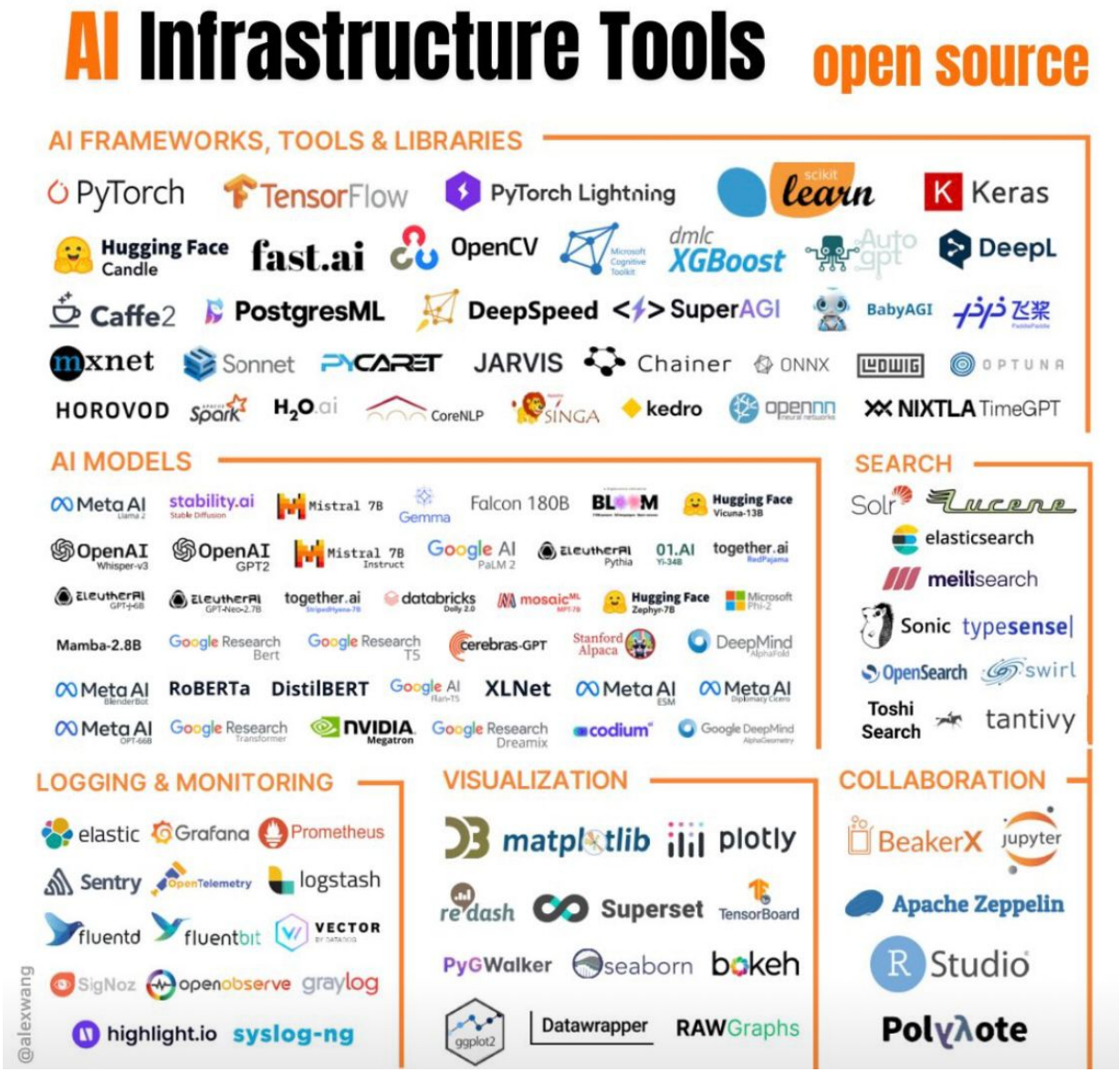
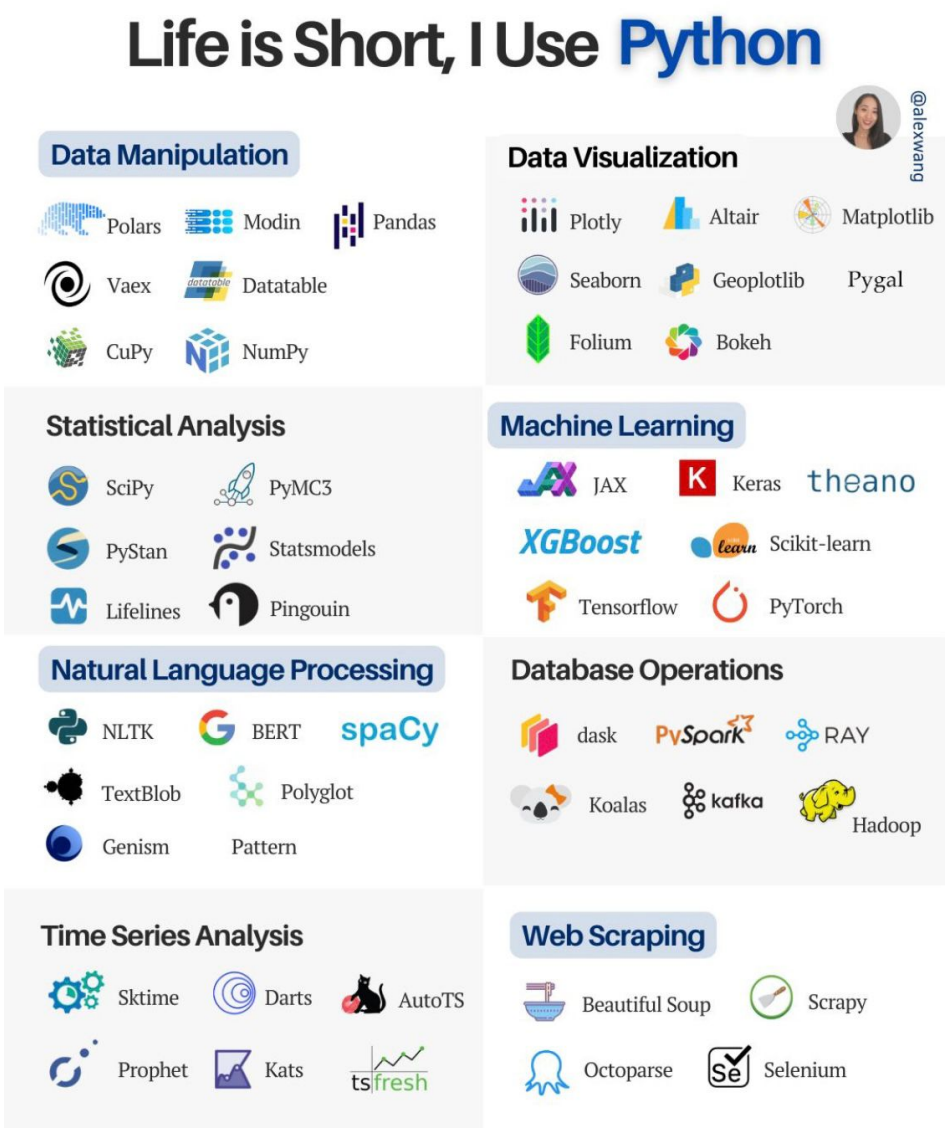
Artificial Intelligence Tech Ecosystem



Data Science Python Tech Ecosystem



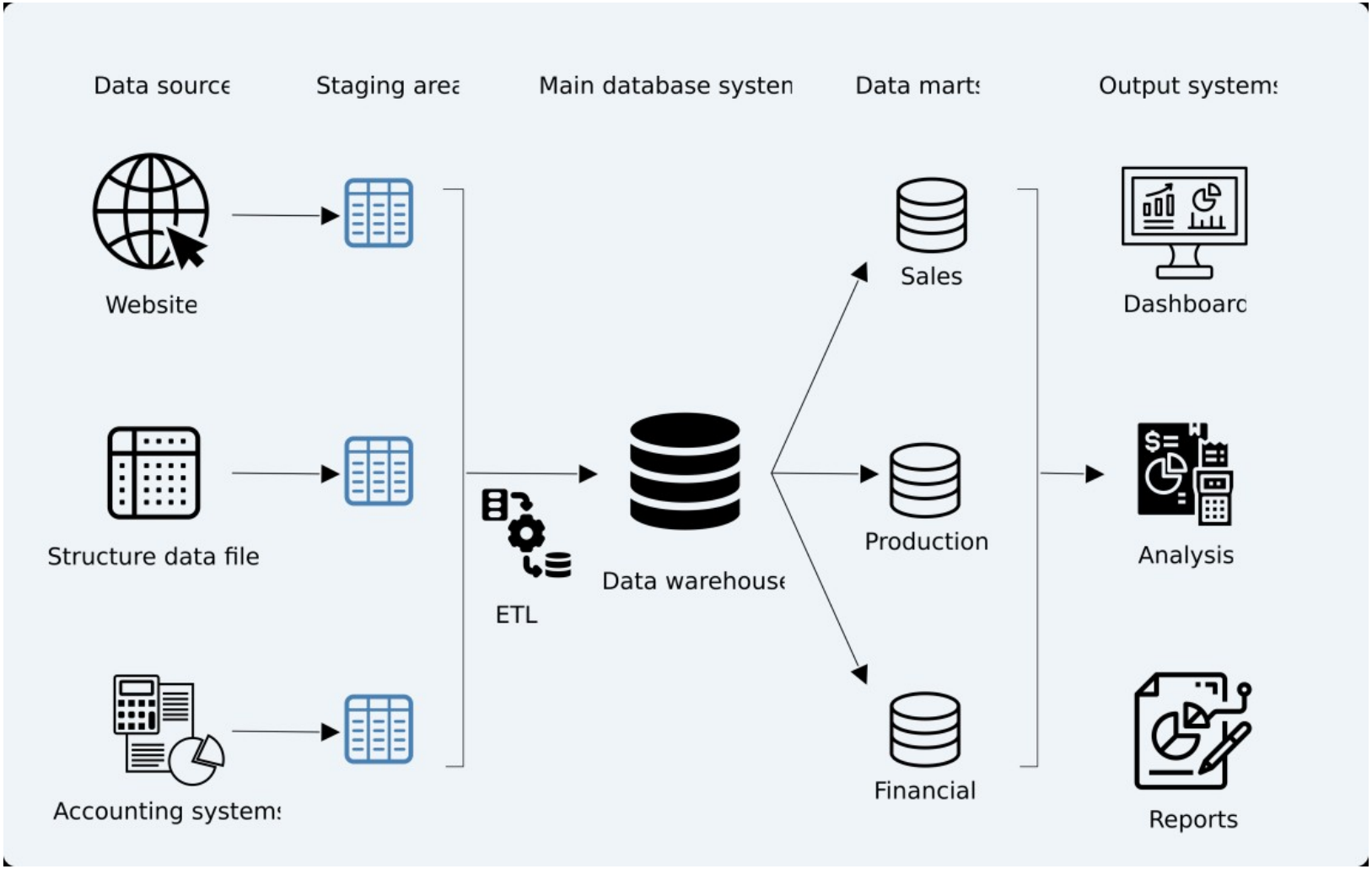
Data Sources and Formats

Data Definition Framework

Data Format

Data Source	Structured	Unstructured
Internal	**Human-Generated** • Survey ratings • Aptitude testing **Machine-Generated** • Web metrics from Web logs • Product purchase from sales Records • Process control measures	**Human-Generated** • Emails, letters, text messages • Audio transcripts • Customer comments • Voicemails • Corporate video/communications • Pictures, illustrations • Employee reviews
External	**Human-Generated** • Number of Retweets, Facebook likes, Google Plus +1s • Ratings on Yelp • Patient ratings ratings **Machine-Generated** • GPS for tweets • Time of tweet/updates/postings	**Human-Generated** • Content of social media updates • Comments in online forums • Comments on Yelp • Video reviews • Pinterest images • Surveillance video

Data Pipelines



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Thanks!

Questions?

Repo: *https://github.com/EngAndres/ud-public/tree/main/courses/data-analysis-programming*

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