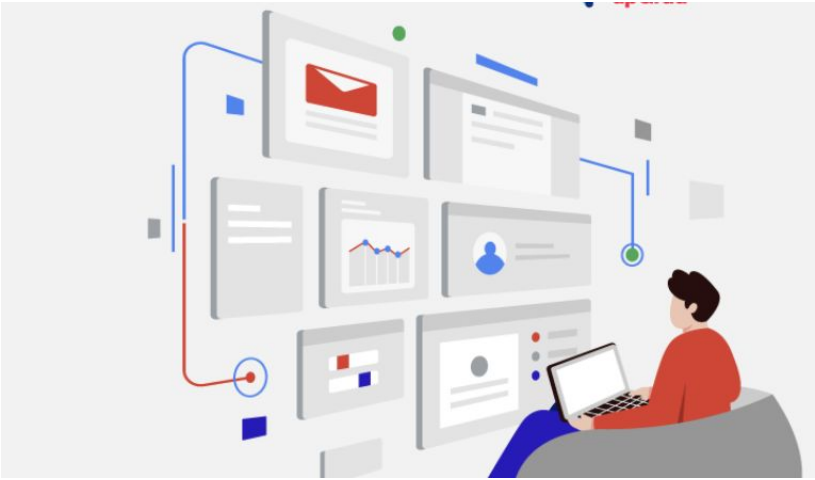
CIS 635 Knowledge Discovery & Data Mining

Data modalities - Introduction and Overview

Outline

- Everyday observed data and their modalities and types
- Data Trends, and where DS fits

Everyday observed (real life) data



Everyday observed (real life) data

- We have seen an **explosion of data** in recent days, especially in the l**ast few years!**
- The transition from the Analog to the Digital World has made this Big Shift (was unimaginable a few decades ago)

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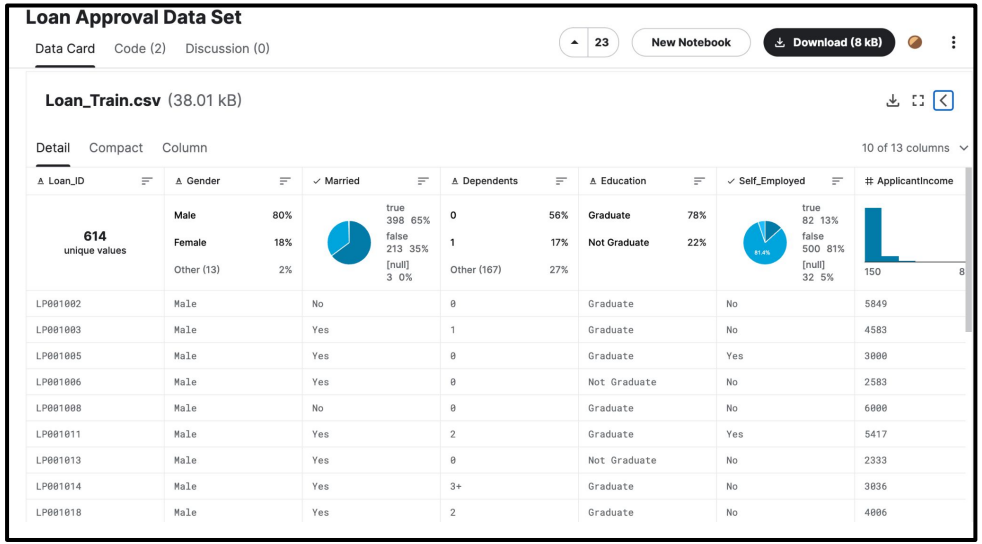
- It's very difficult to **segregate them into different types** as data come in different **format** and in different **modalities**.
- We will try a **simplified approach** to **group** them and try to cover most (NOT ALL) data we perceive in our everyday life.

Everyday observed (real life) data

- Structured data
- Un(and Semi) structured data

Structured data

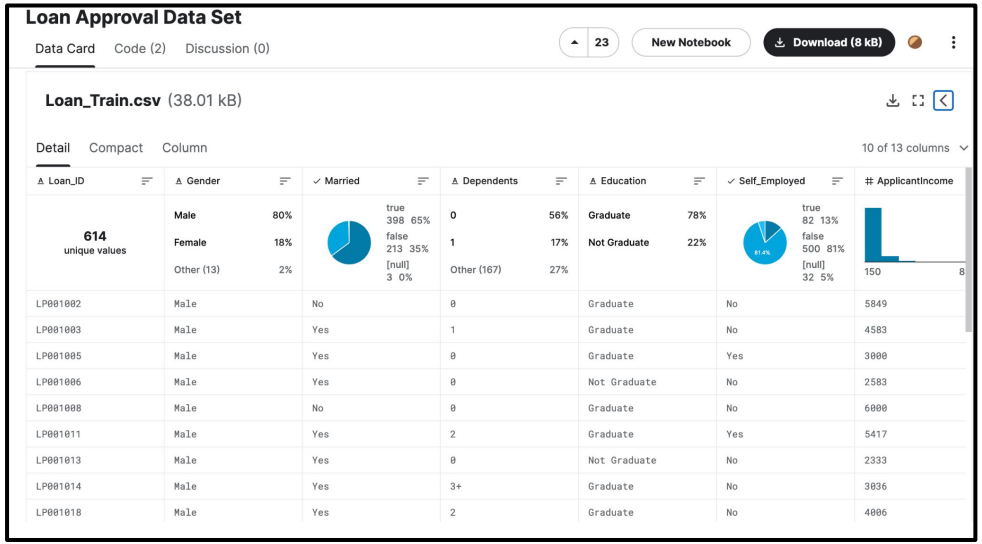


- Generally organized in **tables** and collected through filling **forms** (manual or online)
- Stored in **databases/spread-sheets** mainly
- Also popular the **.csv** file format

- Opening a bank account
- University registration
- Gmail
- Amazon account
- Your health profile

[Kaggle loan approval dataset]

Structured data



Loan Approval Data Set

Data Card | Code (2) | Discussion (0) | 23 | New Notebook | Download (8 kB)

Loan_Train.csv (38.01 kB)

Detail | Compact | Column | 10 of 13 columns

Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome
614 unique values	Male 80% Female 18% Other (13) 2%	true 398 65% false 213 35% [null] 3 0%	0 56% 1 17% Other (167) 27%	Graduate 78% Not Graduate 22%	true 82 13% false 500 81% [null] 32 5%	150 – 8
LP001002	Male	No	0	Graduate	No	5849
LP001003	Male	Yes	1	Graduate	No	4583
LP001005	Male	Yes	0	Graduate	Yes	3000
LP001006	Male	Yes	0	Not Graduate	No	2583
LP001008	Male	No	0	Graduate	No	6000
LP001011	Male	Yes	2	Graduate	Yes	5417
LP001013	Male	Yes	0	Not Graduate	No	2333
LP001014	Male	Yes	3+	Graduate	No	3036
LP001018	Male	Yes	2	Graduate	No	4006

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- Opening a **bank account**
- **University registration**
- **Gmail, Azure, and/or Amazon** account
- Your immigration, health, social media **profile**

[Kaggle loan approval dataset]

Structured data

- There also other formats, or you can convert them to
- Some are stand alone, while others are sequences and/or series
- Software generated logs

- Genomics data
- Stock prices
- Your CC history
- Weather data
- Google maps

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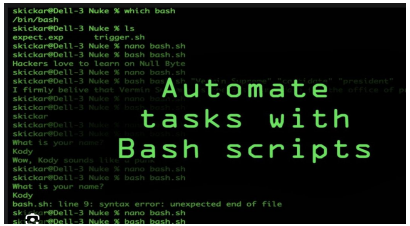
Un/Semi Structured data

- Free forms
- Stored in data lake/warehouses mainly
- **Languages**: sequence of strings (semantics)
- **Audio**: Language + Acoustics; Music
- **Image** : Visual representation of the world
- **Video**: Sequence of images



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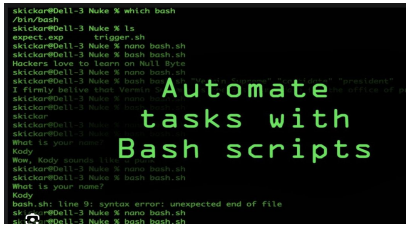

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- Some are sequence, while others are stand alone
- **Social media** data (discussions, messages, emotions, vives)

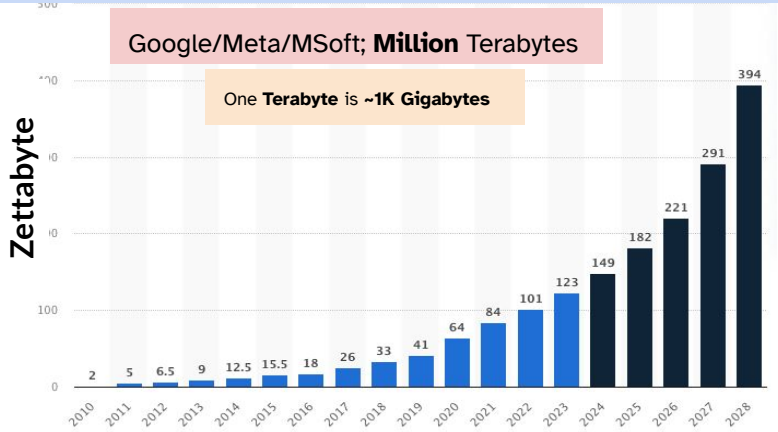
Data Growth and the Trend

Data Growth and the Trend

One **Zettabyte** is approximately equal **1 billion Terabytes**

Google/Meta/MSoft; **Million** Terabytes

One **Terabyte** is **~1K Gigabytes**



- **Exponential growth**
  - ***Before 2010 collectively relatively close to Zero Zetabyte***
- Mainly due to
  - IoT sensors
  - Social media
  -
- Forecast might be underestimated as we expect more due to the recent Generative AI/LLM releases (ChatGPT for an example)

[Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2023, with forecasts from 2024 to 2028 (in Zettabytes)]

statista

2024

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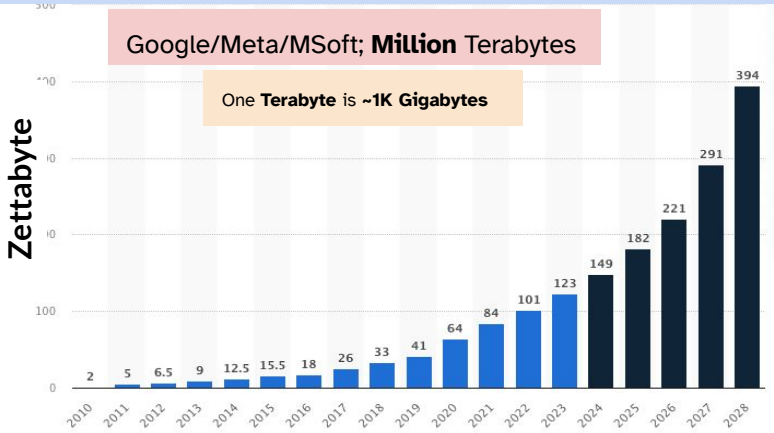

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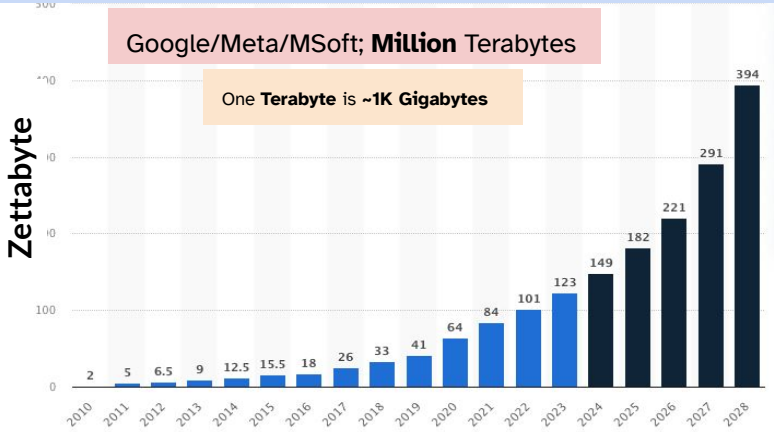

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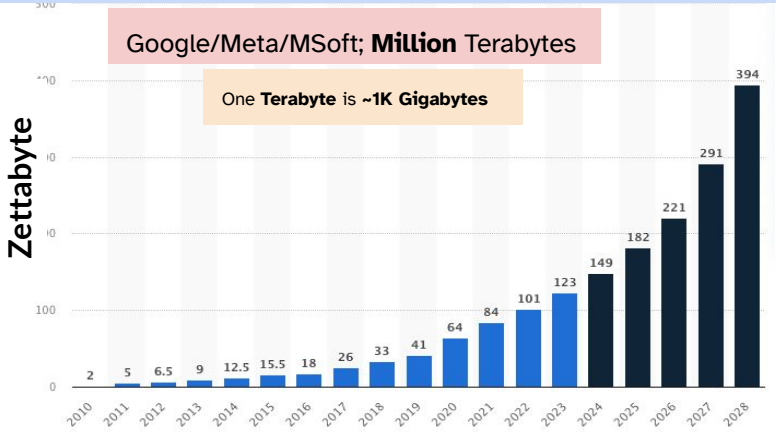

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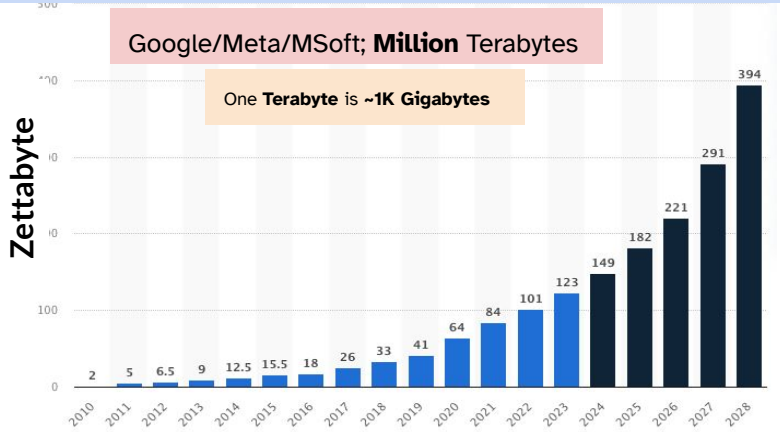

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- **Data Science has emerged as an important discipline**
- We need to tackle new challenges, and many more are yet to come
- We will be learn about modern day **pioneers** in our class moving forward
- However, most the basic principles relates to basics of Math, Statistics and Probability theories. **Tribute** to

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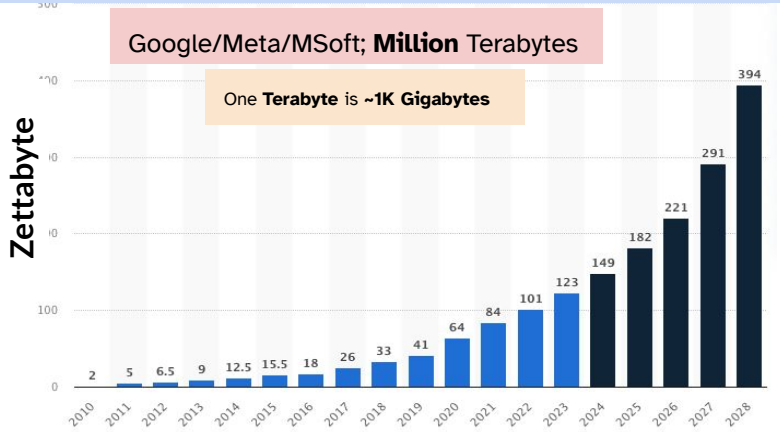

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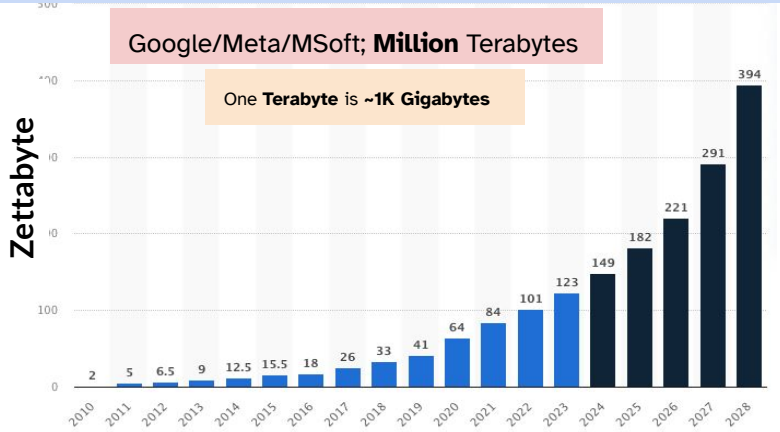

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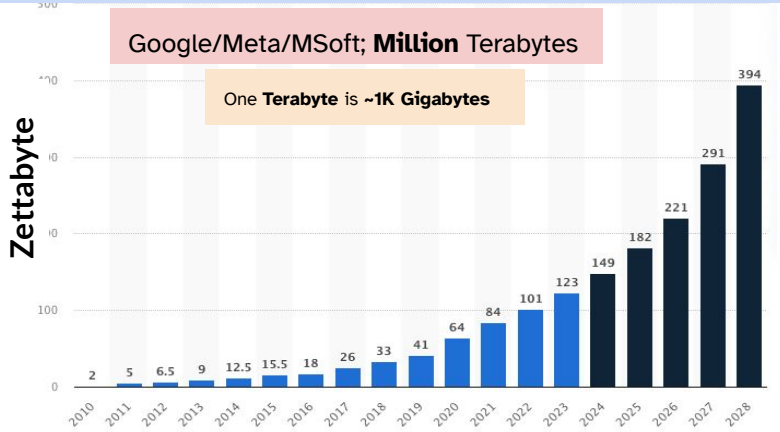

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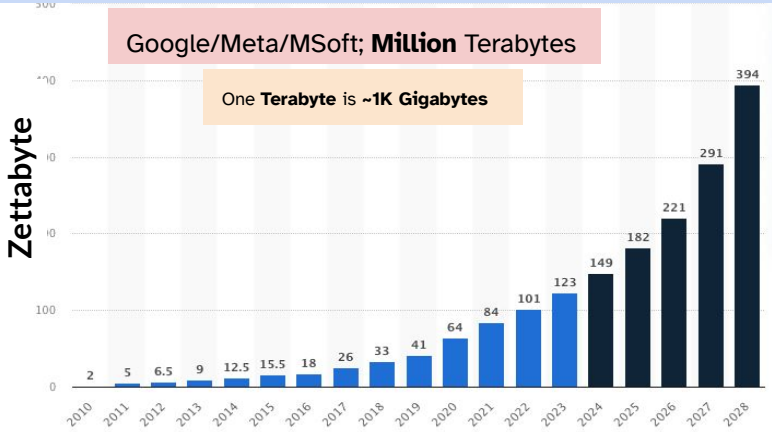

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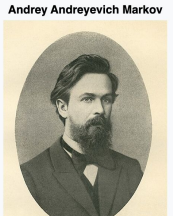
Bernoulli's *Ars Conjectandi* was the first work that dealt with probability theory as currently understood.

Carl Friedrich Gauss made major contributions to probabilistic methods leading to statistics;

ortrait purportedly of Bayes used in a 1936 ok,[1] but it is doubtful whether the portrait is ually of him.[2] No earlier portrait or claimed portrait survives.

Gerolamo Cardano (16th century)



Markov in 1886

QA