Introduction to Big Data Analytics - From Data Management to Project Deployment

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*** Open Source and Not-For-Profit Sharing / Demo**

What will be covered?

- Introduction to (Big) Data Analytics
- Data Management
- Data Governance
- Type of Analytics
- CRISP-DM
- Turning Data into Actionable Insights
- Data Engineering
- MLOps & DataOps
- Business Intelligence & Data Storytelling
- Practical Activities

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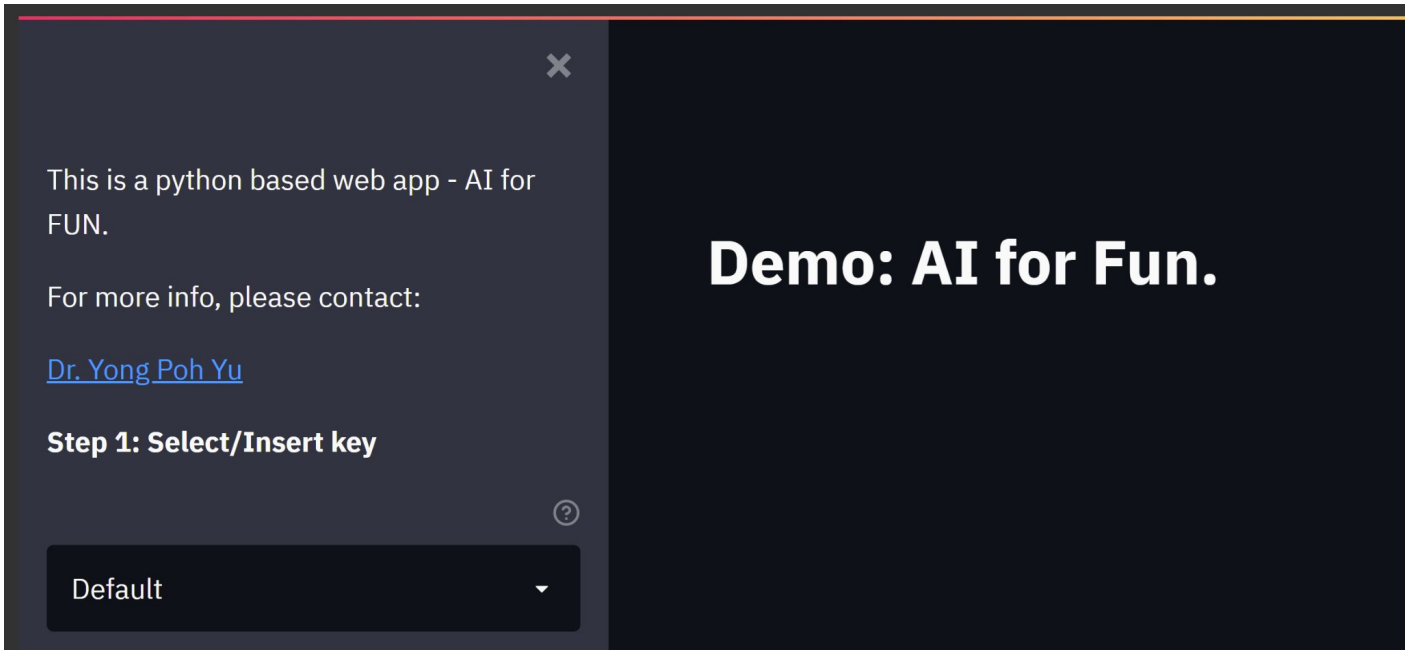
https://github.com/richieyuyongpoh/creating-value-through-data-transformation

Before We continue:

Please make sure you have a Google account

A: Introduction to Big Data Analytics



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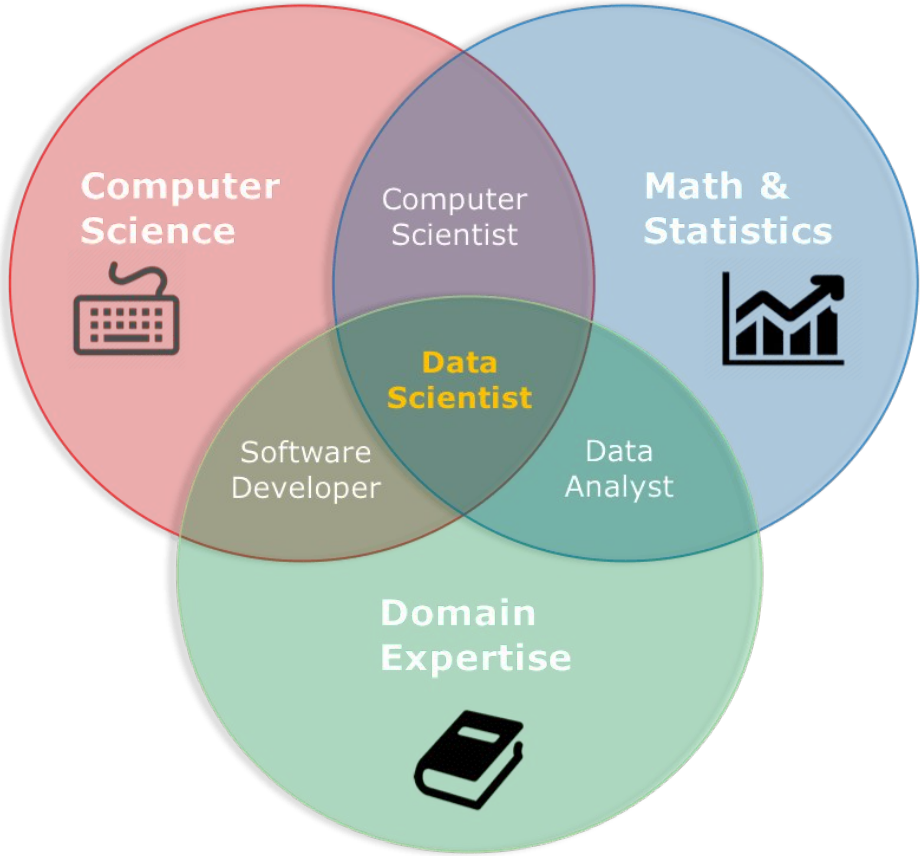
Data science is a field for mathematical geeks

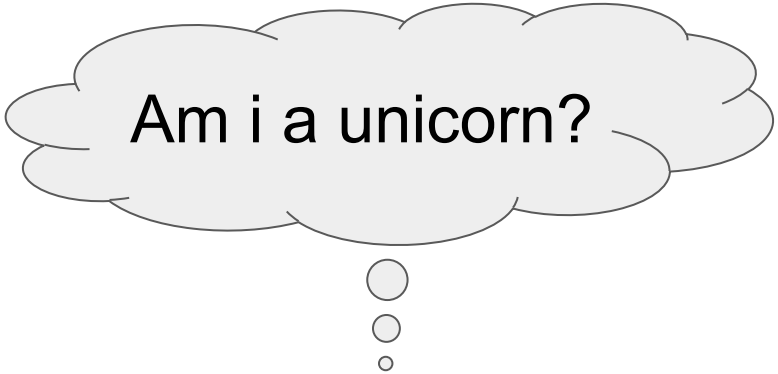
Learning a tool is the equivalent of learning data science

Data scientists will be replaced by artificial intelligence soon

What is/are …

Data Science?
Artificial Intelligence?
Machine Learning?





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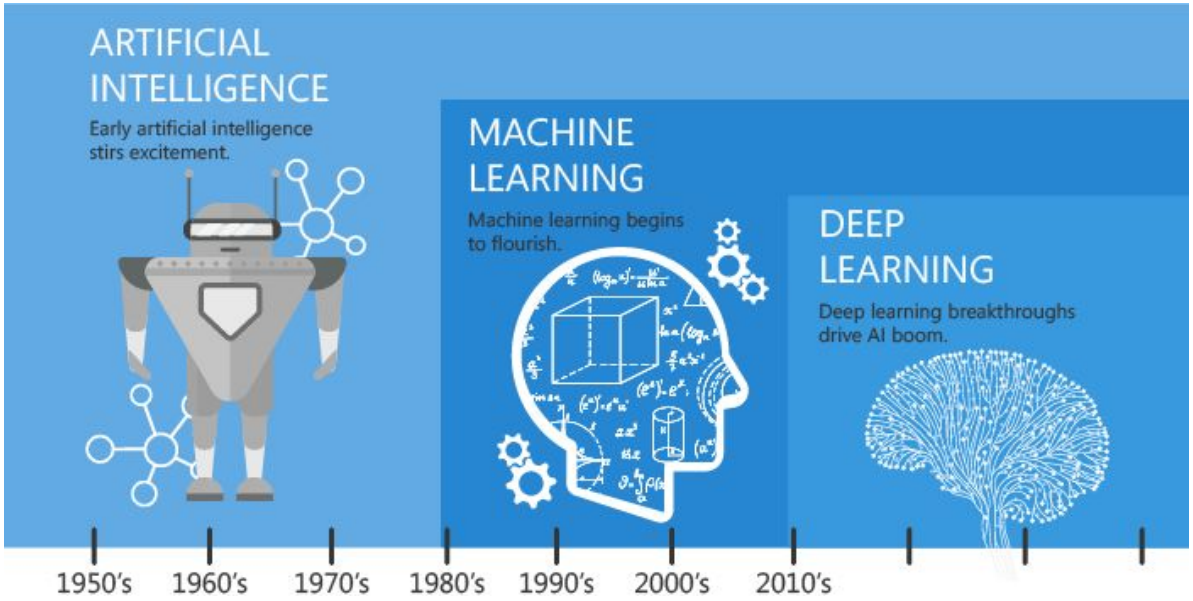

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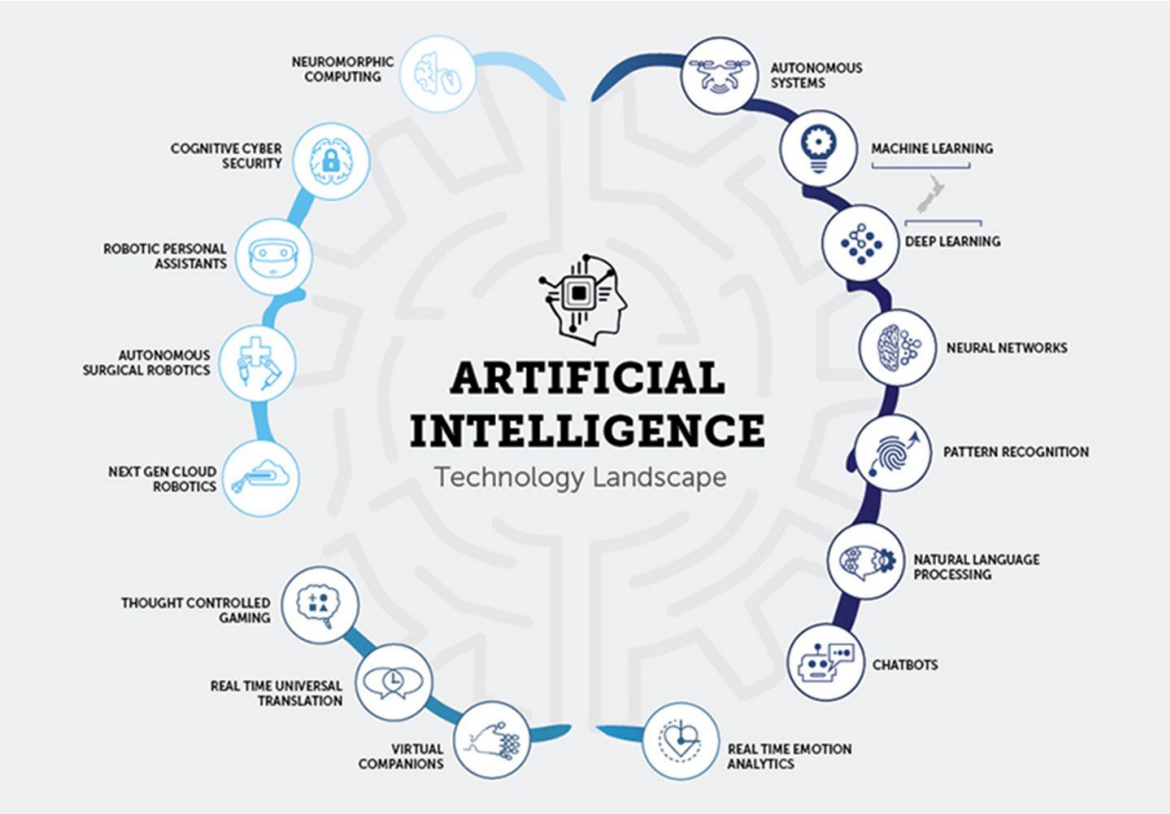

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Data, AI, ML

Berpisah tiada

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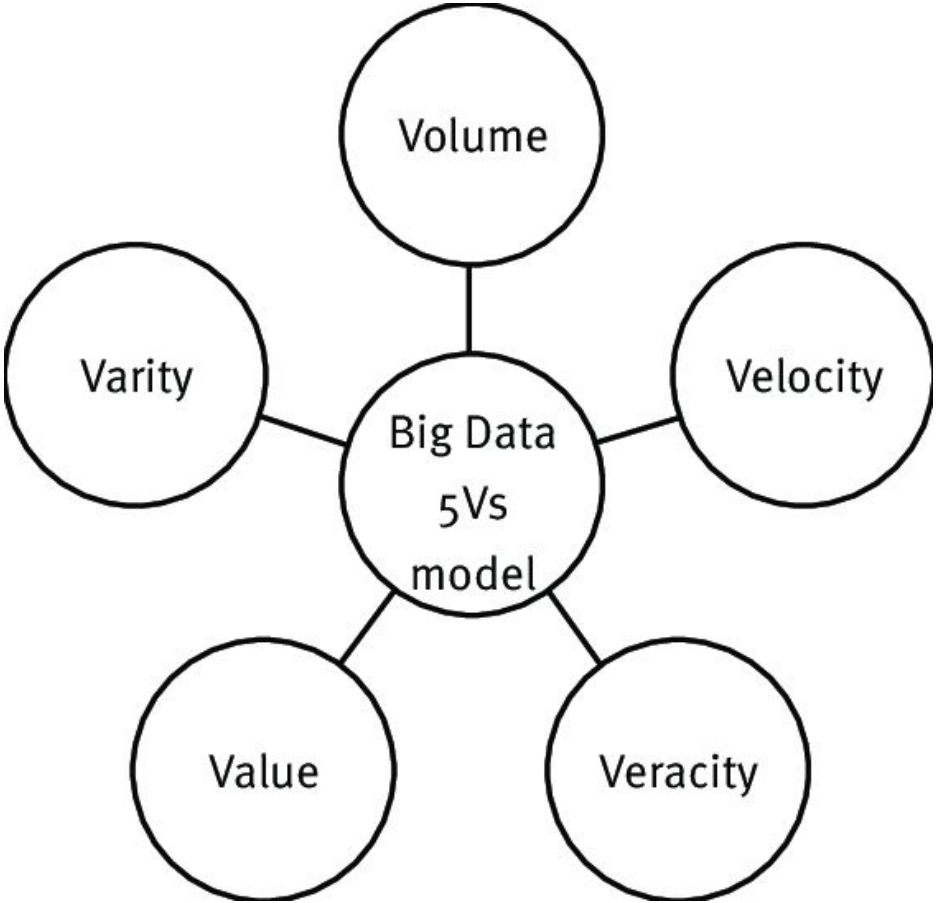
Then, what is …

Big Data?



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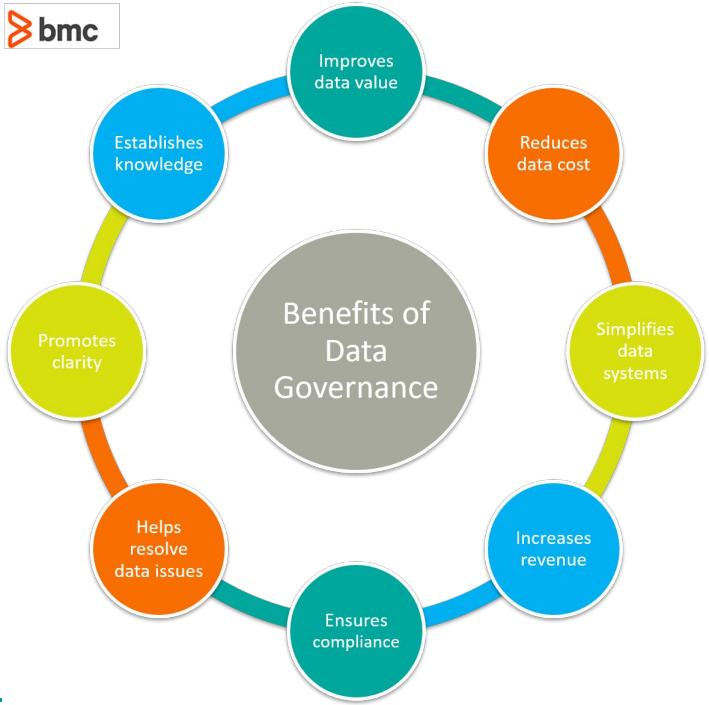
- **Volume**: very large volumes of data.
- **Variety**: different data formats and types, such as text, video, and audio.
- **Velocity**: The speed at which data is generated and stored is faster than other systems and produced more continuously.
- **Veracity**: We need to check whether the data corresponds with what we expect the data to be

Activity : Discussion

Discuss a use case/case study (based on your profession/domain/discipline) that requires big data analytics.

B: Data Management & Challenges



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Data Management

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Data Management: *W* and *H*

- **What** problem do we try to solve? What **value** can big data bring in?
- **Who** holds the data, who owns the data, and who can access the data?
- **What** data do we need?
- **Where** to store the data and how long to keep them?

Data Management: *W* and *H*

- **How** to ensure the data quality?
- **How** to analyze and visualize the data?
- **How** to manage the complexity?

Developing the Right Data Strategy

Roadmap…
roadmap…

The road not taken

Developing the Right Data Strategy

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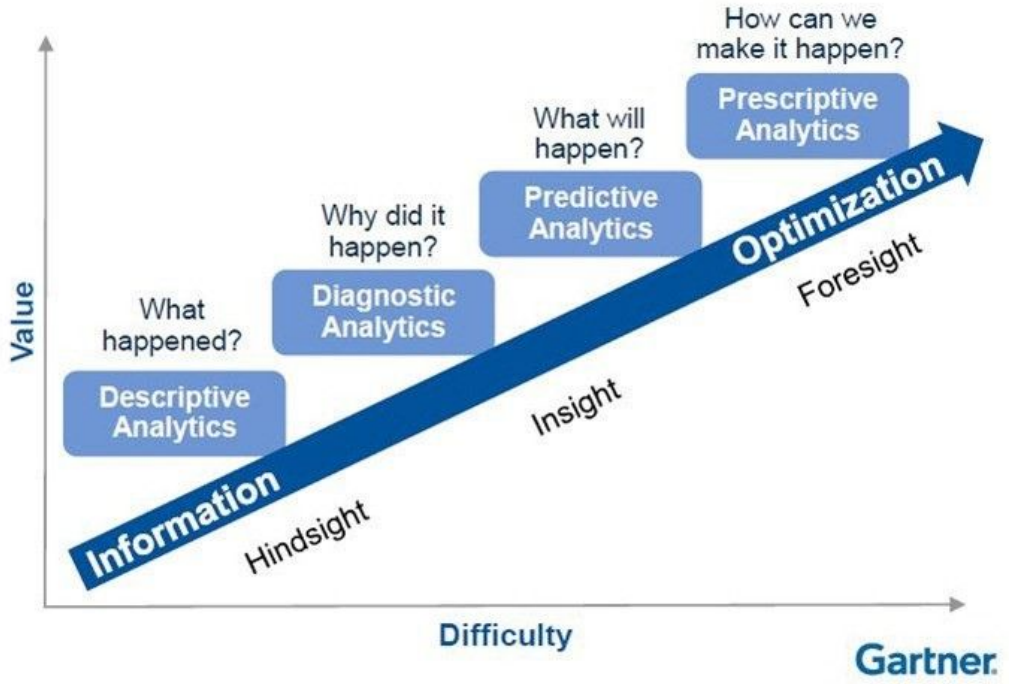
Developing the Right Data Strategy



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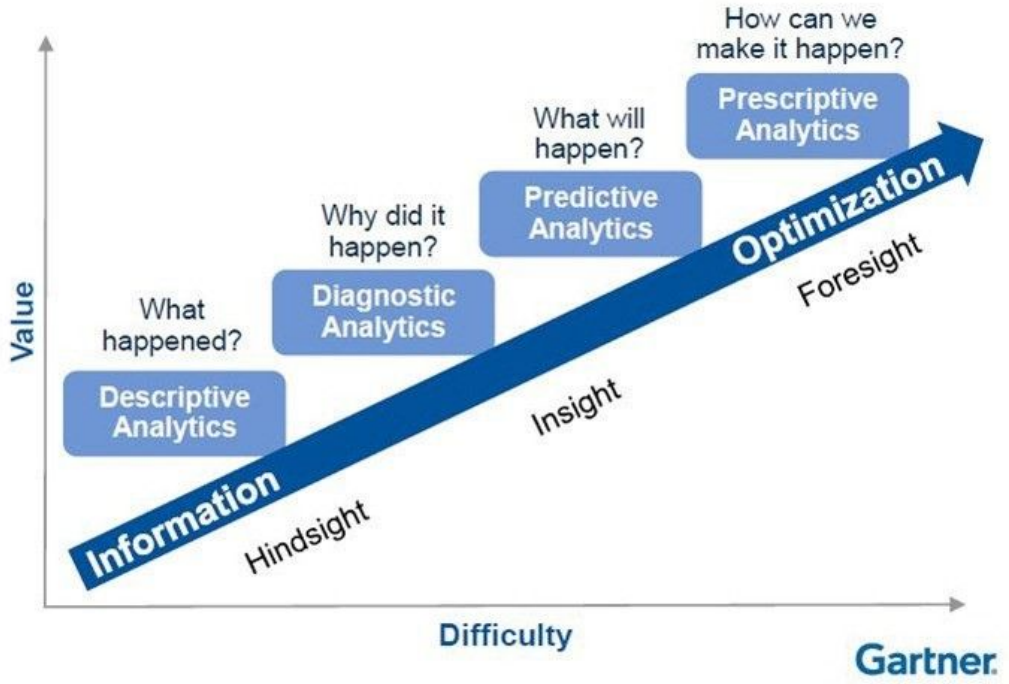
Developing the Right Data Strategy



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Big Data Challenges & Solutions

- Insufficient Knowledge
- Need top-down approach

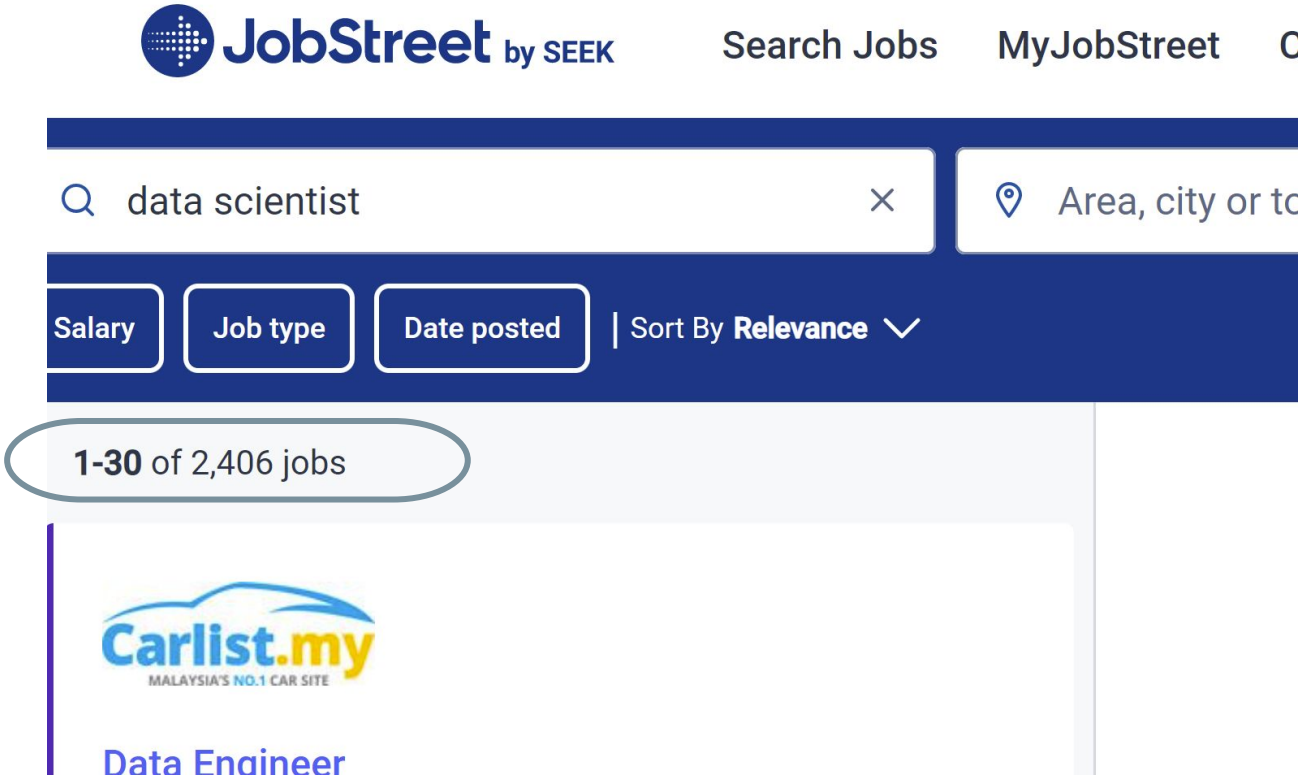
Big Data Challenges & Solutions

- Confusing variety of Big Data Technologies
- Talent Development, Outsourcing etc

Big Data Challenges & Solutions

- Money, Money, Money
- Step-by-step , pay as per use (eg: cloud service)

Side Note: Job Opportunities



Side Note: Job Opportunities

Employers

malaysianpaygap

Lead data science, manager, industry data analytics

36/Malay/male

8years

Location KL

PhD in artificial intelligence

Current salary: 18,200 basic, 400 allowance

Data science is the new exciting trends. Salary pay is varied depending on qualifications and experience. MNC companies are willing to pay high if you have the right expertise and experience handling these complex projects. Many people claimed they are data scientists but come short in interview/real world applications. Ability to prove and understand your worth. You will always be in upper hands discussing salary with HR or recruiters

Employees

Side Note: Job Opportunities

Data Scientist

[redacted]

MYR 1,500 - MYR 2,100

Posted on 24-Feb-22

Big Data Challenges & Solutions

- Complexity of managing data quality
- Proper Data Management

Boost My Quality of Life

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Big Data Challenges & Solutions

- Data Security & Privacy
- Start from the very beginning

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Big Data Challenges & Solutions

- Tricky & Tedious Processes
- Proper BDA ecosystem

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Big Data Challenges & Solutions

- Scalability
- Proper BDA ecosystem

Big Data Challenges

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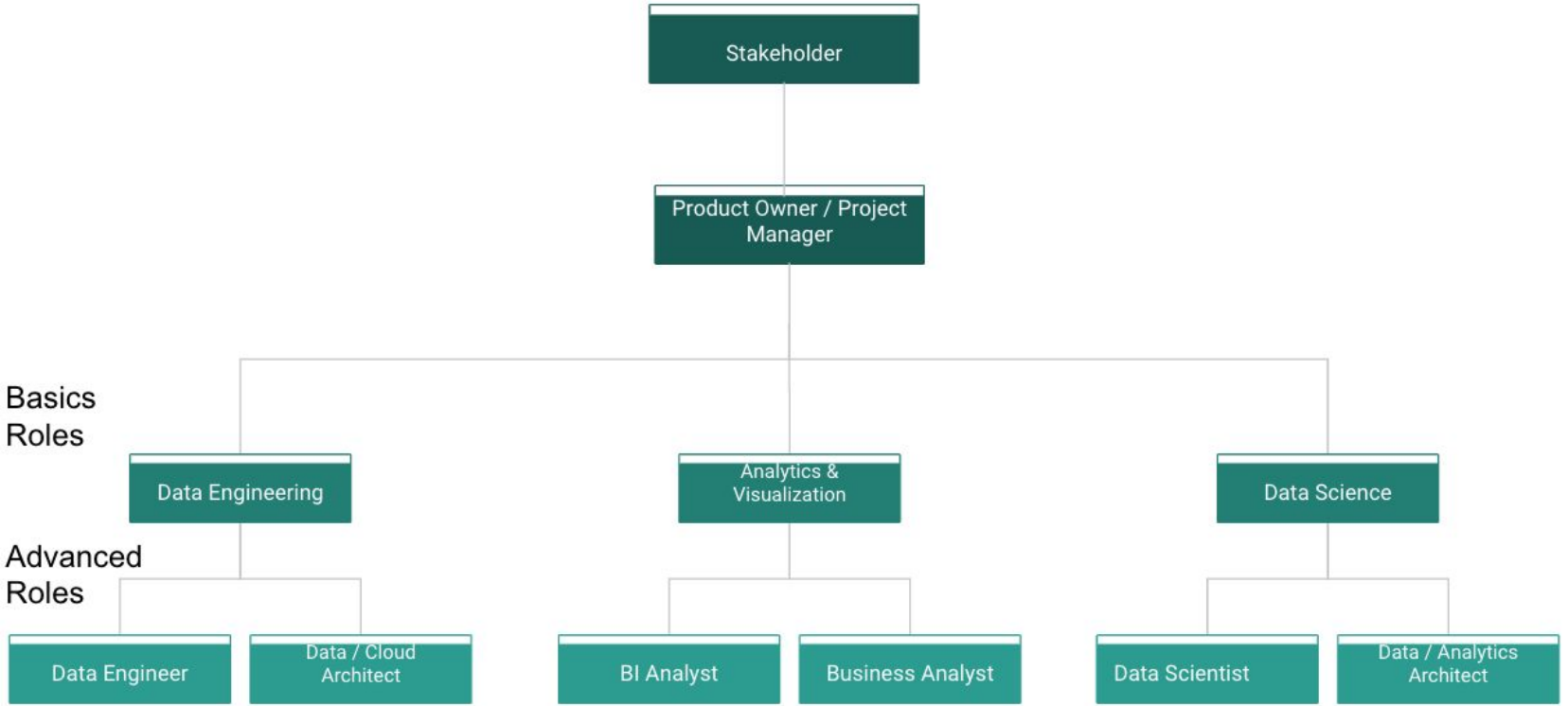
Activity : Discussion

Referring to a use case/case study (based on your profession /domain /discipline) , discuss the challenges that are potentially faced by the data team.

C: Building a Data Team



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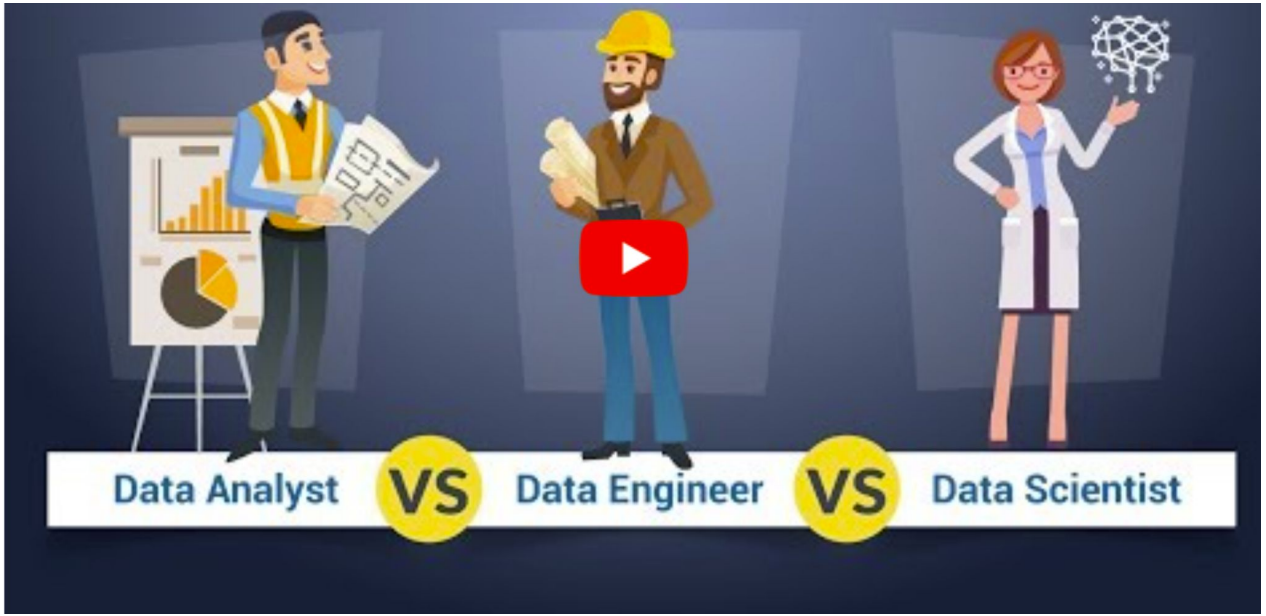
Data Engineer vs Data Analyst vs Data Scientist



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Data Analyst	Data Engineer	Data Scientist
Data Analyst analyzes numeric data and uses it to help companies make better decisions.	Data Engineer involves in preparing data. They develop, constructs, tests & maintain complete architecture.	A data scientist analyzes and interpret complex data. They are data wranglers who organize (big) data.

Image Credit: HERE

Data Analyst	Data Engineer	Data Scientist
Data Warehousing	Data Warehousing & ETL	Statistical & Analytical skills
Adobe & Google Analytics	Advanced programming knowledge	Data Mining
Programming knowledge	Hadoop-based Analytics	Machine Learning & Deep learning principles
Scripting & Statistical skills	In-depth knowledge of SQL/ database	In-depth programming knowledge (SAS/R/ Python coding)
Reporting & data visualization	Data architecture & pipelining	Hadoop-based analytics
SQL/ database knowledge	Machine learning concept knowledge	Data optimization
Spread-Sheet knowledge	Scripting, reporting & data visualization	Decision making and soft skills

Image Credit: HERE

Data Analyst	Data Engineer	Data Scientist
Pre-processing and data gathering	Develop, test & maintain architectures	Responsible for developing Operational Models
Emphasis on representing data via reporting and visualization	Understand programming and its complexity	Carry out data analytics and optimization using machine learning & deep learning
Responsible for statistical analysis & data interpretation	Deploy ML & statistical models	Involved in strategic planning for data analytics
Ensures data acquisition & maintenance	Building pipelines for various ETL operations	Integrate data & perform ad-hoc analysis
Optimize Statistical Efficiency & Quality	Ensures data accuracy and flexibility	Fill in the gap between the stakeholders and customer

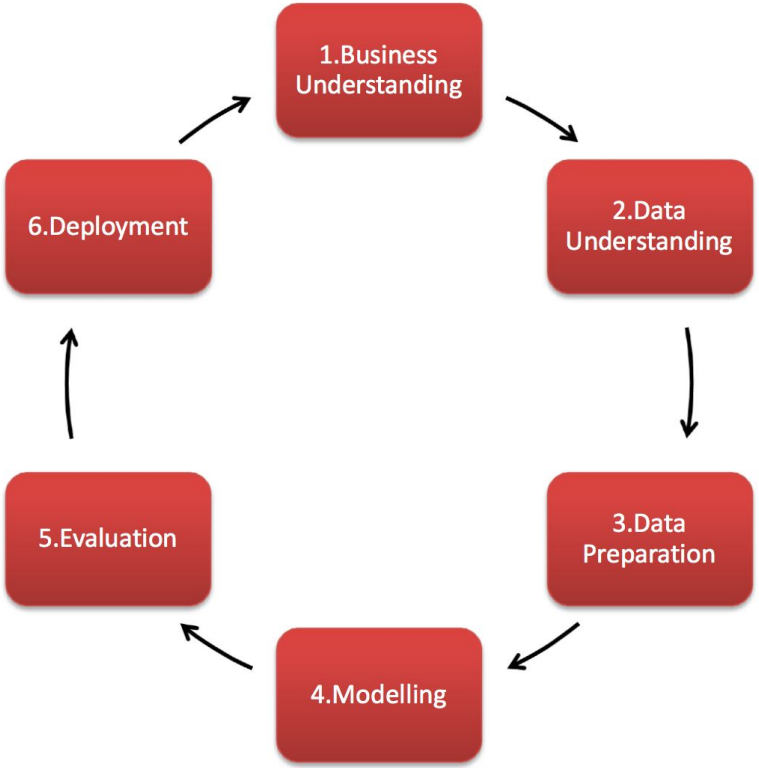
Image Credit: HERE

D: Data Science - CRISP-DM Approach

Did you mean crispy?

1. **Measure the right things**
2. Ask the right questions to stakeholders
3. Use segmentation to drive action
4. Use clear visualizations to convey your message
5. Discover the context of your data set
6. **Build a solid optimization plan**
7. Construct a great hypothesis
8. Integrate data sources
9. Break down organizational silos
10. **Don't forget to hire smart people**

Source: HERE



Business

Data

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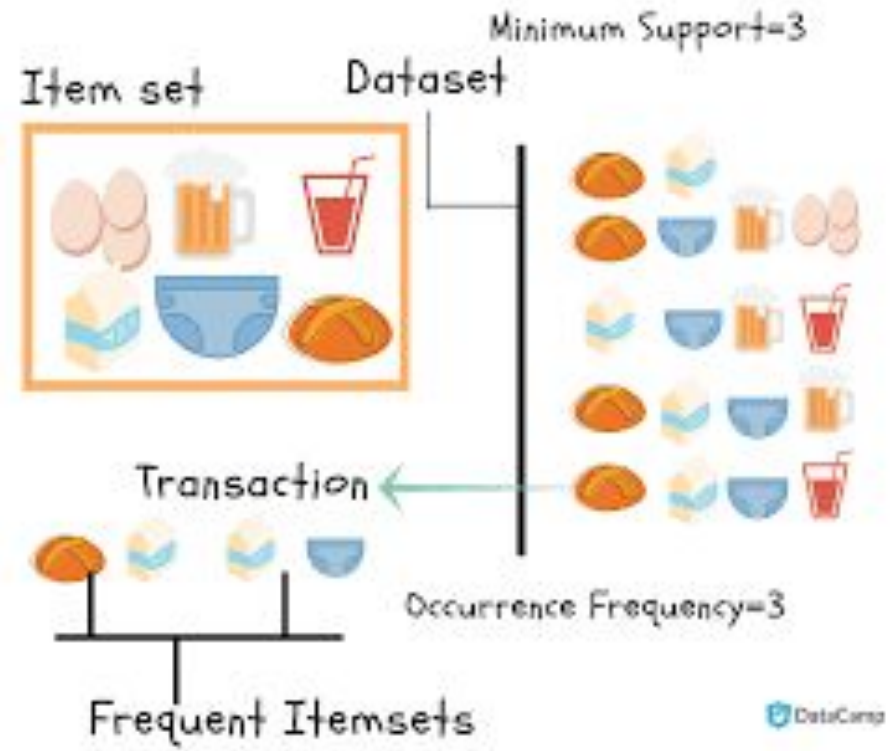
1) Business Understanding

What are the leading factors?

Automate a data-drive solution

Use Case: Stock Price Forecasting

Use Case: Market Basket Analysis



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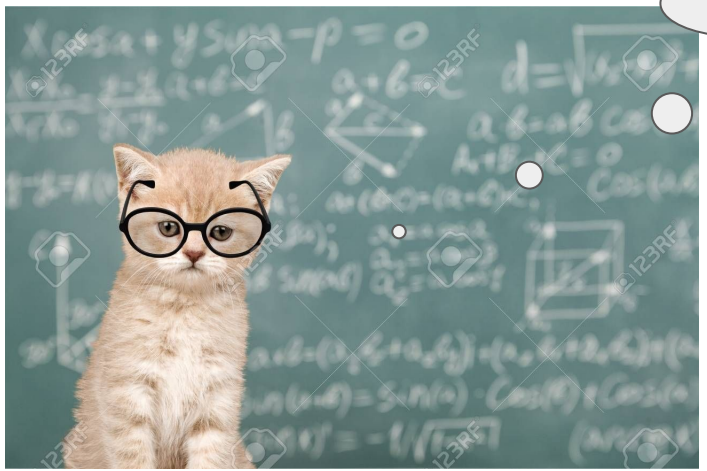
Use Case : Customer Segmentation

https://www.richieyyptutorialpage.com/demo-r-series/customer-segmention-using-k-means

What is the problem with the previous dashboard?



Data Storytelling is important

Customer Segmentation - Background

- Clustering
- k-means
- Spending behaviors, demographic Information etc

Use Case: Household Income and Food Expenditure

https://www.richieyyptutorialpage.com/demo-r-series/household-income-and-food-expenditure

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What is the problem with the previous dashboard?

When data is extraordinary ...

Background

- Data Visualization
- Storytelling
- Domain Knowledge

Use Case 3: Customer Churn Activity

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What are the leading factors?

Can you give a list of potential churners?

Background

- Classification
- Random Forest (Machine Learning)
- Garbage in, Garbage out

And MANY MANY MORE:

Marketing	Risk Management	Government	Web	Logistics	Other
Response modeling	Credit risk modeling	Tax avoidance	Web analytics	Demand forecasting	Text analytics
Net lift modeling	Market risk modeling	Social security fraud	Social media analytics	Supply chain analytics	Business process analytics
Retention modeling	Operational risk modeling	Money laundering	Multivariate testing		
Market basket analysis	Fraud detection	Terrorism detection			
Recommender systems					
Customer segmentation					

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2) Data Understanding

What are the X?

What is the y?

Missing value?

Outliers?

Get Your Hands Dirty

Activity 1

Get the Dataset at HERE. Make a copy.

How many observations (rows) do we have? _____

How many columns (variables) do we have? _____

PostalCode	HashCode	Age	Gender	Payment Method	rowNumber	LastTransaction	ChurnDate
49278	BOl2gvcX	64	male	credit card	1	2012-04-17 02:05:40	2014-01-24 18:27:13
39982	IJC8cDTW	35	male	cheque	2	2011-11-25 06:58:03	2012-08-09 13:01:39
87213	tKIbadnh	25	female	credit card	3	2012-02-15 17:29:26	
38548	RcW2Pb3w	39	female	credit card	4	2010-10-09 11:22:28	2013-11-07 10:27:31
38794	z9twA4AJ	39	male	credit card	5	2012-06-13 10:13:08	
44573	akWNQl4e	28	female	cheque	6	2010-07-16 09:39:10	2011-06-23 07:08:53
70936	glrPDLzY	21	female	credit card	7	2012-03-15 22:17:03	
71302	Pn6FkbuL	48	male	credit card	8	2011-06-16 21:46:18	
49705	3rGPBX98	70	female	credit card	9	2011-03-30 14:17:44	2012-07-05 02:34:33
36049	9Eng7yl0	36	male	credit card	10	2013-04-17 18:06:59	
26323	uP7dRmDK	22	male	credit card	11	2013-03-11 17:37:27	
42376	XlxhfOIo	53	female	cash	12	2010-08-31 17:39:06	2013-08-31 17:21:18
42215	KYmSR2vE	27	male	cash	13	2011-07-15 07:16:15	
80059	EOGj6tDH	234	männlich	credit card	14	2014-02-26 18:22:25	
57984	yTDlEBXc	22	male	cash	15	2011-05-09 06:30:35	
52245	3ANQ9shn	49	female	credit card	16	2011-02-18 10:22:00	2012-04-03 06:13:43
56625	BDEPLKmG	24	female	cash	17	2011-01-22 03:19:03	2013-02-28 23:50:54
50003	8vB4XorN	45	männlich	credit card	18	2013-02-11 21:16:18	
37852	1SDtHCf7	45	male	credit card	19	2011-02-06 11:31:19	
66713	gQBDZ8Lw	66	female	cash	20	2011-03-09 23:04:48	2013-04-19 04:27:33
70052	G1c0kZqQ	82	female	cash	21	2010-10-10 10:29:03	2013-12-17 15:21:46
44272	lJC8cDTW	35	female	credit card	22	2010-10-14 07:48:11	
71962	n5YVLJ7v	17	female	credit card	23	2011-08-14 16:40:26	

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Activity 1

No	Dimension	Data Type	Comment
1	PostalCode	Integer	Whole number, therefore use integer
2	HashCode	Polynominal	Different strings, so polynominal is fine.
3	Age	Integer	Whole number, therefore use integer
4	Gender	Polynominal	Should be binominal, but inconsistent data type
5	PaymentMethod	Polynominal	3 payment methods: what are they?
6	rowNumber	Integer	Integer
7	LastTransaction	Date_time	Contains date
8	ChurnDate	Date_time	Contains date

3) Data Preparation

Missing value?

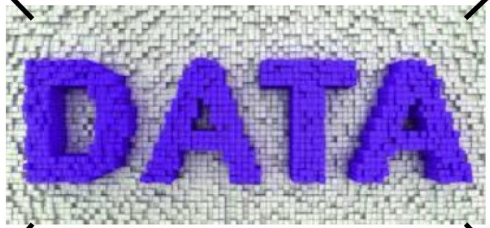
Outliers?

New Column/Variable/Feature?

I heard that ...

Garbage in, garbage out (GIGO)

Key Ingredient



Messy

The more the better

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I heard that ...

DATA SCIENCE = DATA CLEANING

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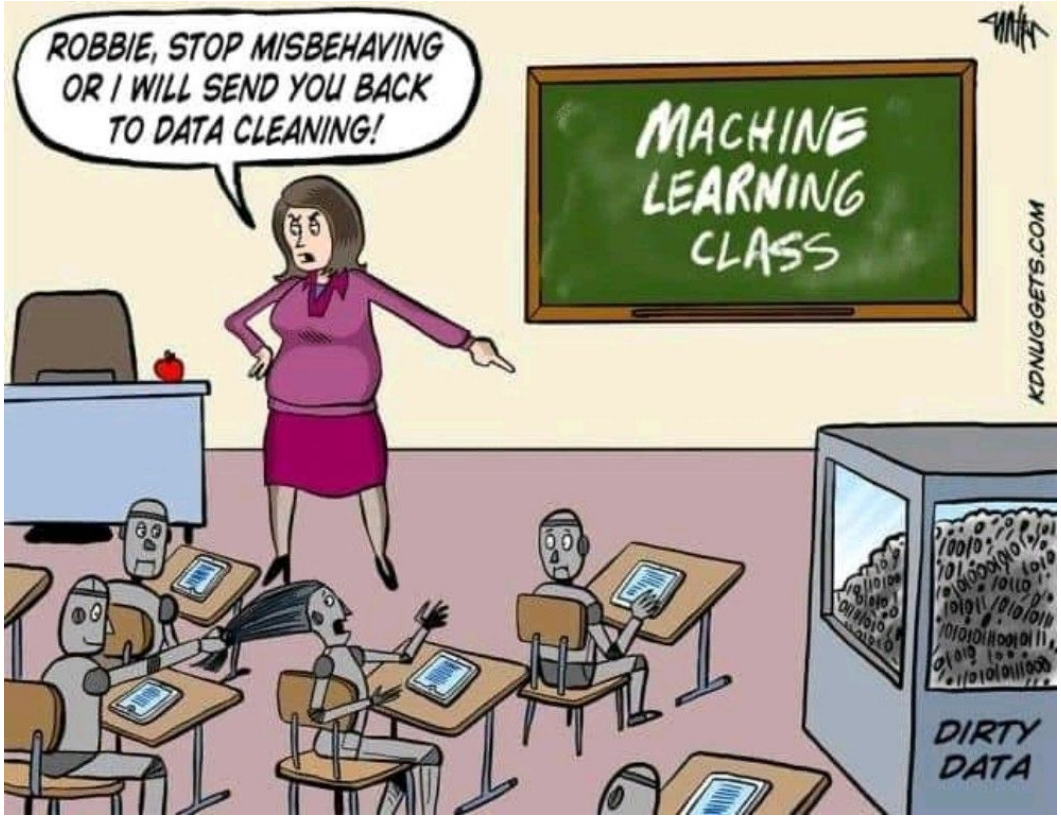

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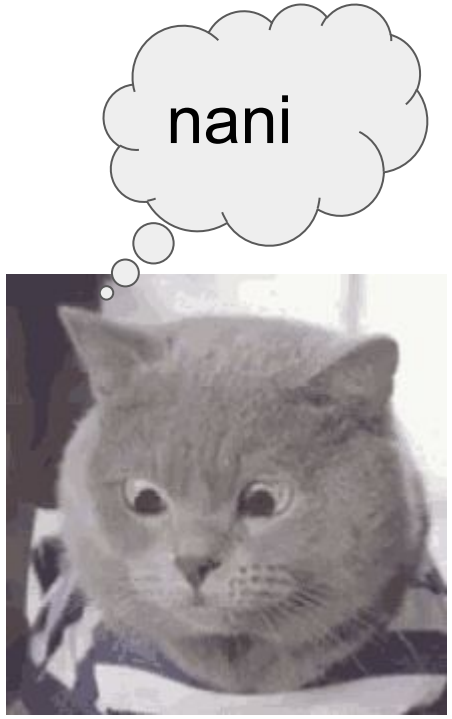
Data, AI, ML

Berpisah tiada

I heard that data is incomplete...

ID	Age	Income	Marital Status	Credit Bureau Score	Class
1	34	1,800		620	Churner
2	28	1,200	Single		Nonchurner
3	22	1,000	Single	?	Nonchurner
4	60	2,200	Widowed	700	Churner
5	58	2,000	Married		Nonchurner
6	44				Nonchurner
7	22	1,200	Single		Nonchurner
8	26	1,500	Married	350	Nonchurner
9	34		Single		Churner
10	50	2,100	Divorced		Nonchurner



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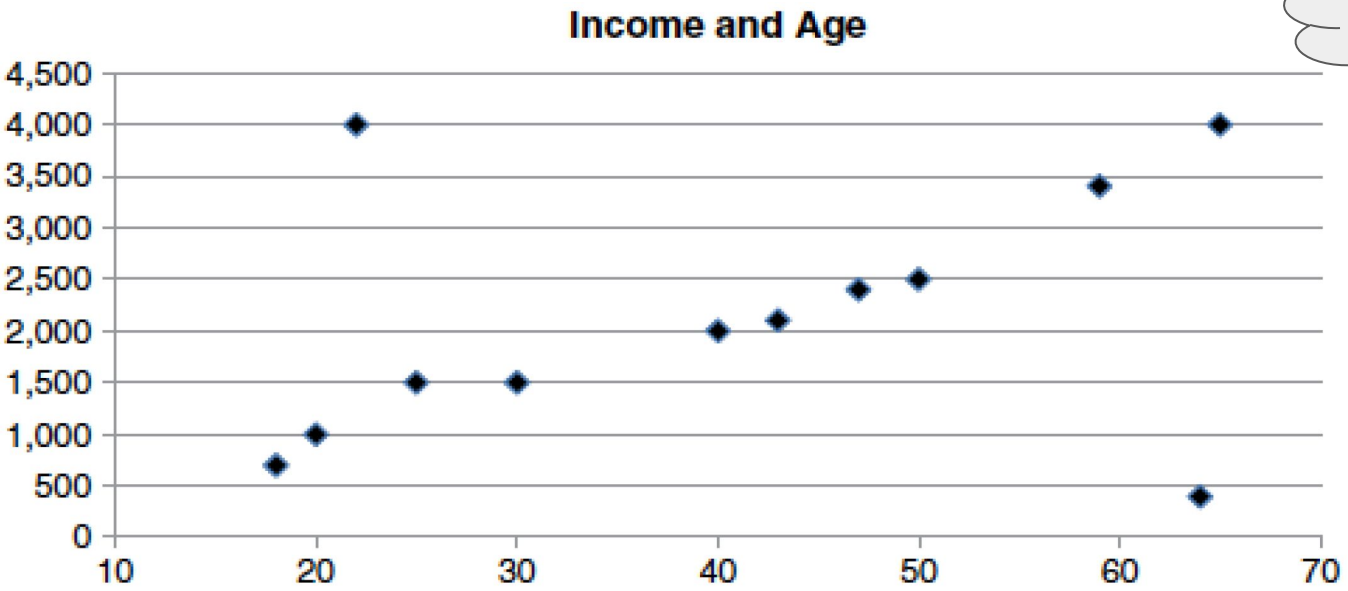
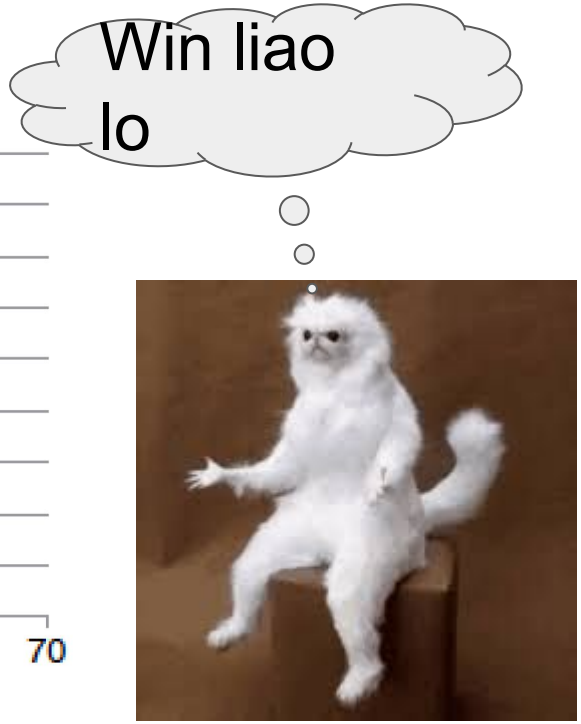
I heard that data always surprises us...





I heard that data quality is important...

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https://githu

Activity 2: Dealing with Missing Values

4 factors to consider when dealing with missing data:

i. If an attribute contains too many missing data, consider discarding it.

ii. In a categorical (ChurnDate) attribute with missing values, consider introducing a new category eg. "*unknown*". ("*unknown*" means something very different from missing)

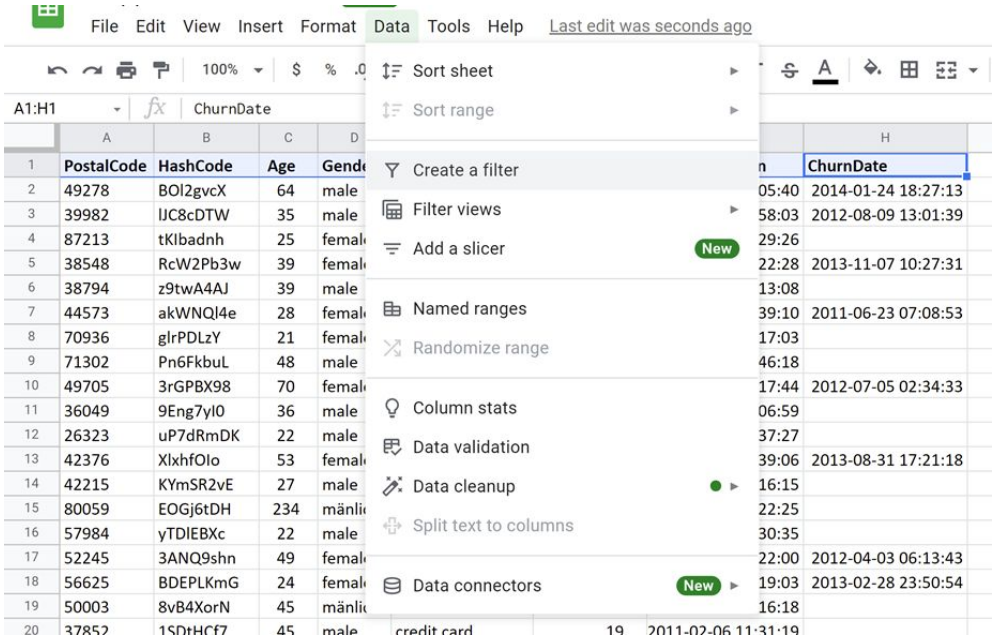
iii. If only few rows contain missing values, consider removing those rows.

iv. If we cannot afford to discard data, consider imputing values into the missing values.

- Analyze your data. Which attributes possess missing values?

Activity 2: Dealing with Missing Values

For *Age* and *Gender*, only 1 missing value. Doesn't make much difference to remove (filter) them.



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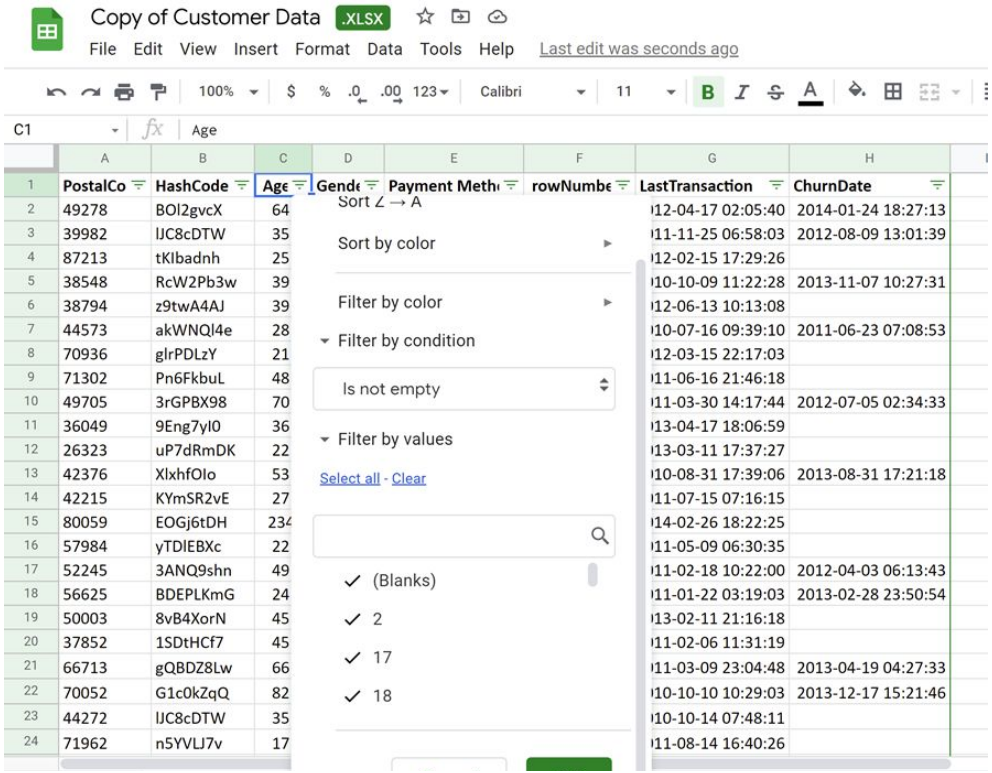
Activity 2: Dealing with Missing Values



	A	B	C	D	E	F	G	H
1	PostalCo	HashCode	Age	Gende	Payment Meth	rowNumbe	LastTransaction	ChurnDate
2	49278	BOl2gvcX	64				12-04-17 02:05:40	2014-01-24 18:27:13
3	39982	IJC8cDTW	35				11-11-25 06:58:03	2012-08-09 13:01:39
4	87213	tKIbadnh	25				12-02-15 17:29:26	
5	38548	RcW2Pb3w	39				10-10-09 11:22:28	2013-11-07 10:27:31
6	38794	z9twA4AJ	39				12-06-13 10:13:08	
7	44573	akWNQl4e	28				10-07-16 09:39:10	2011-06-23 07:08:53
8	70936	glrPDLzY	21				12-03-15 22:17:03	
9	71302	Pn6FkbuL	48				11-06-16 21:46:18	
10	49705	3rGPBX98	70				11-03-30 14:17:44	2012-07-05 02:34:33
11	36049	9Eng7yI0	36				13-04-17 18:06:59	
12	26323	uP7dRmDK	22				13-03-11 17:37:27	
13	42376	XlxhfOIo	53				10-08-31 17:39:06	2013-08-31 17:21:18
14	42215	KYmSR2vE	27				11-07-15 07:16:15	
15	80059	EOGj6tDH	234				14-02-26 18:22:25	
16	57984	yTDlEBXc	22				11-05-09 06:30:35	
17	52245	3ANQ9shn	49				11-02-18 10:22:00	2012-04-03 06:13:43
18	56625	BDEPLKmG	24				11-01-22 03:19:03	2013-02-28 23:50:54
19	50003	8vB4XorN	45				13-02-11 21:16:18	
20	37852	1SDtHCf7	45				11-02-06 11:31:19	
21	66713	gQBDZ8Lw	66				11-03-09 23:04:48	2013-04-19 04:27:33
22	70052	G1c0kZqQ	82				10-10-10 10:29:03	2013-12-17 15:21:46
23	44272	IJC8cDTW	35				10-10-14 07:48:11	
24	71962	n5YVLJ7v	17				11-08-14 16:40:26	

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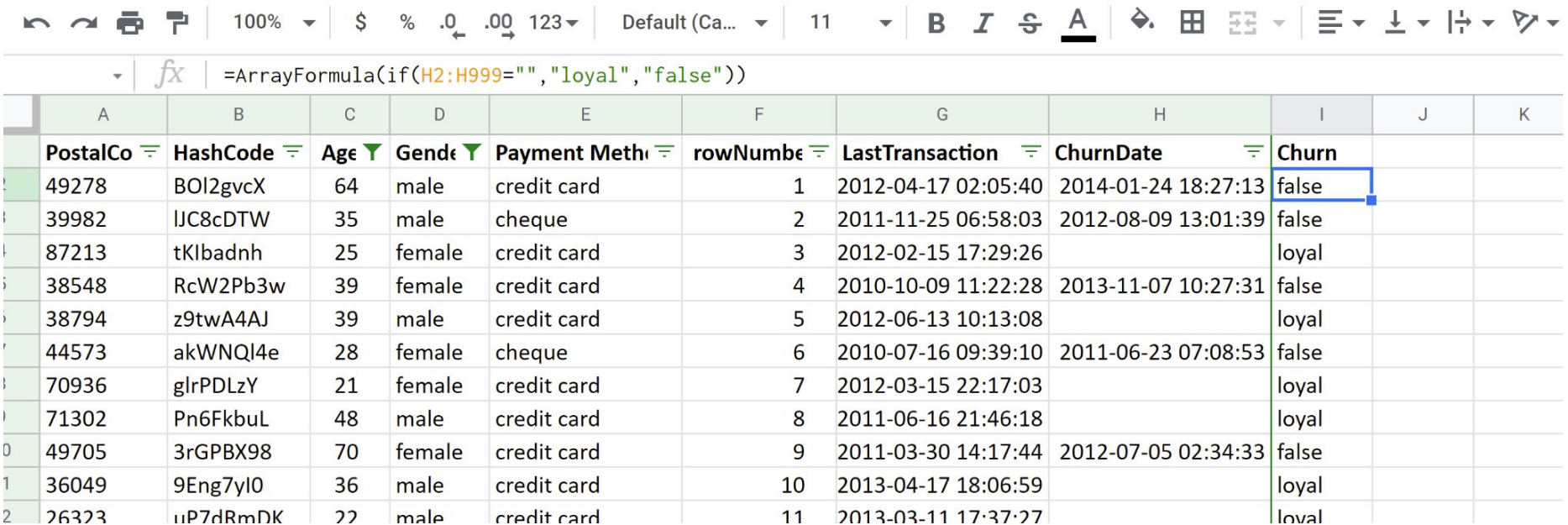
Activity 3: Creating a new Column

1. For ChurnDate, it involves semantics and has meaning, hence removing them is NOT an option. (But we know, that if the ChurnDate is missing, the customer is still loyal)

2. So let's generate a "*Churn*" attribute that will tell us whether a customer is 'loyal' or 'churn'.

Activity 3: Creating a new Column



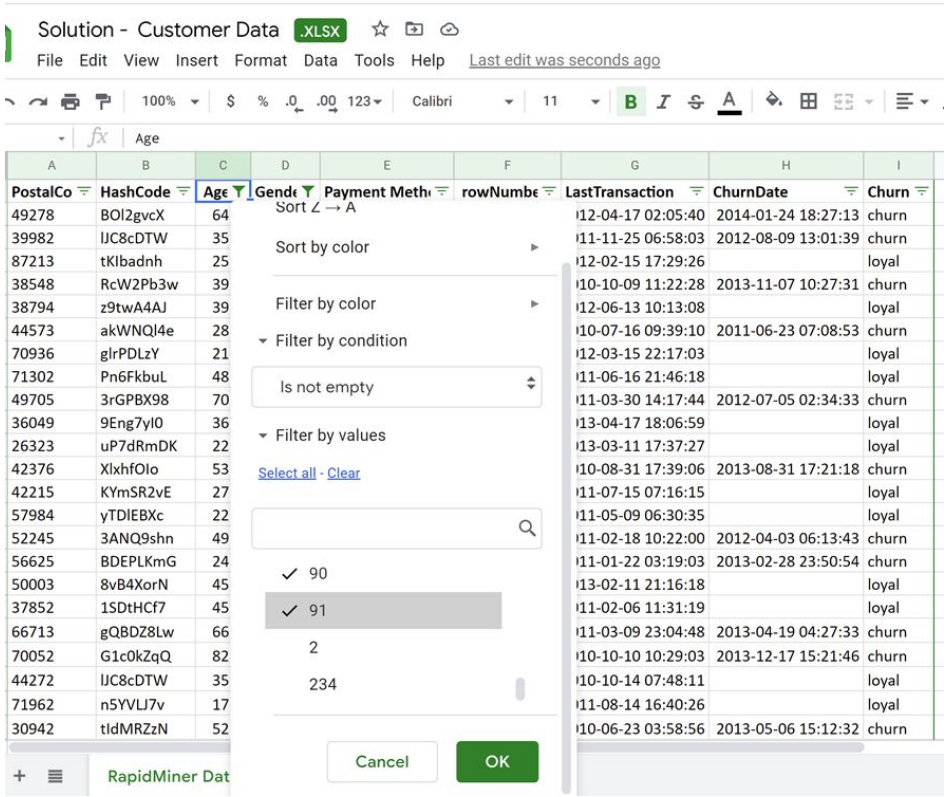
	A	B	C	D	E	F	G	H	I	J	K
	PostalCo	HashCode	Age	Gende	Payment Meth	rowNumbe	LastTransaction	ChurnDate	Churn		
2	49278	BOl2gvcX	64	male	credit card	1	2012-04-17 02:05:40	2014-01-24 18:27:13	false		
3	39982	lJC8cDTW	35	male	cheque	2	2011-11-25 06:58:03	2012-08-09 13:01:39	false		
4	87213	tKIbadnh	25	female	credit card	3	2012-02-15 17:29:26		loyal		
5	38548	RcW2Pb3w	39	female	credit card	4	2010-10-09 11:22:28	2013-11-07 10:27:31	false		
6	38794	z9twA4AJ	39	male	credit card	5	2012-06-13 10:13:08		loyal		
7	44573	akWNQl4e	28	female	cheque	6	2010-07-16 09:39:10	2011-06-23 07:08:53	false		
8	70936	glrPDLzY	21	female	credit card	7	2012-03-15 22:17:03		loyal		
9	71302	Pn6FkbuL	48	male	credit card	8	2011-06-16 21:46:18		loyal		
10	49705	3rGPBX98	70	female	credit card	9	2011-03-30 14:17:44	2012-07-05 02:34:33	false		
11	36049	9Eng7yI0	36	male	credit card	10	2013-04-17 18:06:59		loyal		
12	26323	uP7dRmDK	22	male	credit card	11	2013-03-11 17:37:27		loyal		

Activity 4: Removing Outliers/Extraordinary Values

Let us assume that in this case, the term and condition states that the minimum age is more than 16 years old. Hence, there are invalid age values (2 years old and 234 years old!)

Challenge: Multiple filters in one column….??

Activity 4: Removing Outliers/Extraordinary Values



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Activity 5: Cleaning Gender Column

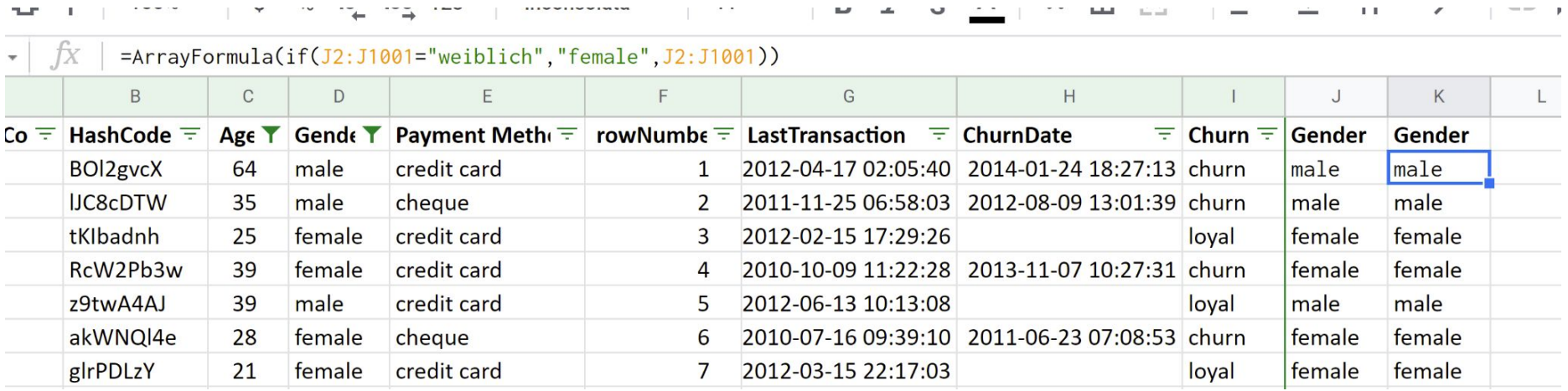
- Gender attribute contains male, female, *manlich* and *weiblich* (German terms for male and female).

Activity 5: Cleaning Gender Column

```
=ArrayFormula(if(D2:D1001="mänlich","male",D2:D1001))
```

B	C	D	E	F	G	H	I	J
ashCode	Age	Gende	Payment Meth	rowNumbe	LastTransaction	ChurnDate	Churn	Gender
Ol2gvcX	64	male	credit card	1	2012-04-17 02:05:40	2014-01-24 18:27:13	churn	male
C8cDTW	35	male	cheque	2	2011-11-25 06:58:03	2012-08-09 13:01:39	churn	male
Ibadnh	25	female	credit card	3	2012-02-15 17:29:26		loyal	female

Activity 5: Cleaning Gender Column



=ArrayFormula(if(J2:J1001="weiblich","female",J2:J1001))

	B	C	D	E	F	G	H	I	J	K	L
Co	HashCode	Age	Gende	Payment Meth	rowNumbe	LastTransaction	ChurnDate	Churn	Gender	Gender	
	BOl2gvcX	64	male	credit card	1	2012-04-17 02:05:40	2014-01-24 18:27:13	churn	male	male	
	lJC8cDTW	35	male	cheque	2	2011-11-25 06:58:03	2012-08-09 13:01:39	churn	male	male	
	tKIbadnh	25	female	credit card	3	2012-02-15 17:29:26		loyal	female	female	
	RcW2Pb3w	39	female	credit card	4	2010-10-09 11:22:28	2013-11-07 10:27:31	churn	female	female	
	z9twA4AJ	39	male	credit card	5	2012-06-13 10:13:08		loyal	male	male	
	akWNQl4e	28	female	cheque	6	2010-07-16 09:39:10	2011-06-23 07:08:53	churn	female	female	
	glrPDLzY	21	female	credit card	7	2012-03-15 22:17:03		loyal	female	female	

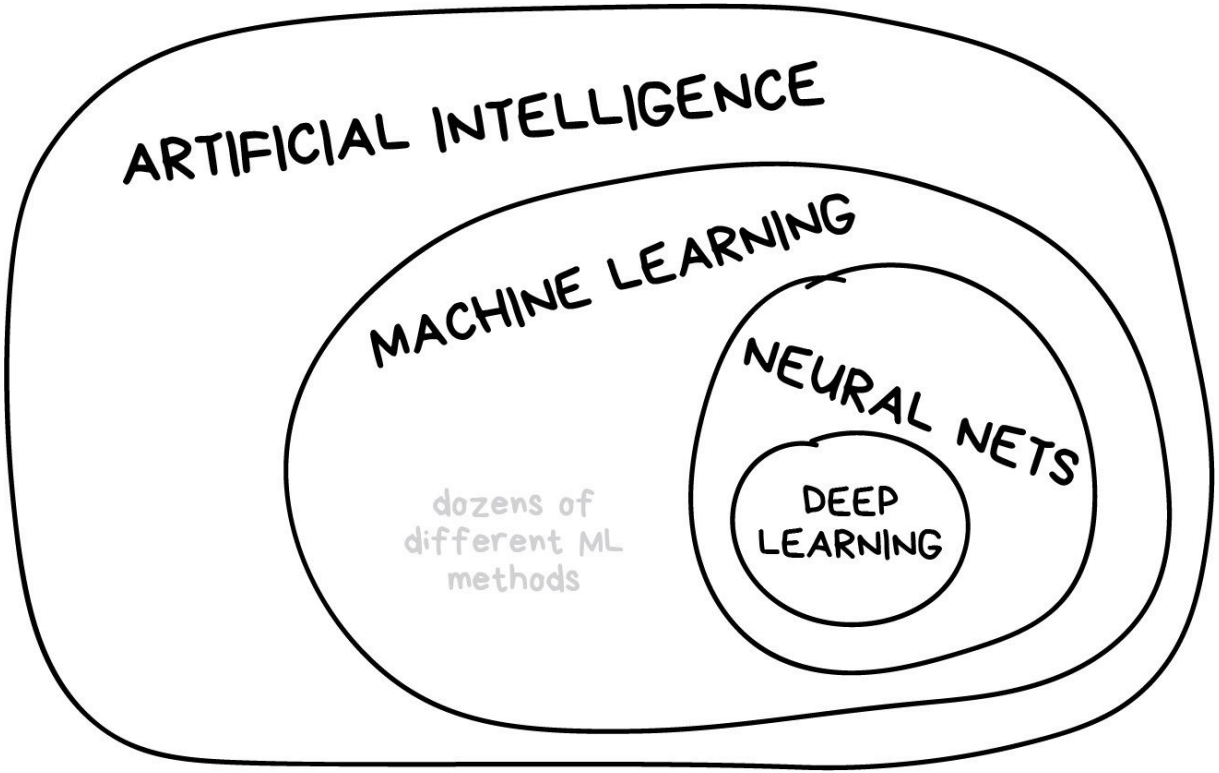
Activity 6: Getting the First Character of texts in the PostalCode Column

=ArrayFormula(LEFT(A2:A1001))

B	C	D	E	F	G	H	I	J	K	L	M
shCode	Age	Gende	Payment Meth	rowNumbe	LastTransaction	ChurnDate	Churn	Gender	Gender	PostalCode	
l2gvcX	64	male	credit card	1	2012-04-17 02:05:40	2014-01-24 18:27:13	churn	male	male	4	
8cDTW	35	male	cheque	2	2011-11-25 06:58:03	2012-08-09 13:01:39	churn	male	male	3	
badnh	25	female	credit card	3	2012-02-15 17:29:26		loyal	female	female	8	
W2Pb3w	39	female	credit card	4	2010-10-09 11:22:28	2013-11-07 10:27:31	churn	female	female	3	
twA4AJ	39	male	credit card	5	2012-06-13 10:13:08		loyal	male	male	3	
WNQl4e	28	female	cheque	6	2010-07-16 09:39:10	2011-06-23 07:08:53	churn	female	female	4	
PDLzY	21	female	credit card	7	2012-03-15 22:17:03		loyal	female	female	7	

4) Modelling

Are you looking for a model?



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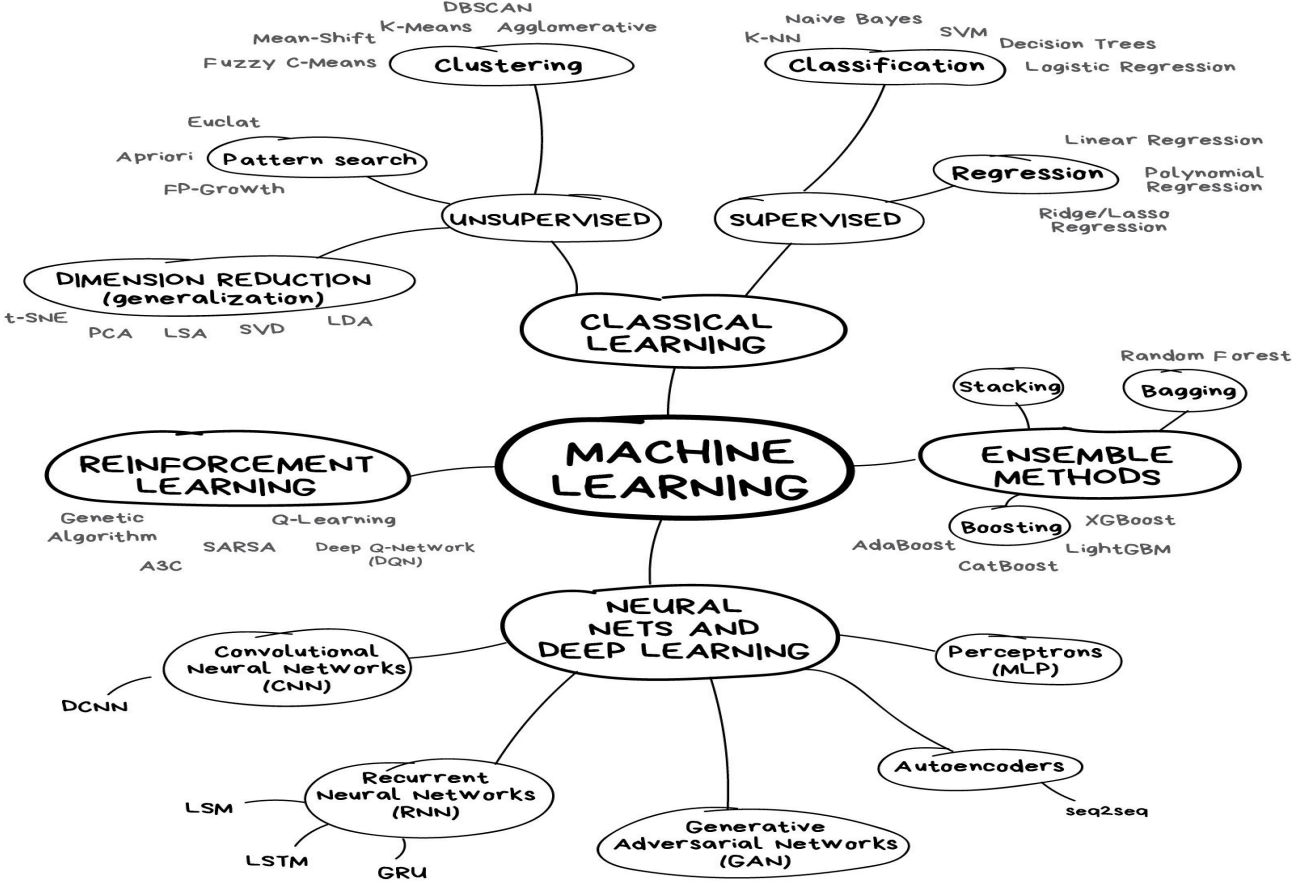

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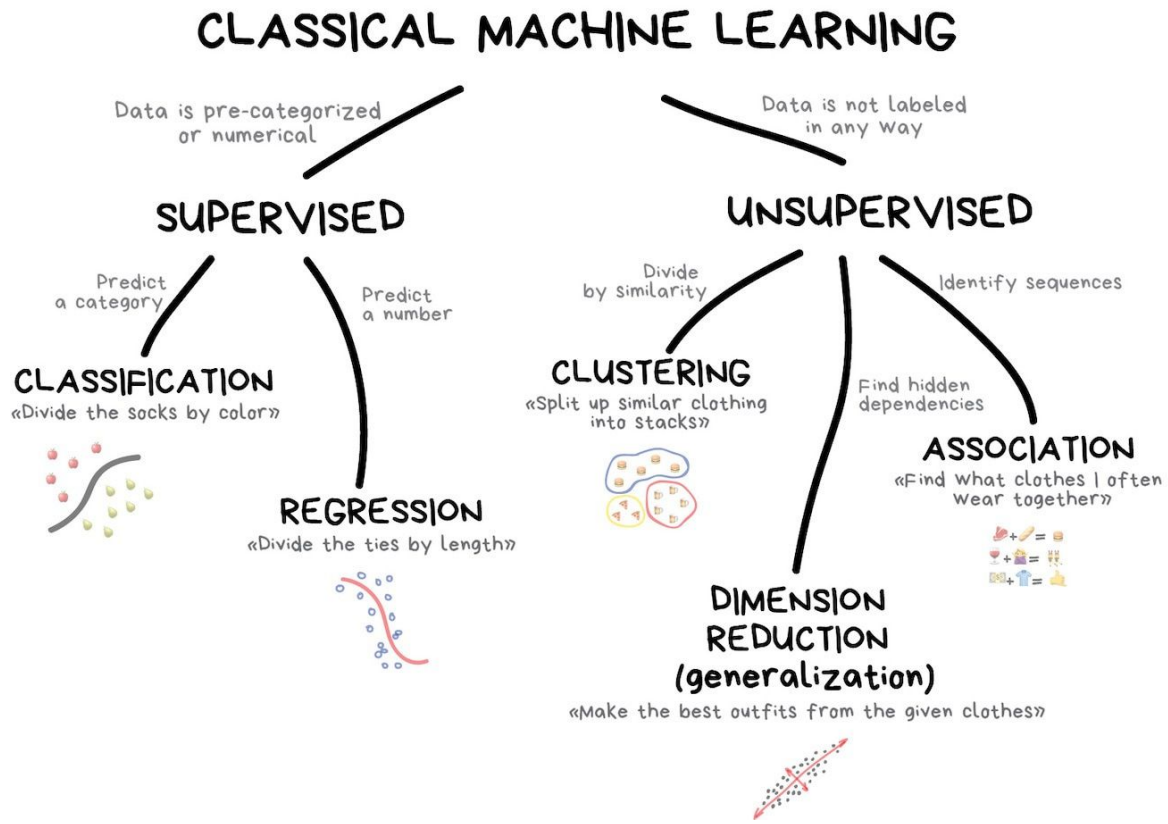

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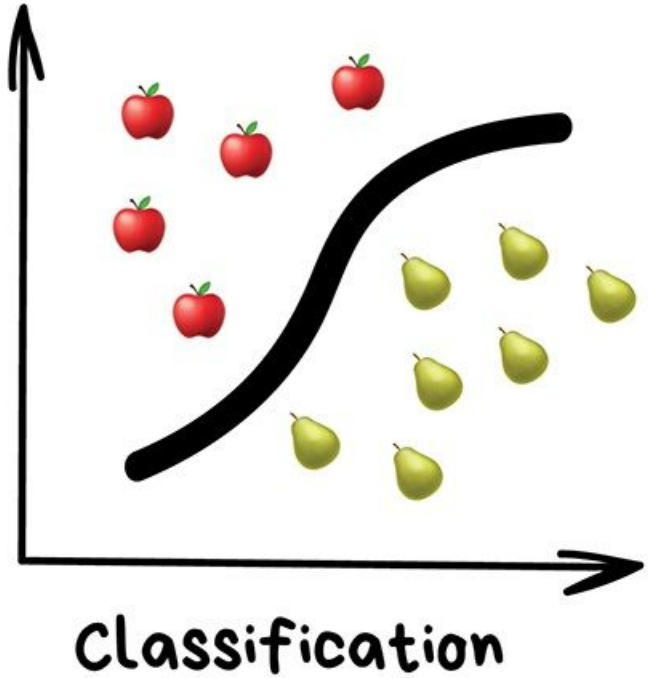

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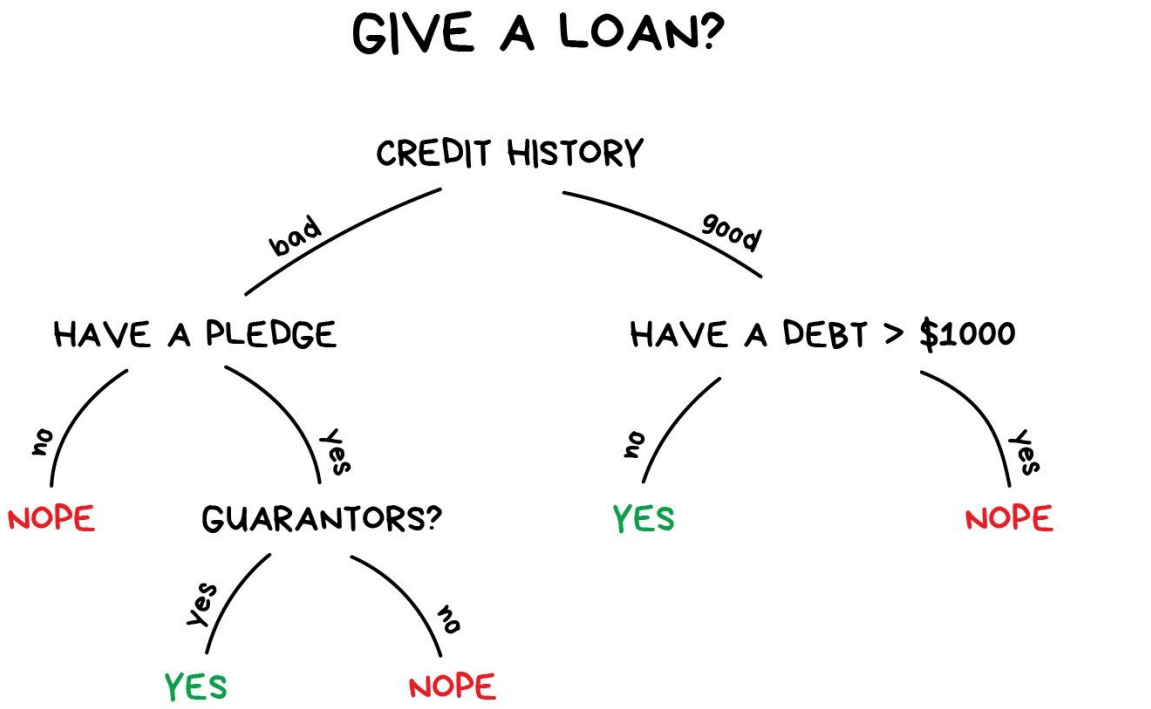

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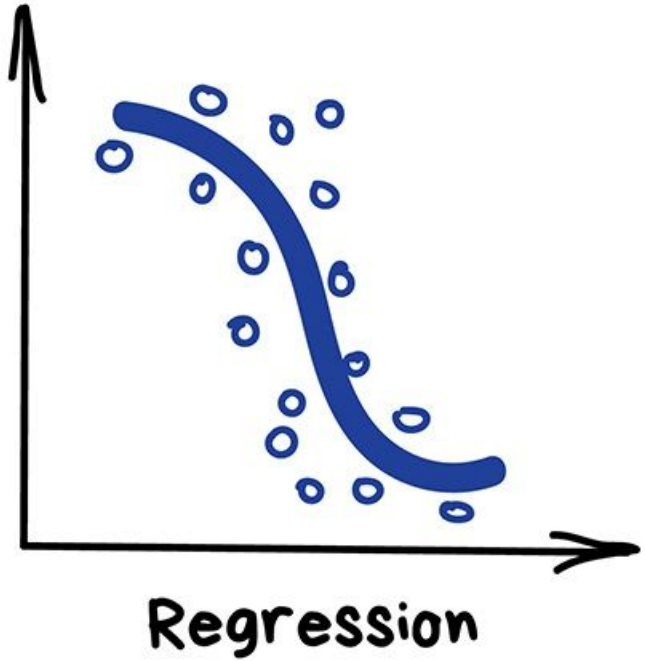
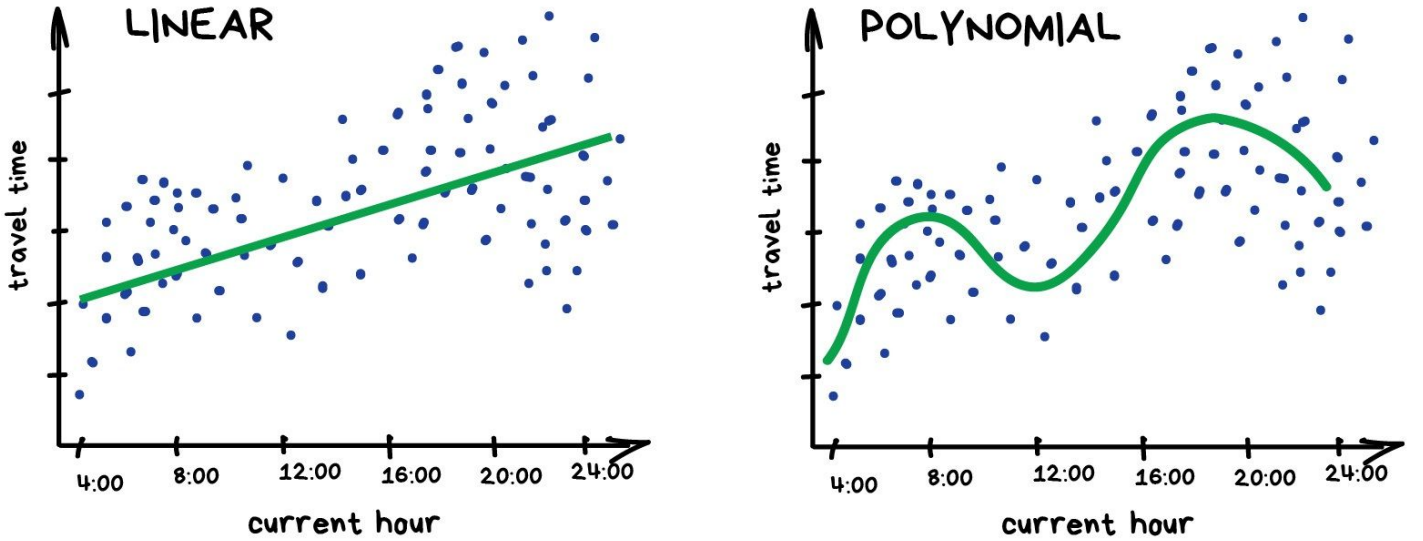


Reference: here

PREDICT TRAFFIC JAMS



REGRESSION

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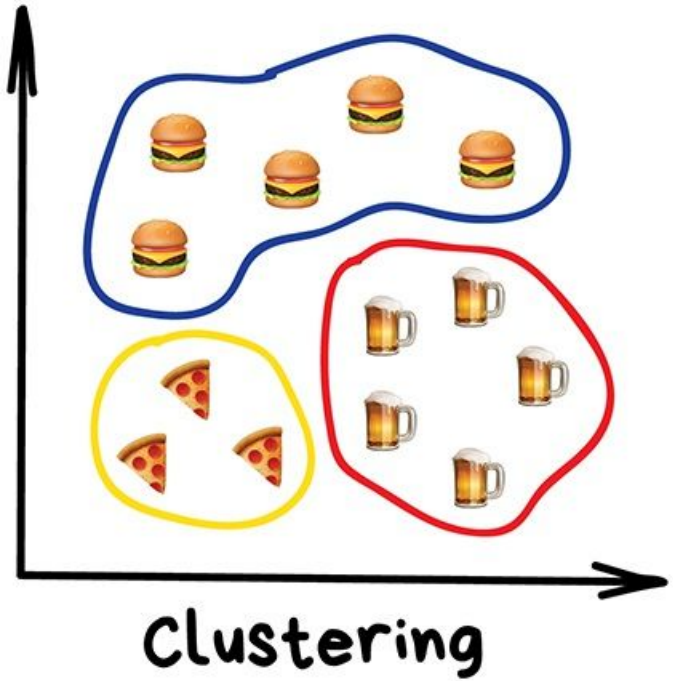
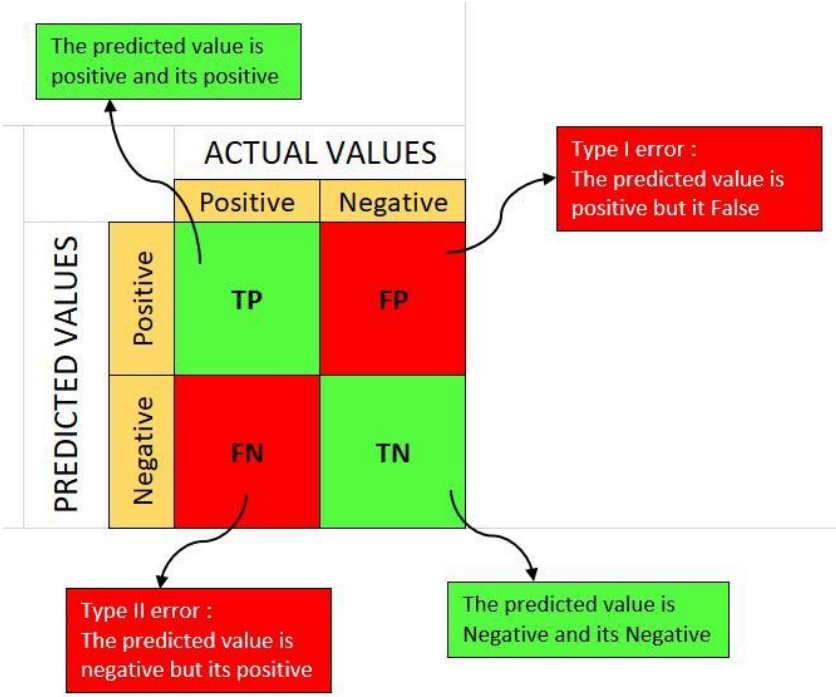


Reference: here

5) Evaluation

Classification: Confusion Matrix



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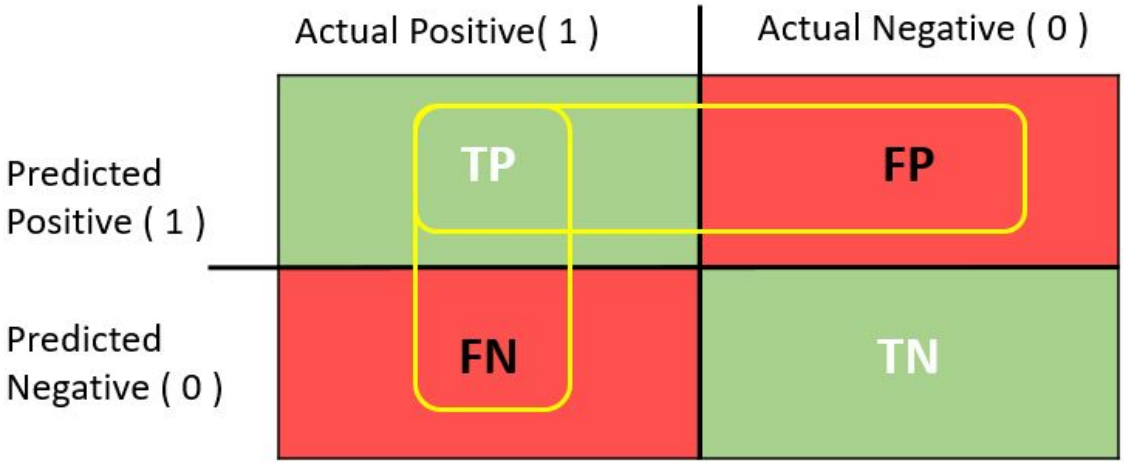
Classification: Precision & Recall



Reference: here

Regression: RMSE & Rsquare

What…
maths equation…

$$MAE = \frac{1}{N}\sum_{i=1}^{N}|y_i - \hat{y}|$$

$$MSE = \frac{1}{N}\sum_{i=1}^{N}(y_i - \hat{y})^2$$

$$RMSE = \sqrt{MSE} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(y_i - \hat{y})^2}$$

$$R^2 = 1 - \frac{\sum(y_i - \hat{y})^2}{\sum(y_i - \bar{y})^2}$$

Where,

$\hat{y}$ – *predicted value of y*

$\bar{y}$ – *mean value of y*

Reference: here

Activity 7: Use Case - Discussion

By using a use case/case study in your profession/domain/discipline, discuss which evaluation metric is more suitable.

6) Deployment

6) Cloud

E: Data Engineering

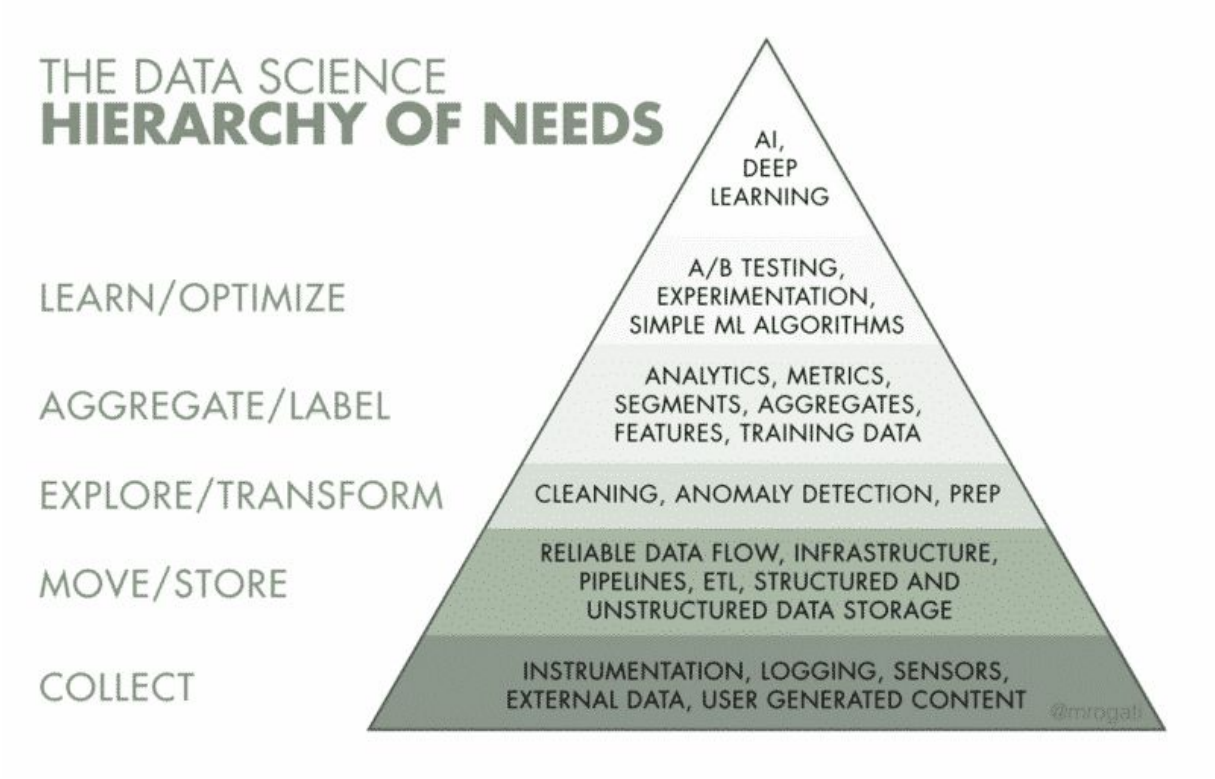
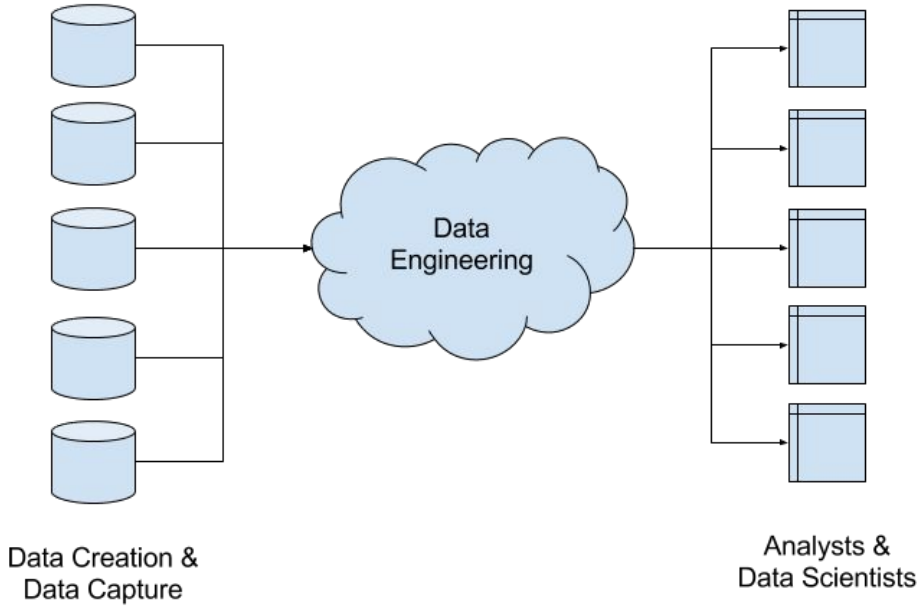


Image Credit: HERE

Data Engineering



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Data Engineering

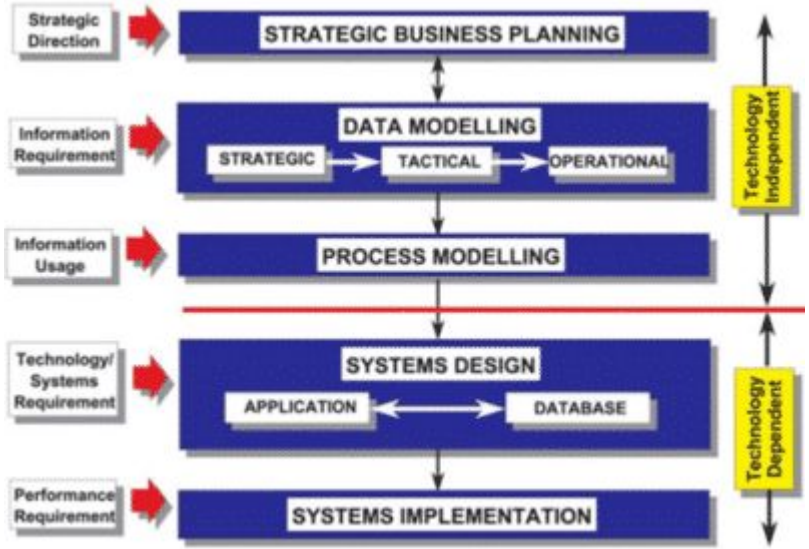


Image Credit: HERE

Data Engineering

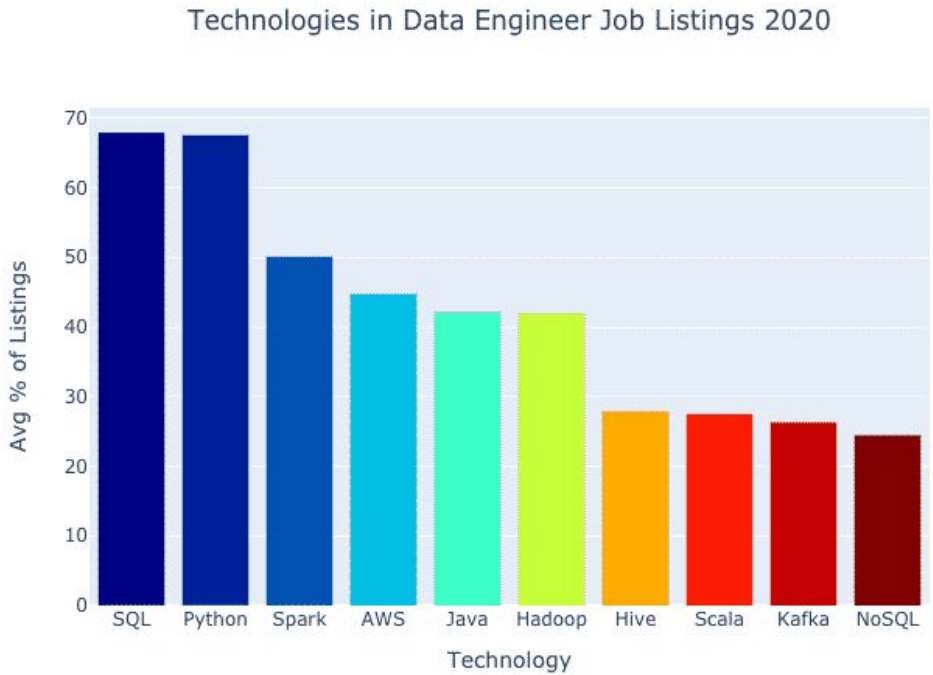
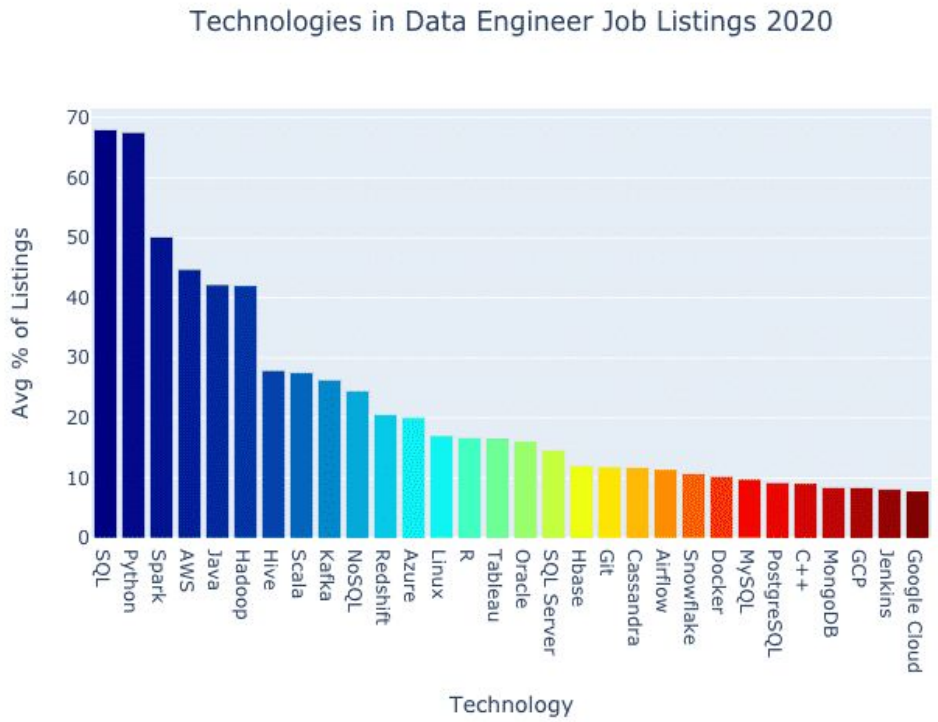


Image Credit: HERE

Data Engineering



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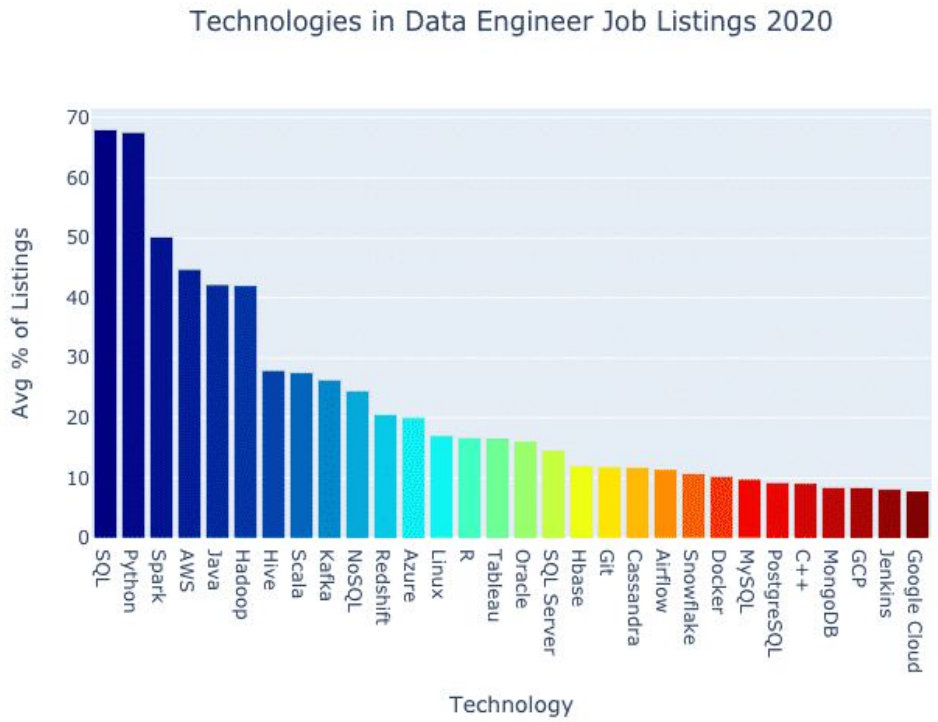
Data Engineering



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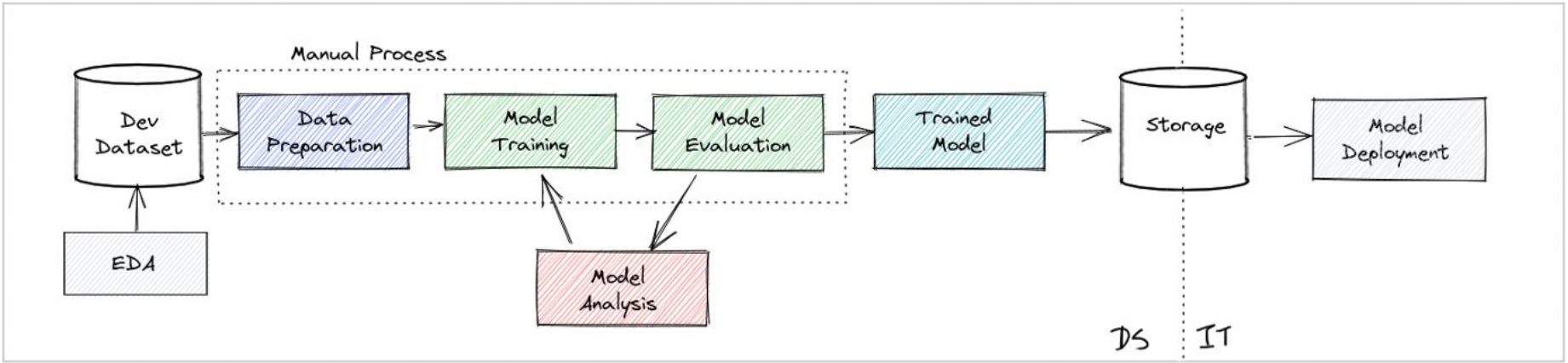
MLOps - Level 0



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MLOps - Level 1

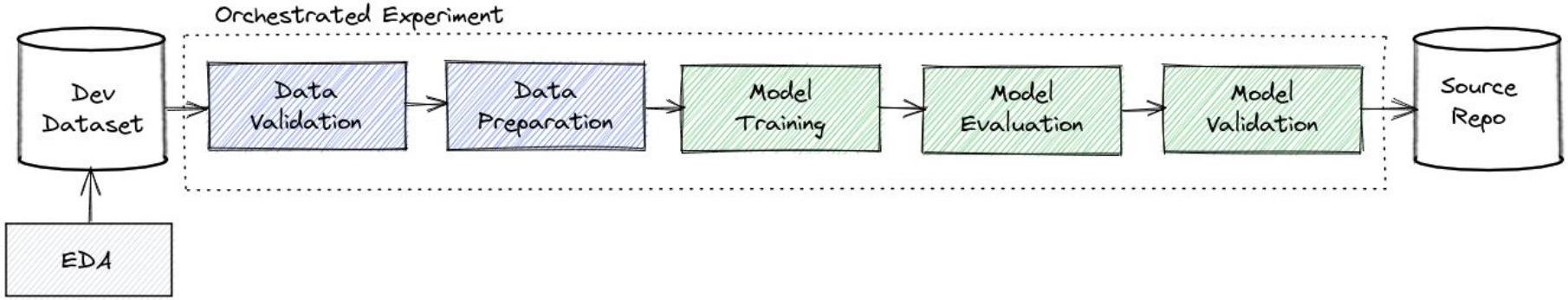
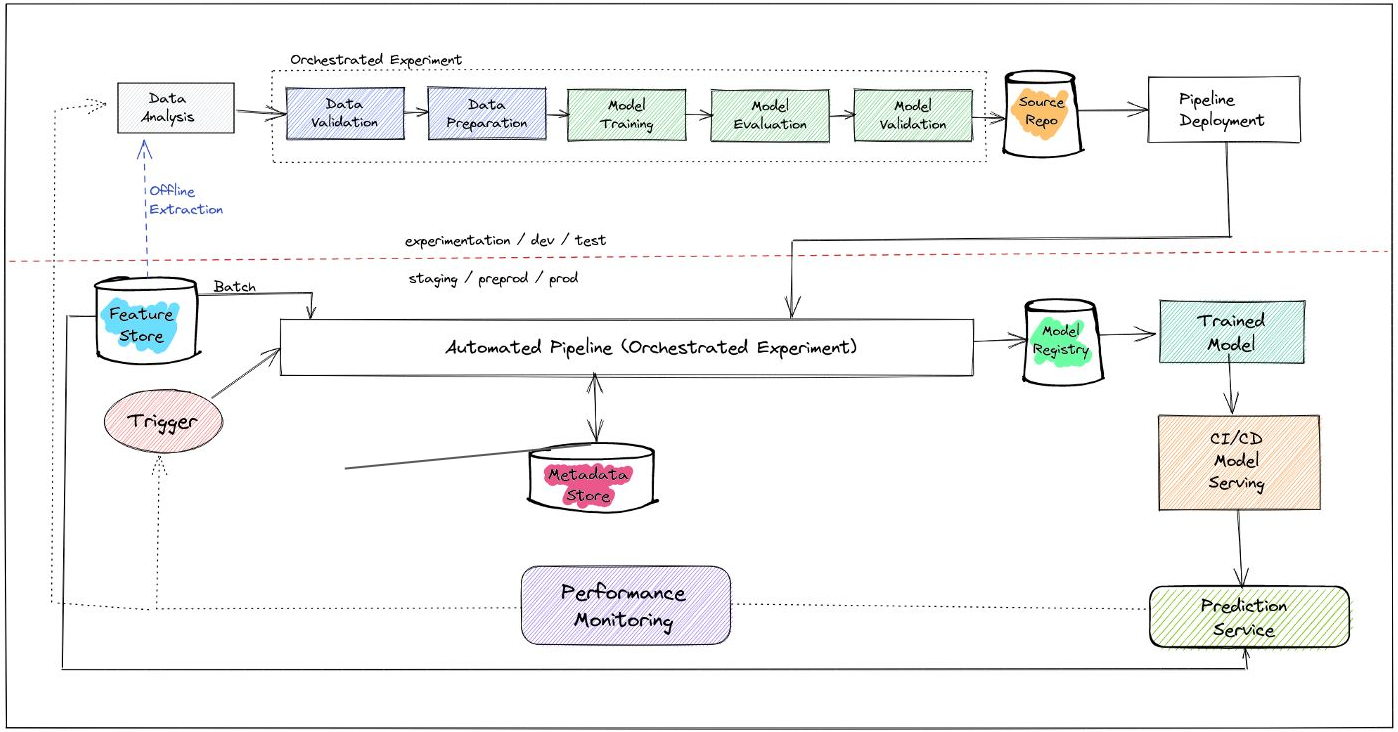


Image Credit: HERE

MLOps - Level 2



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F: Business Intelligence & Data Storytelling

I am listening now…

"Let's shrink Big Data into Small Data ...
and hope it magically becomes Great Data."

Image Credit: HERE

When you have mastered numbers, you will in fact no longer be reading numbers, any more than you read words when reading books. You will be reading meanings.

~ W.E.B. Du Bois

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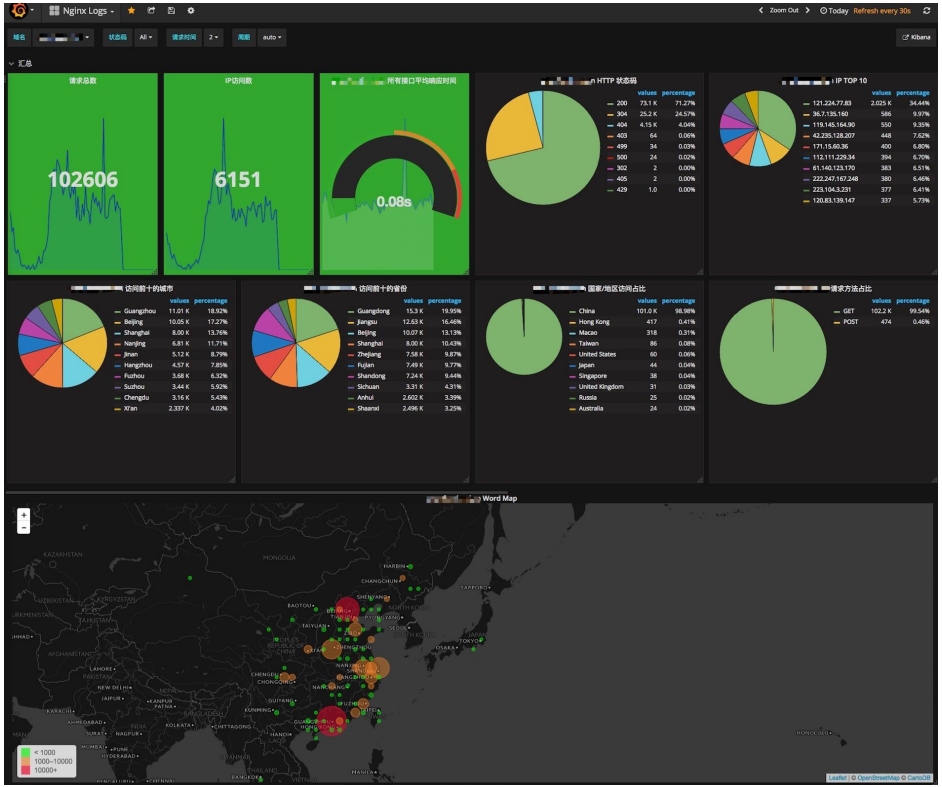

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https://github.com/richieyuyongpoh/creating-value-through-data-transformation

G: Turning Data into Actionable Insights

Well… So many stuff about data.. What is the insight?

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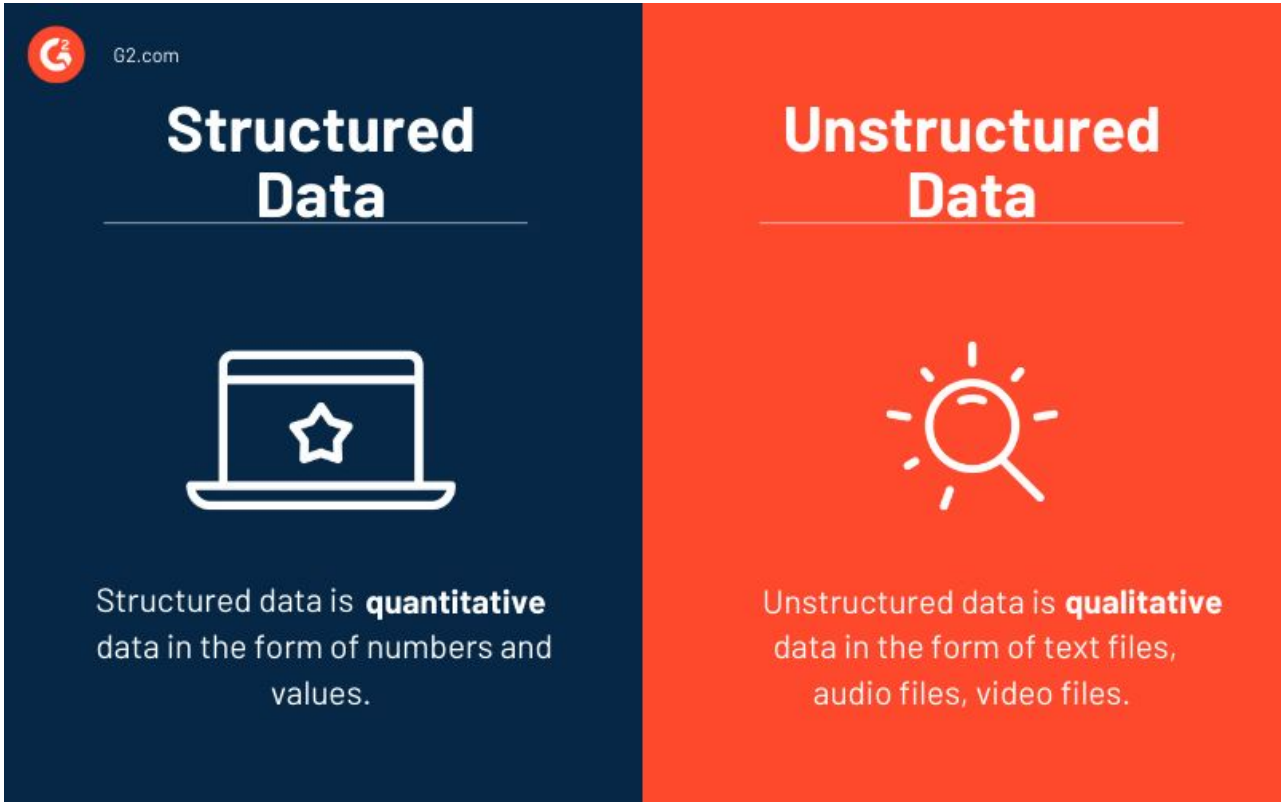


Image Credit: HERE

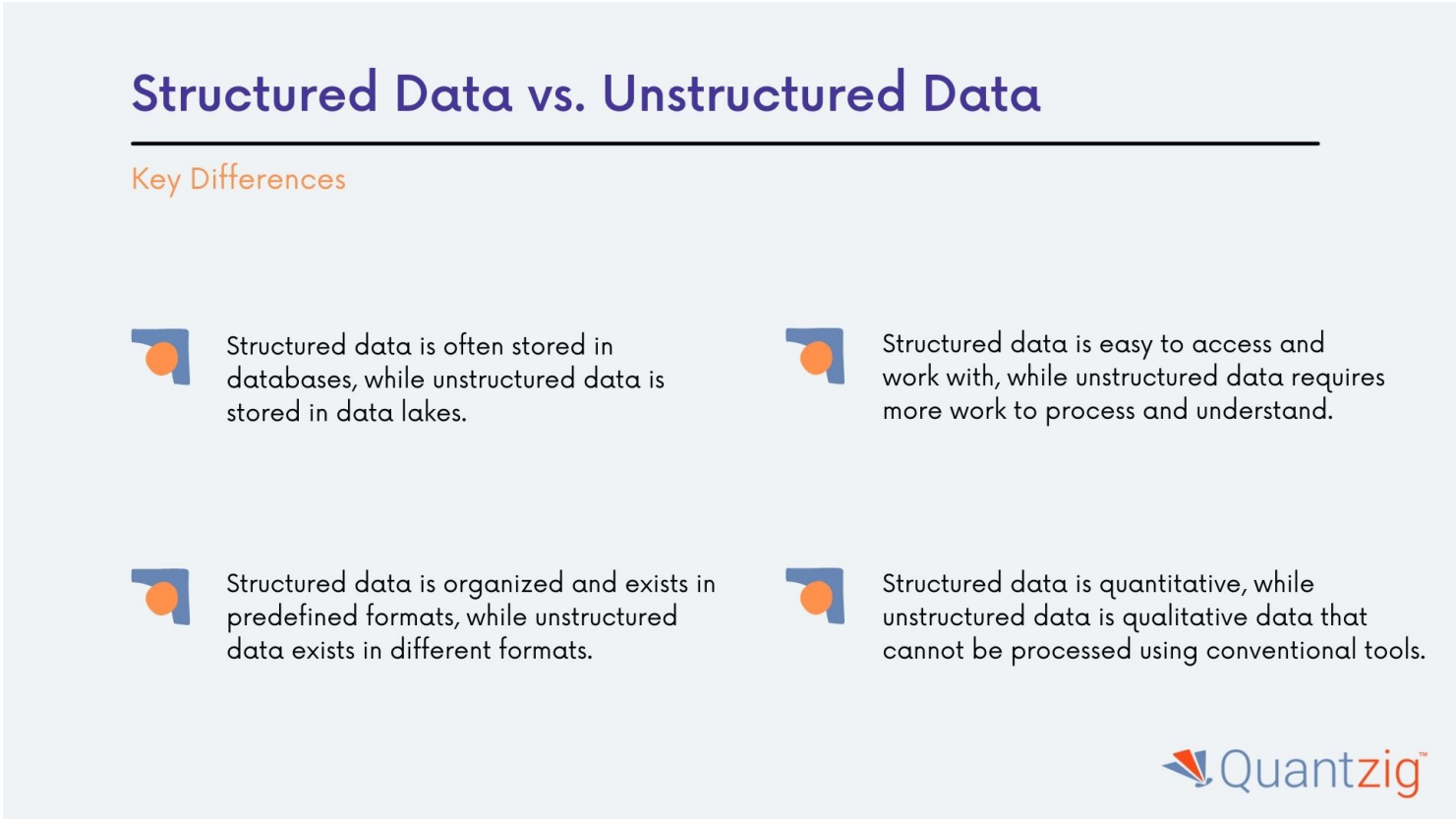


Image Credit: HERE

Use cases for structured data

- **Customer relationship management (CRM):** CRM software runs structured data through analytical tools to create datasets that reveal customer behavior patterns and trends.
- **Online booking:** Hotel and ticket reservation data (e.g., dates, prices, destinations, etc.) fits the “rows and columns” format indicative of the pre-defined data model.
- **Accounting:** Accounting firms or departments use structured data to process and record financial transactions.

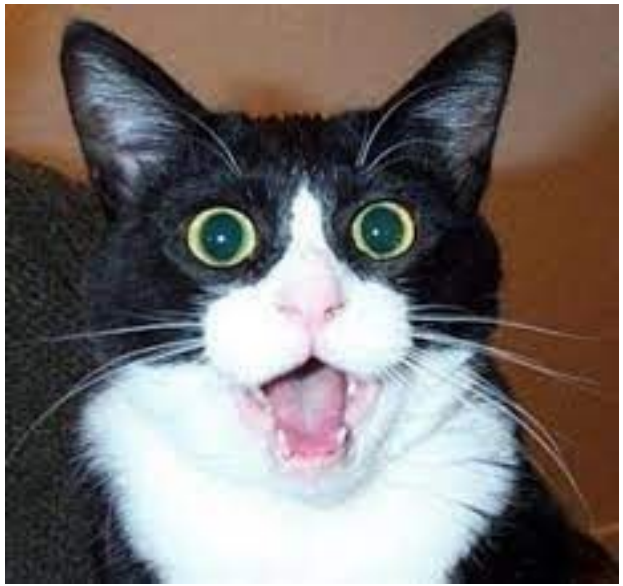
Source: HERE

Use cases for unstructured data

- **Data mining:** Enables businesses to use unstructured data to identify consumer behavior, product sentiment, and purchasing patterns to better accommodate their customer base.
- **Predictive data analytics:** Alert businesses of important activity ahead of time so they can properly plan and accordingly adjust to significant market shifts.
- **Chatbots:** Perform text analysis to route customer questions to the appropriate answer sources.

Source: HERE

80% of global data will be unstructured by 2025



Source: HERE

Unstructured Data: Image

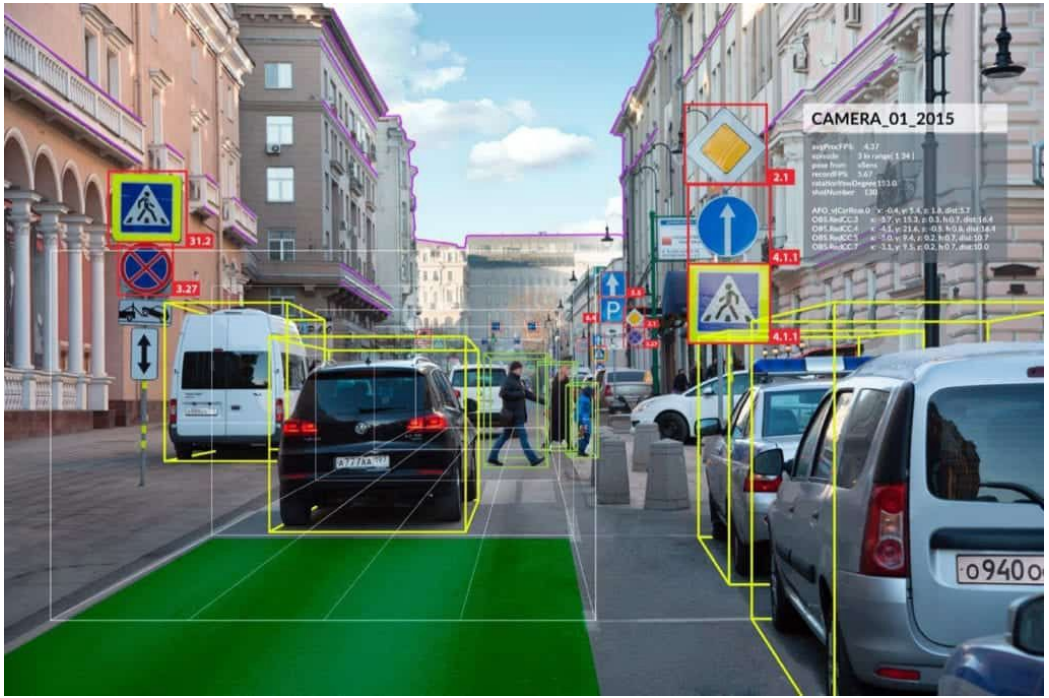
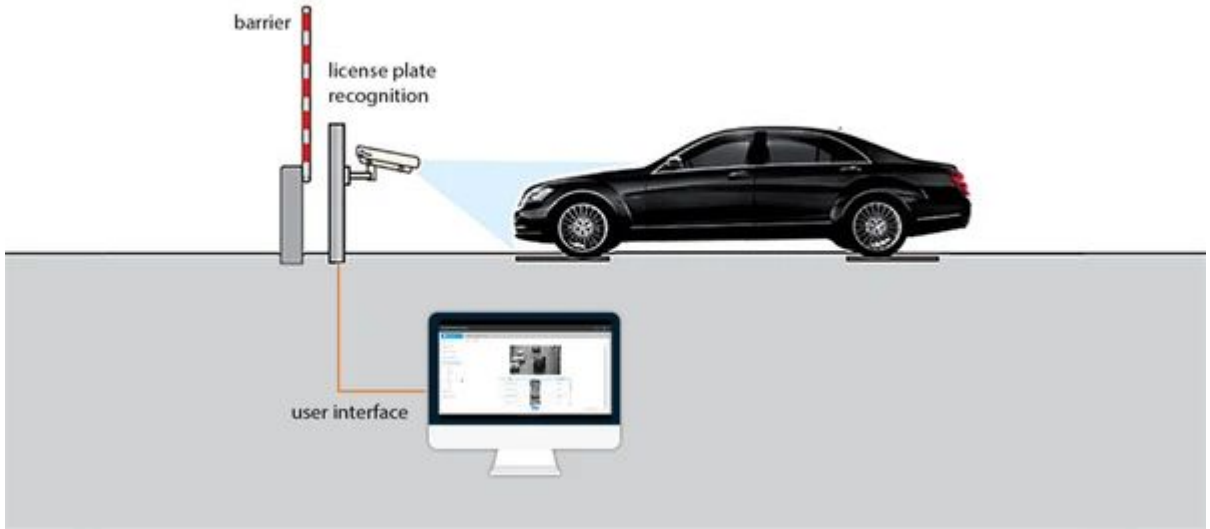


Image Credit: HERE

Image - Background

- Image Processing & Analytics (Domain)
- CNN/YOLO and many more (Deep Learning)
- Image (Data)

Example 1: Smart Parking System



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Example 2: Manufacturing Defect Detection

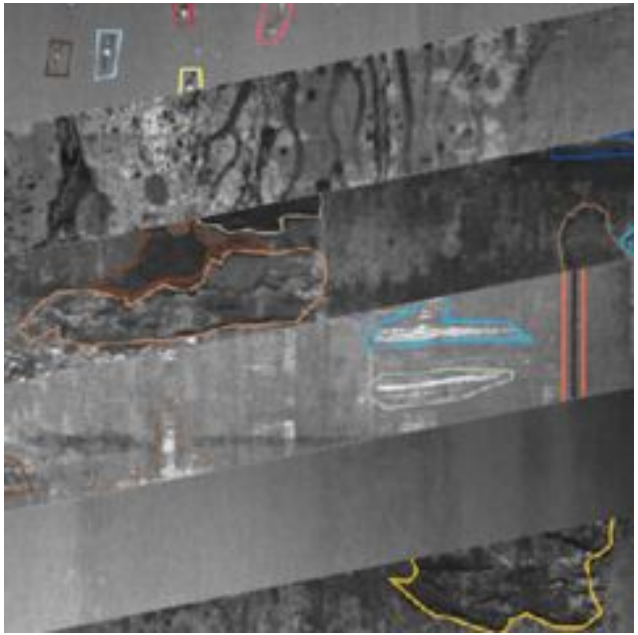

Image Credit: HERE

Example 3: Face Recognition Attendance System

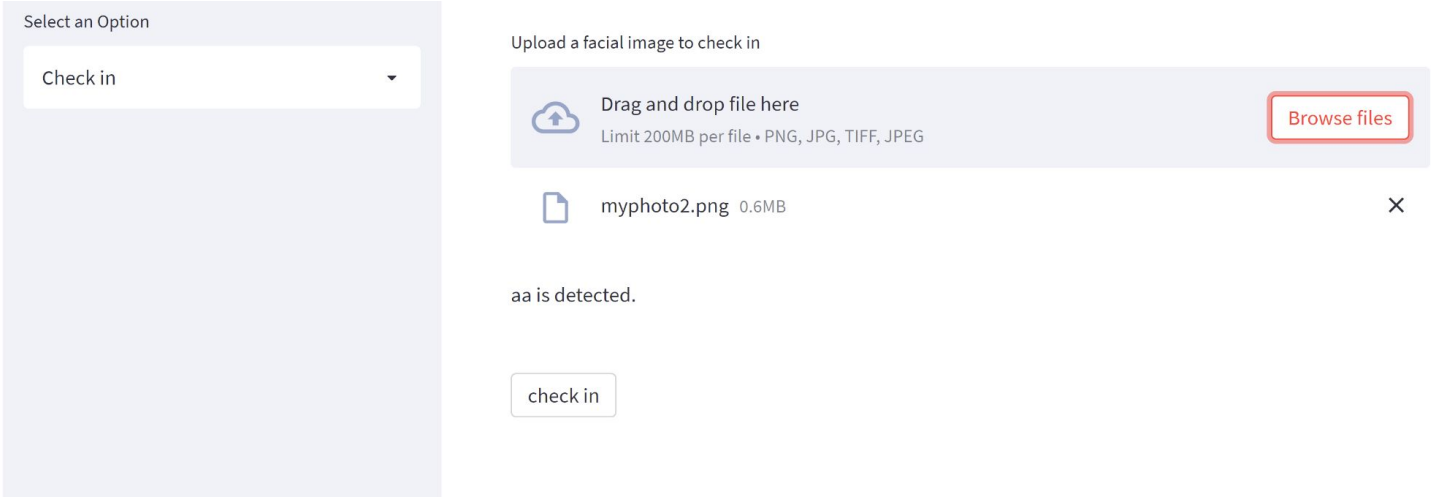

Image Credit: HERE

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Demo: Face Recognition Attendance System

https://www.richieyyptutorialpage.com/demo-python-series/face-recognition-attendance-check-in-system

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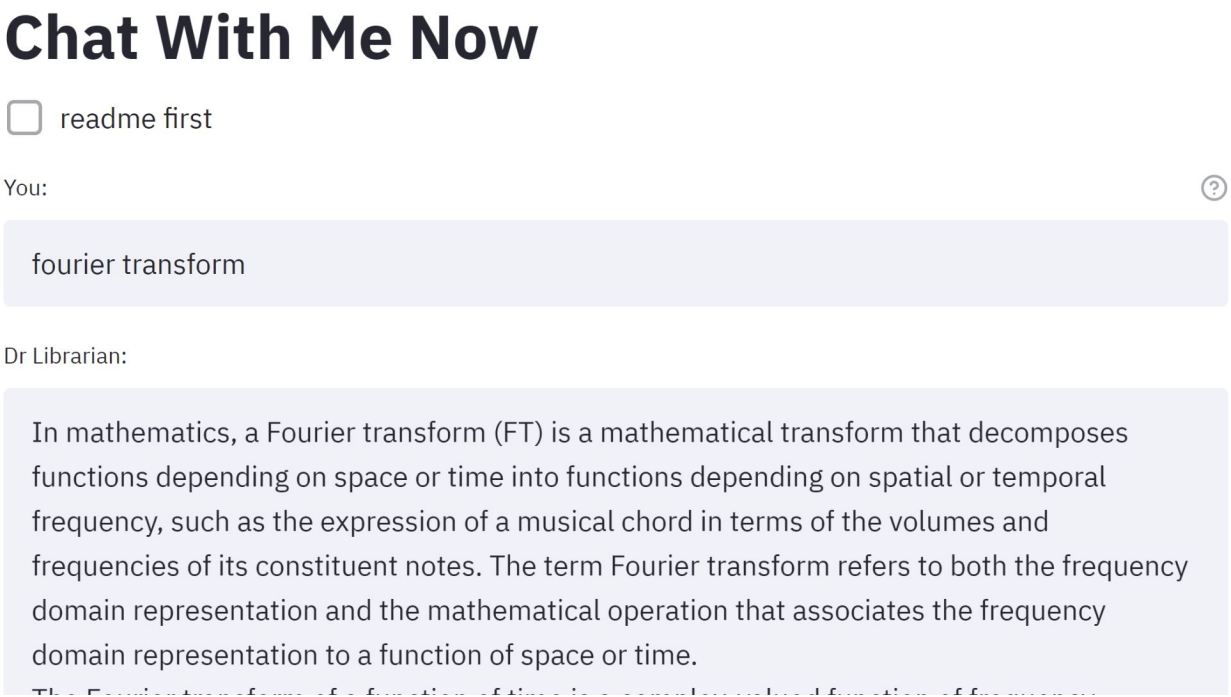
Unstructured Data: Text

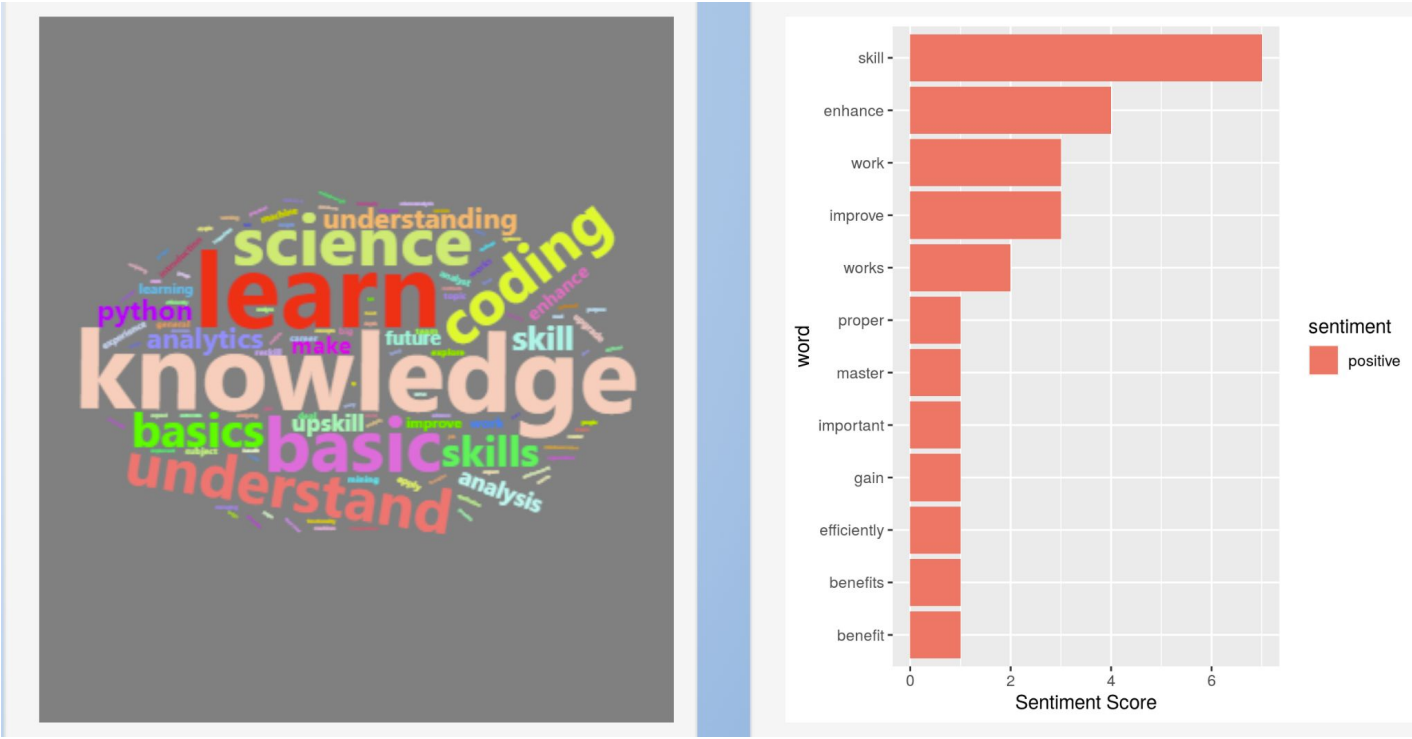


Text - Background

- Text Analytics (Domain)
- Transformer/BERT/GPT3 etc (Deep Learning)
- Text (Data)

Example 1: Chatbot

Example 2: Sentimental Analytics



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Demo: Chatting with Dr. Librarian

https://www.richieyyptutorialpage.com/demo-python-series/ai-chatbot-chat-with-me-now

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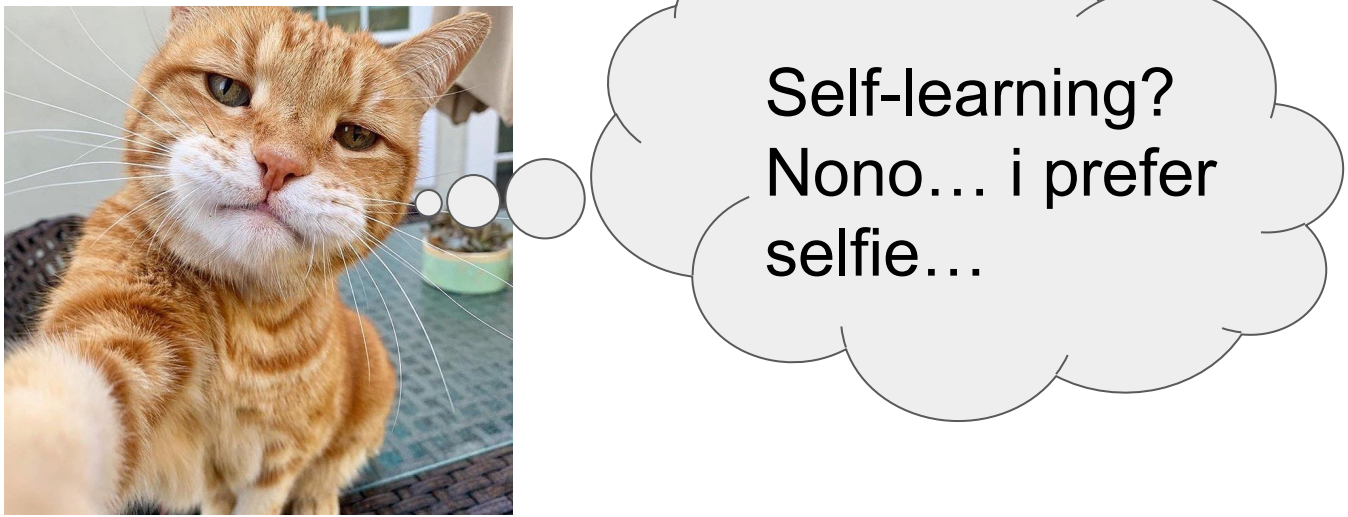
Bonus: Self-learning Activity - Project Deployment



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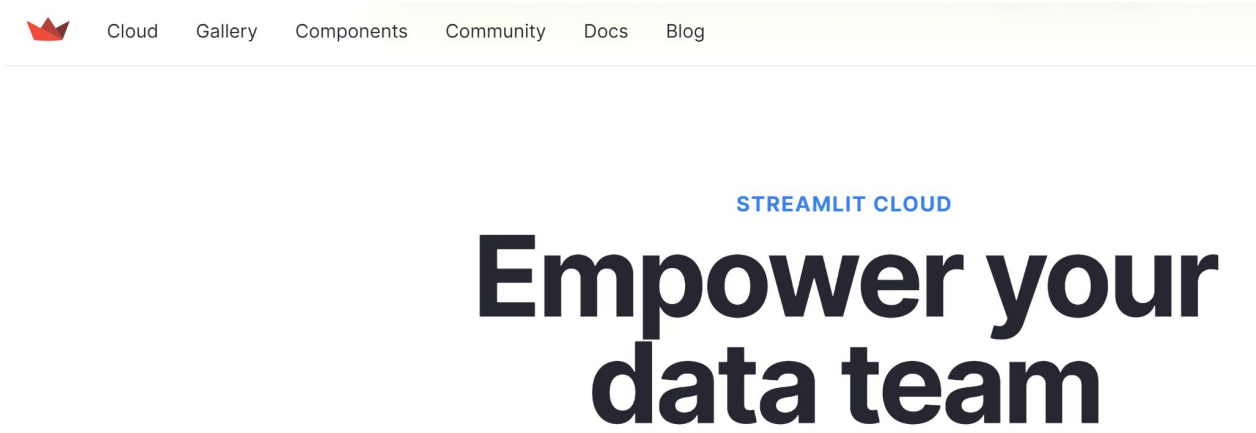
Step1: Create a github & streamlit cloud



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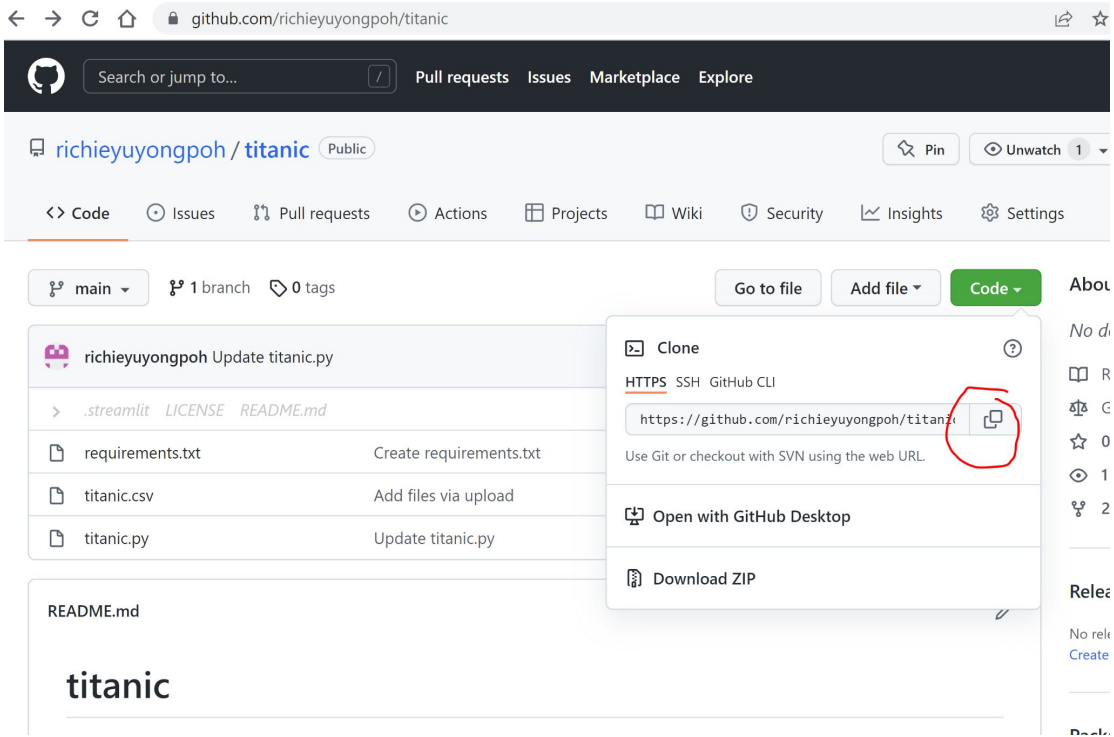
https://github.com/richieyuyongpoh/creating-value-through-data-transformation

Step2: Clone the TITANIC repository



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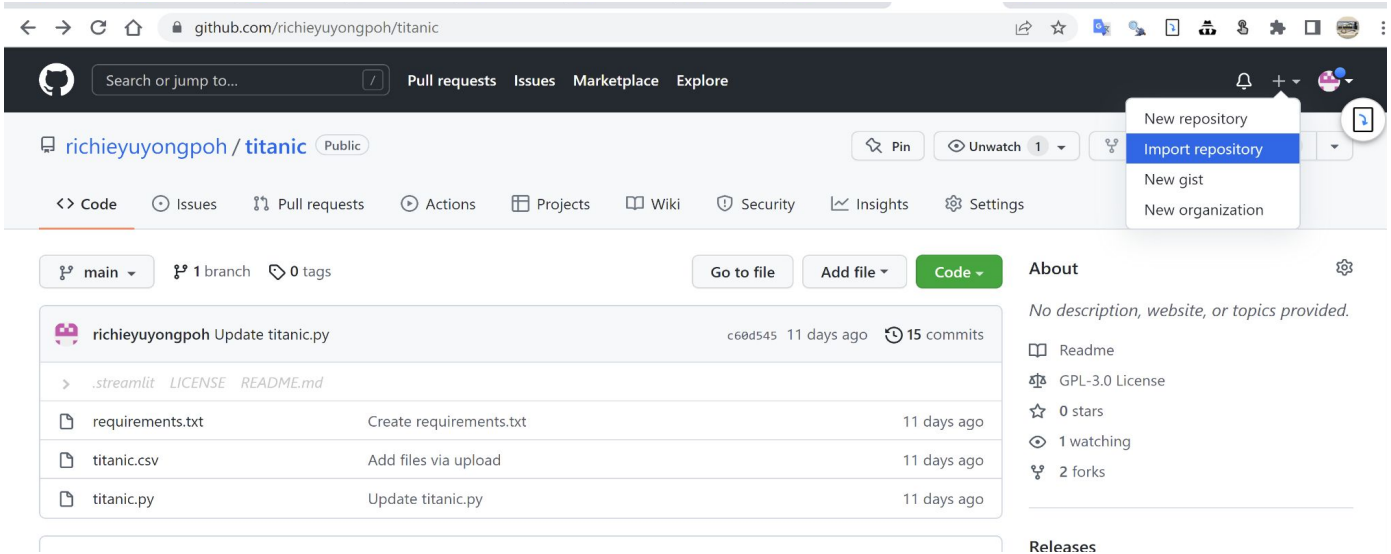
https://github.com/richieyuyongpoh/creating-value-through-data-transformation

Step3: Import it to your new repository



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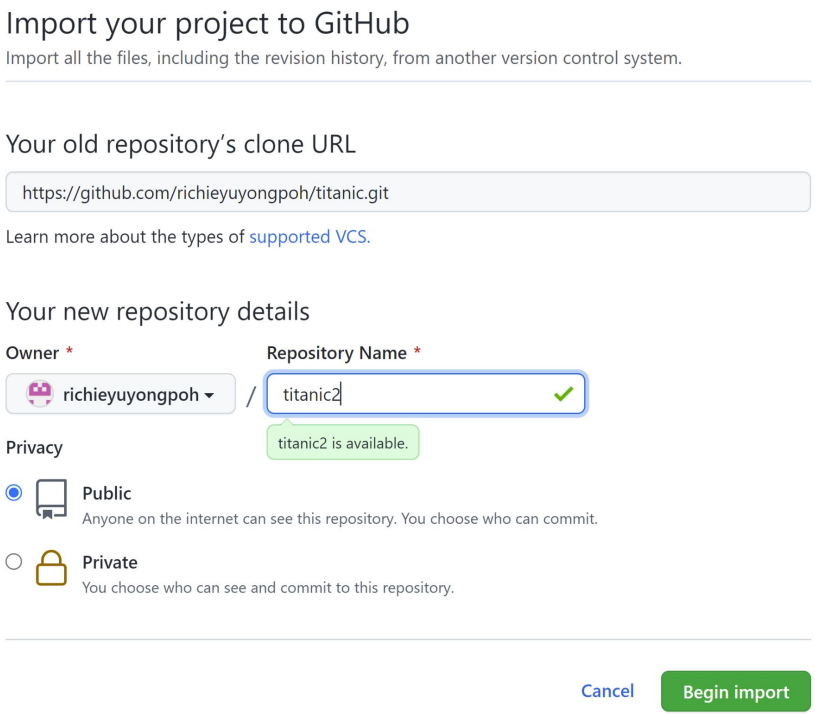
https://github.com/richieyuyongpoh/creating-value-through-data-transformation

Step3: Import it to your new repository



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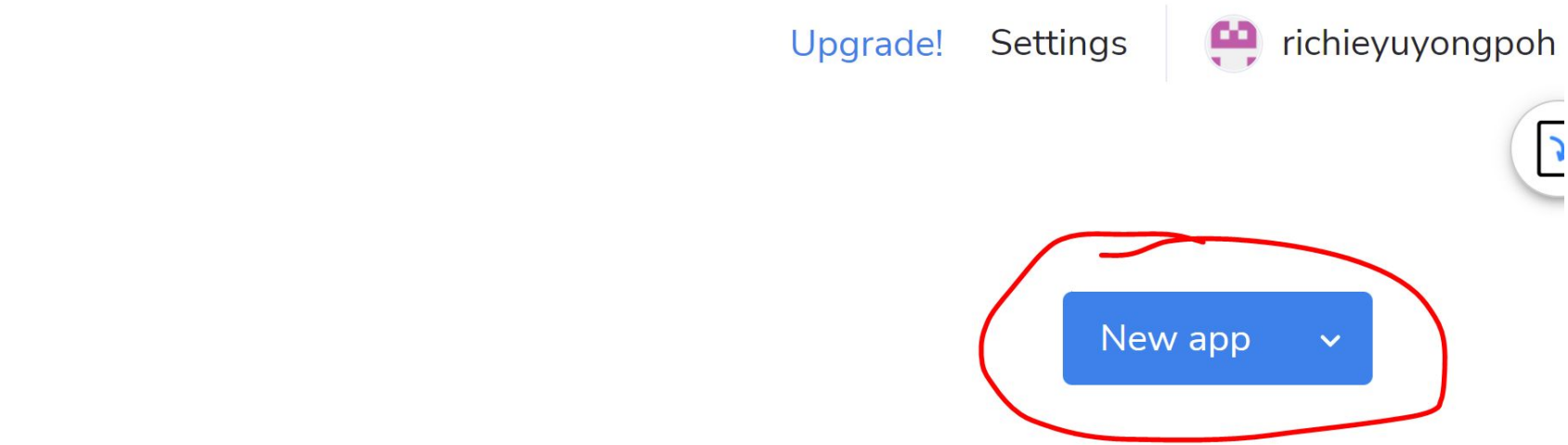
https://github.com/richieyuyongpoh/creating-value-through-data-transformation

Step4: Create a new app using streamlit cloud



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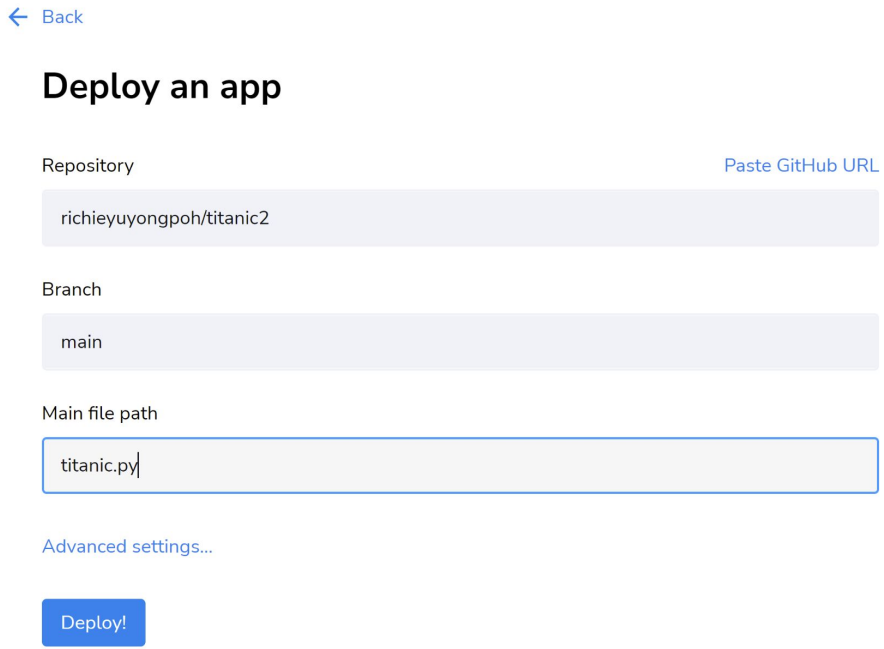
Step5: Deploy the app



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https://github.com/richieyuyongpoh/creating-value-through-data-transformation

Step6: Congratulations

Your app is in the oven

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