Syllabus & Course Overview

Machine Learning and Big Data - DATA622

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Agenda

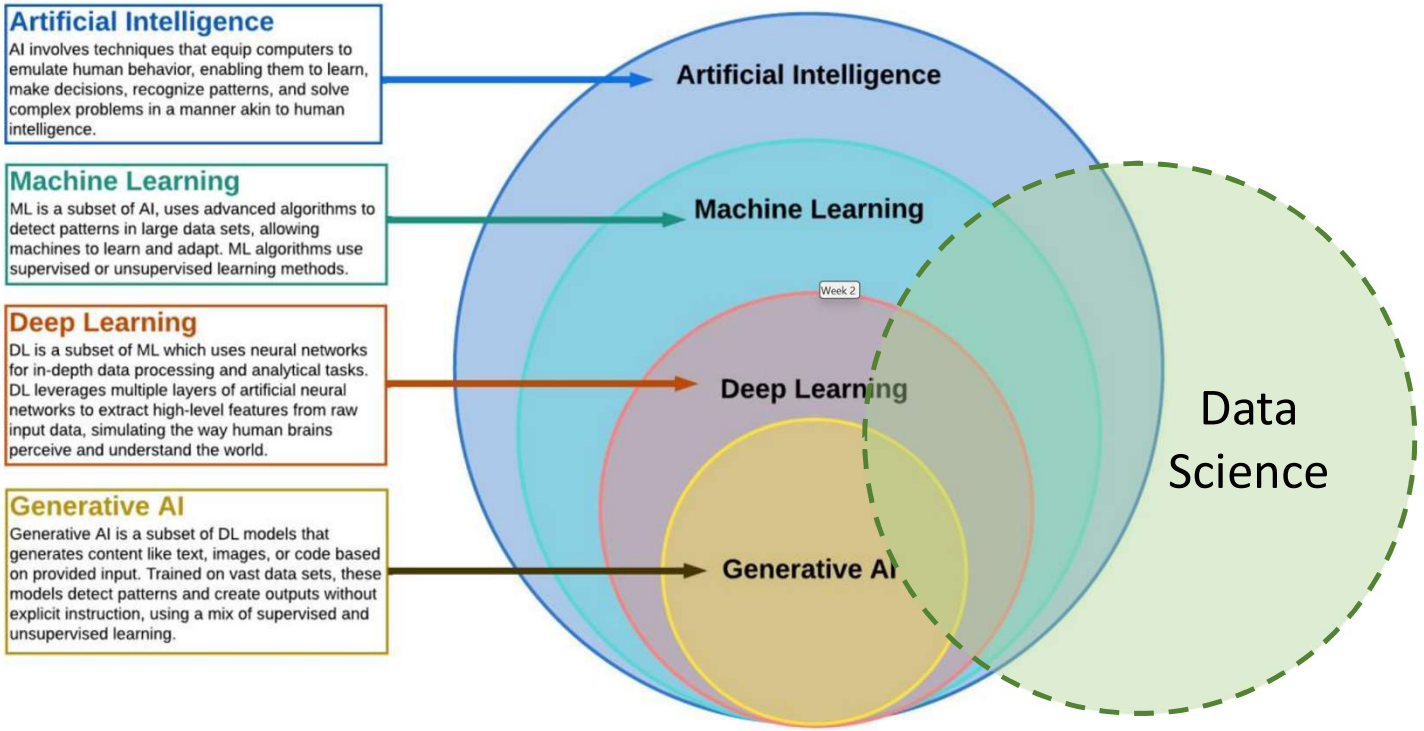
1. Introductions
2. Syllabus
3. Grading
4. Calendar
5. Textbooks
6. Week 1 – Tasks

Weekly calls

- Class calls will be recorded and posted online
- Thursday's 7PM ET
  Call to go over Weekly tasks and concepts.

Details on BrightSpace.

Machine Learning



Source: "The Application of AutoML Techniques in Diabetes Diagnosis: Current Approaches, Performance, and Future Directions", Zhuhadar, Lily Popova; Lytras, Miltiadis, 2023

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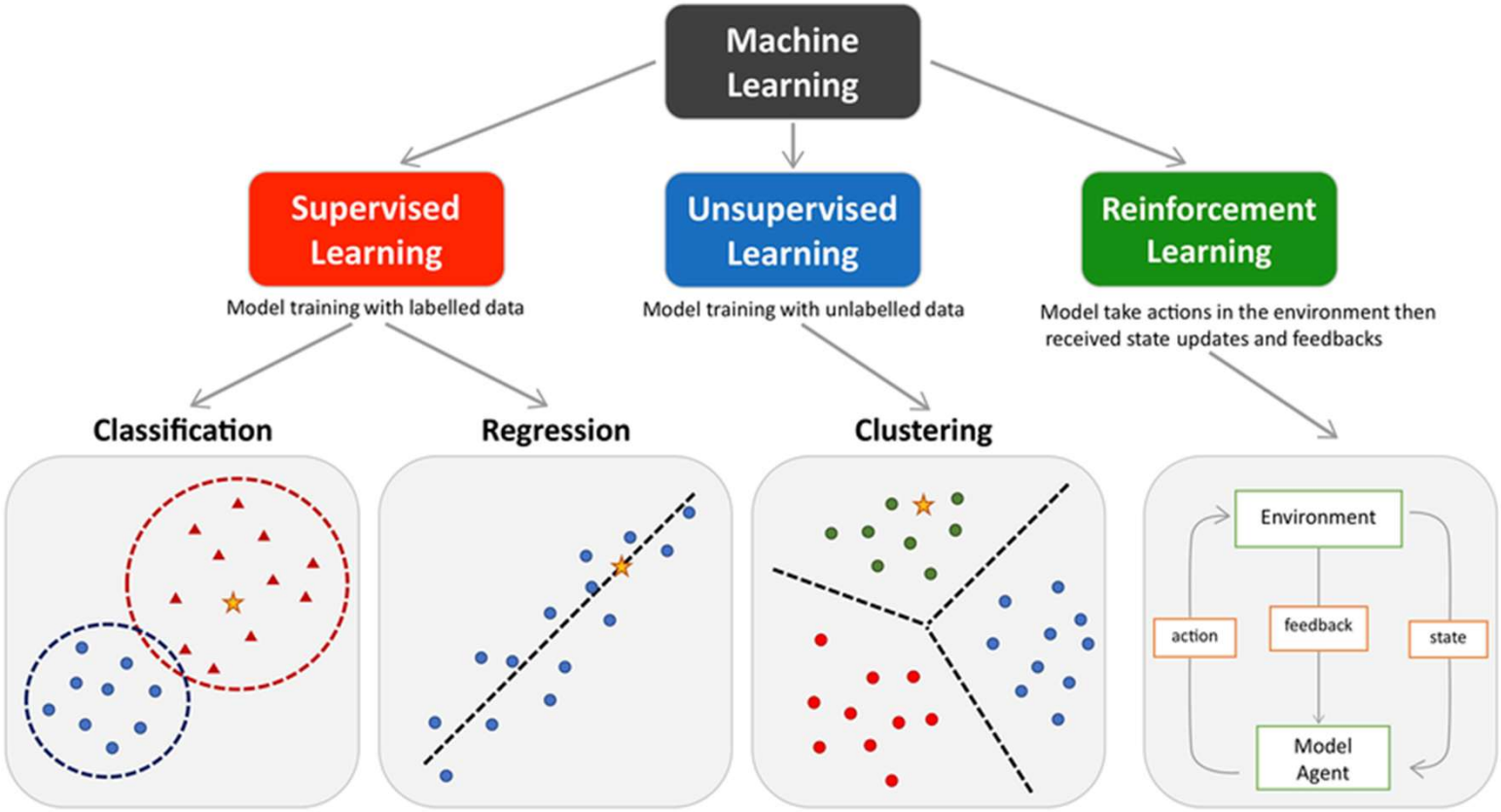
Types of Machine Learning



Source: "Machine Learning Techniques for Personalised Medicine Approaches in Immune-Mediated Chronic Inflammatory Diseases: Applications and Challenges", Pend et al, Sep 2021

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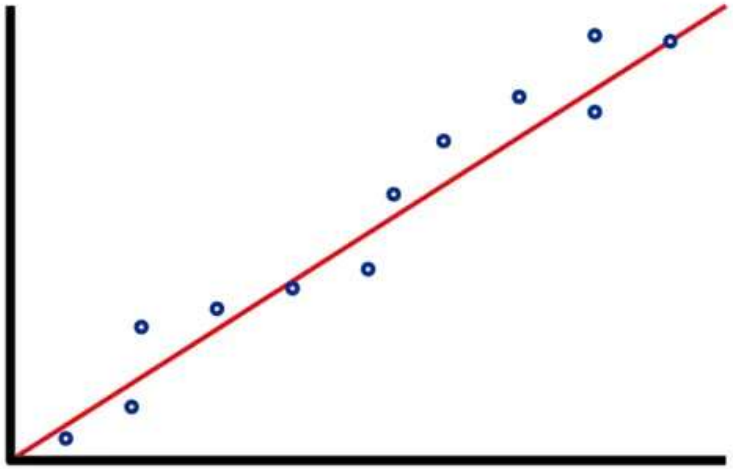
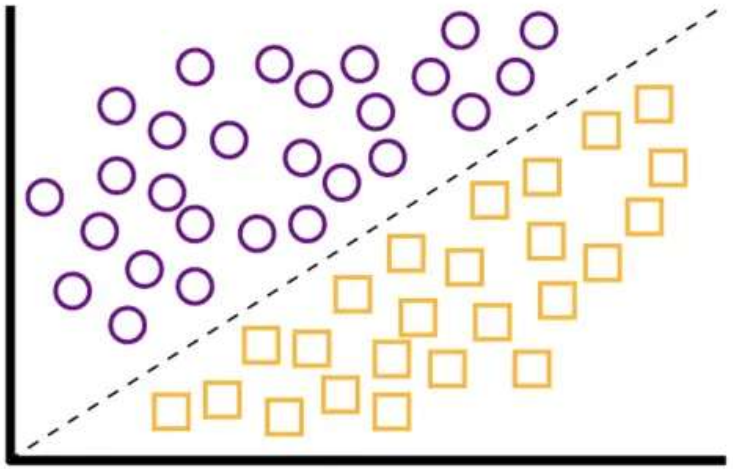
Classification vs Regression

Regression

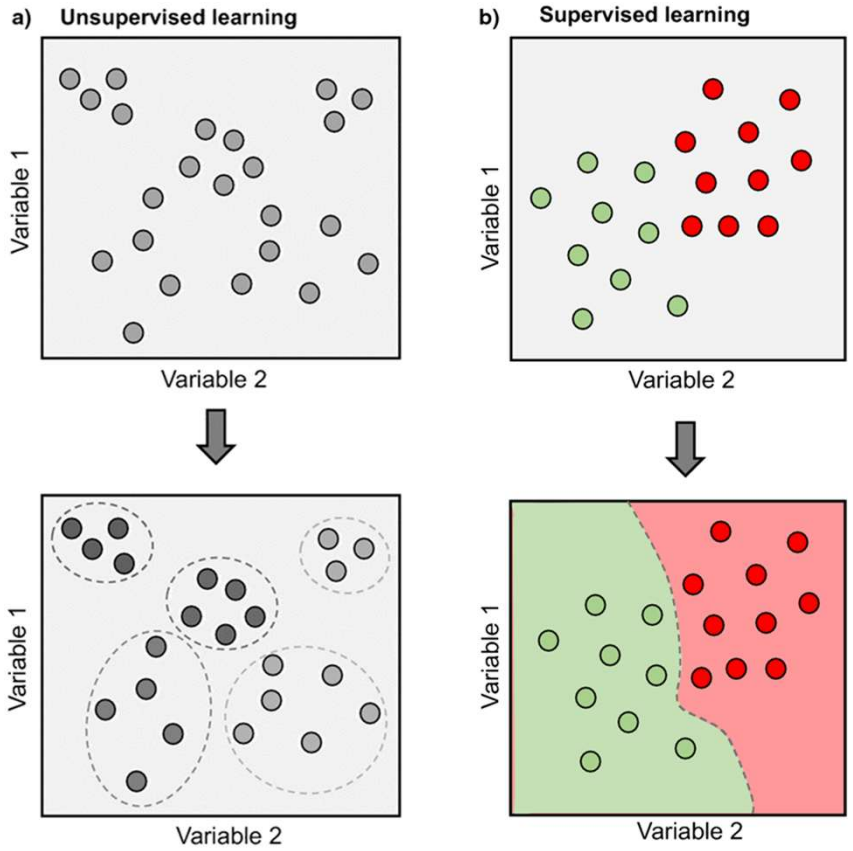


Classification



Unsupervised vs Supervised

Unsupervised learning
Input data is unlabeled
Has no feedback mechanism
Assigns properties of given data to classify it
Divided into Clustering & Association
Used for analysis
Algorithms include: k-means clustering, hierarchical clustering, apriori algorithm
A unknown number of classes



Supervised learning
Input data is labeled
Has a feedback mechanism
Data is classified based on the training dataset
Divided into Regression & Classification
Used for prediction
Algorithms include: decision trees, logistic regressions, support vector machine
A known number of classes

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Machine Learning Process

Source: "Neural Network for Porosity Prediction in Carbonate Formation", Huda F. Al-Saad, 2023

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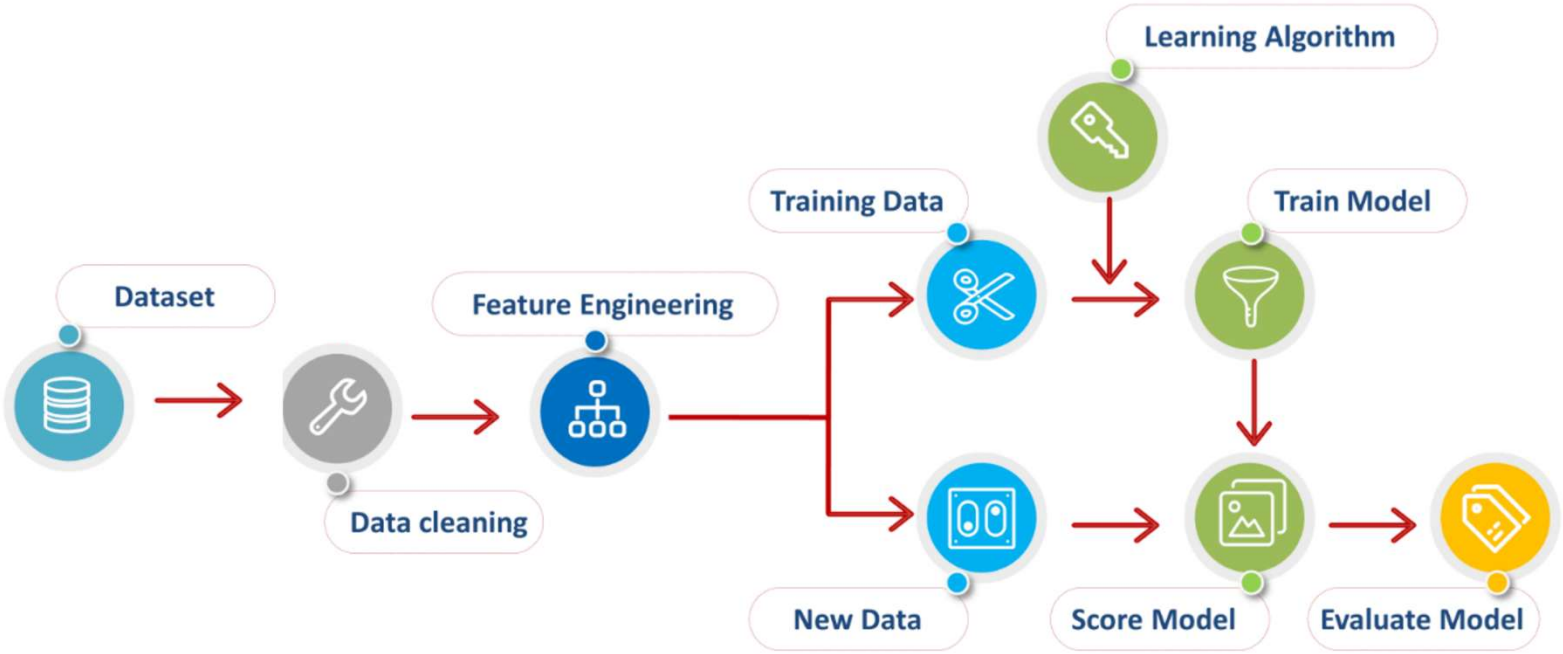
Machine Learning Process



Source: "Neural Network for Porosity Prediction in Carbonate Formation", Huda F. Al-Saad, 2023

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Machine Learning Algorithms

Source: "Neural Network for Porosity Prediction in Carbonate Formation", Huda F. Al-Saad, 2023

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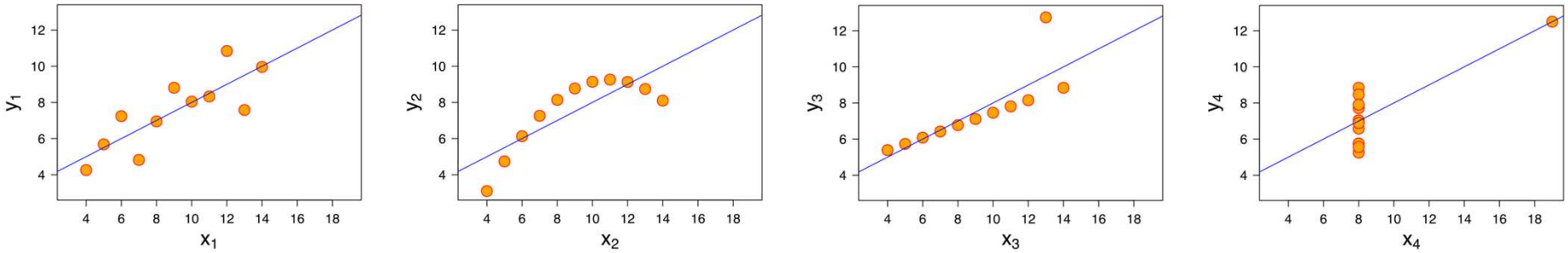
Exploratory Data Analysis (EDA)

What do these data sets have in common?



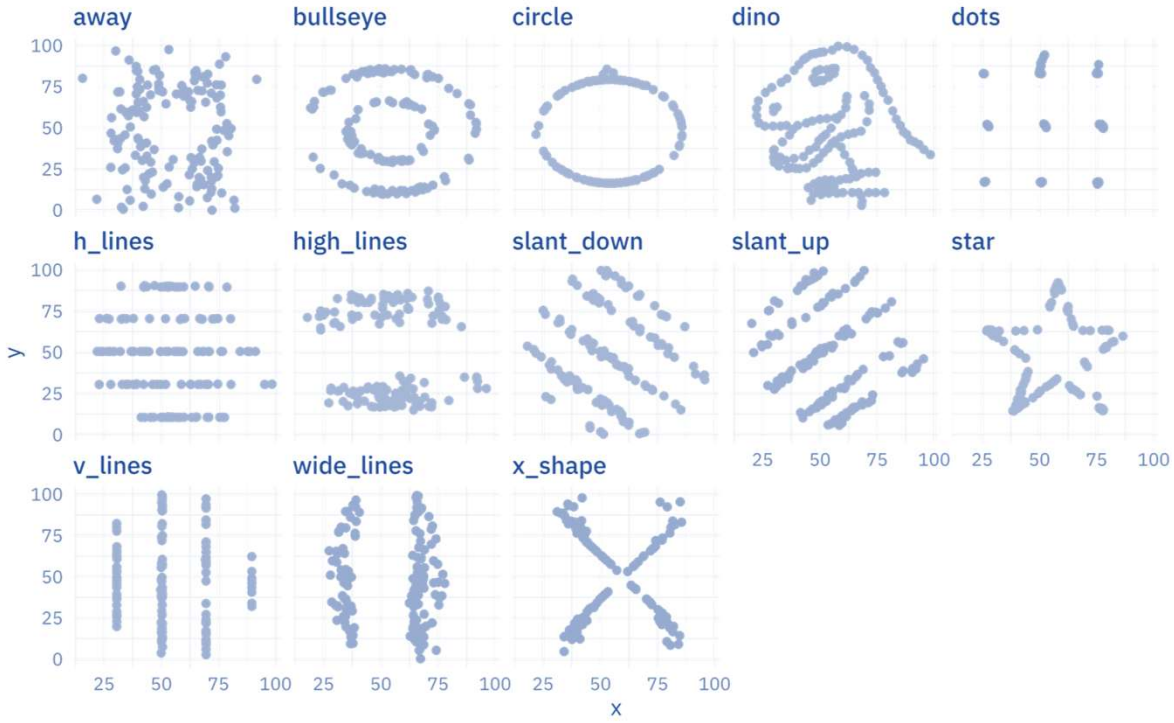
Not much. Except….

Identical means, variances, correlation, coefficients of determination, regressions

Property	Value
Mean of x	9
Sample variance of x: s_x^2	11
Mean of y	7.50
Sample variance of y: s_y^2	4.125
Correlation between x and y	0.816
Linear regression line	y = 3.00 + 0.500x
Coefficient of determination of the linear regression: R^2	0.67

Source: Anscombe's quartet from Wikipedia

Another example



Common statistical values for each group in the dataset

	Summary statistics					*Regression results*	
Dataset	Mean x	Mean y	Std Dev x	Std Dev y	Corr x y	Intercept	Coefficients
Away	54.27	47.83	16.77	26.94	-0.06	53.43	-0.10
Bullseye	54.27	47.83	16.77	26.94	-0.07	53.81	-0.11
Circle	54.27	47.84	16.76	26.93	-0.07	53.80	-0.11
Dino	54.26	47.83	16.77	26.94	-0.06	53.45	-0.10
Dots	54.26	47.84	16.77	26.93	-0.06	53.10	-0.10
H_lines	54.26	47.83	16.77	26.94	-0.06	53.21	-0.10
High_lines	54.27	47.84	16.77	26.94	-0.07	53.81	-0.11
Slant_down	54.27	47.84	16.77	26.94	-0.07	53.85	-0.11
Slant_up	54.27	47.83	16.77	26.94	-0.07	53.81	-0.11
Star	54.27	47.84	16.77	26.93	-0.06	53.33	-0.10
V_lines	54.27	47.84	16.77	26.94	-0.07	53.89	-0.11
Wide_lines	54.27	47.83	16.77	26.94	-0.07	53.63	-0.11
X_shape	54.26	47.84	16.77	26.93	-0.07	53.55	-0.11

Descriptive statistics can be misleading. Data visualization helps.

Source: Datasaurus Dozen from wikipedia

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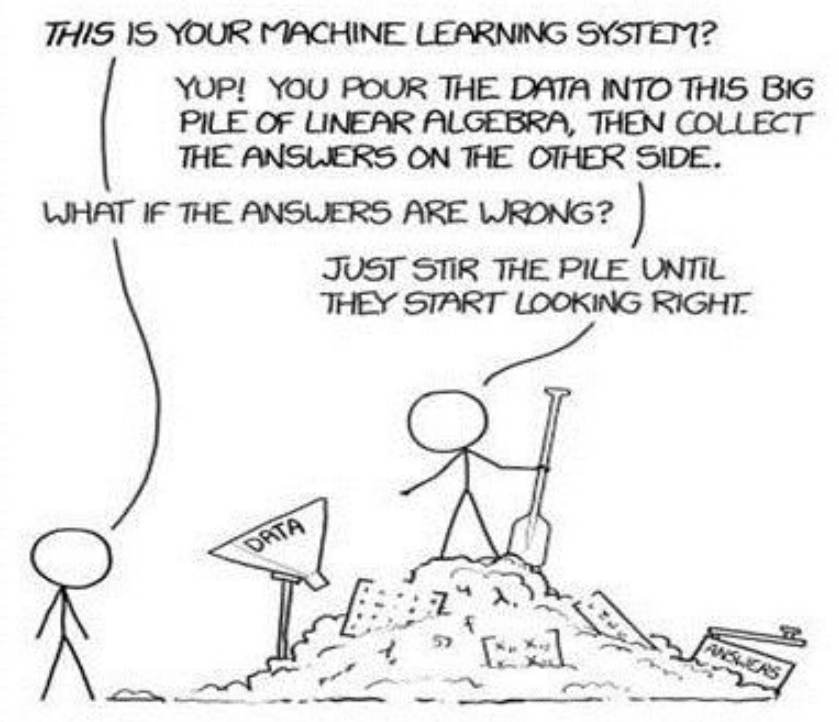
What Exploratory Data Analysis isn't….



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Artificial General Intelligence (AGI)

What is Intelligence?

There are many definitions, here is one:

"Intelligence measures an agent's ability to achieve goals in a wide range of environments." S. Legg and M. Hutter

Narrow AI vs AGI

NARROW AI	ARTIFICIAL GENERAL INTELLIGENCE (AGI)
■ AI focused on a specific, singular or limited task	■ Not fully realized, with some developers questioning if it will be possible
■ Examples include image recognition, hyper-personalization, chatbots, predictive text	■ Seeks machines that can handle a range of cognitive tasks with little oversight
■ Trained on specific tasks by data scientists	■ The ability to learn, generalize, apply knowledge and plan for the future
■ Correlates questions or assignments to a specific data set to accomplish a task	■ Must consistently pass the Turing Test
■ No self-awareness, consciousness, ability to think	■ Single, general intelligence that possesses common sense and creativity and expresses emotions

Source: Definition from "A Collection of Definitions of Intelligence", Shane Legg Marcus Hutter, 2007, Image from Tech target under fair use