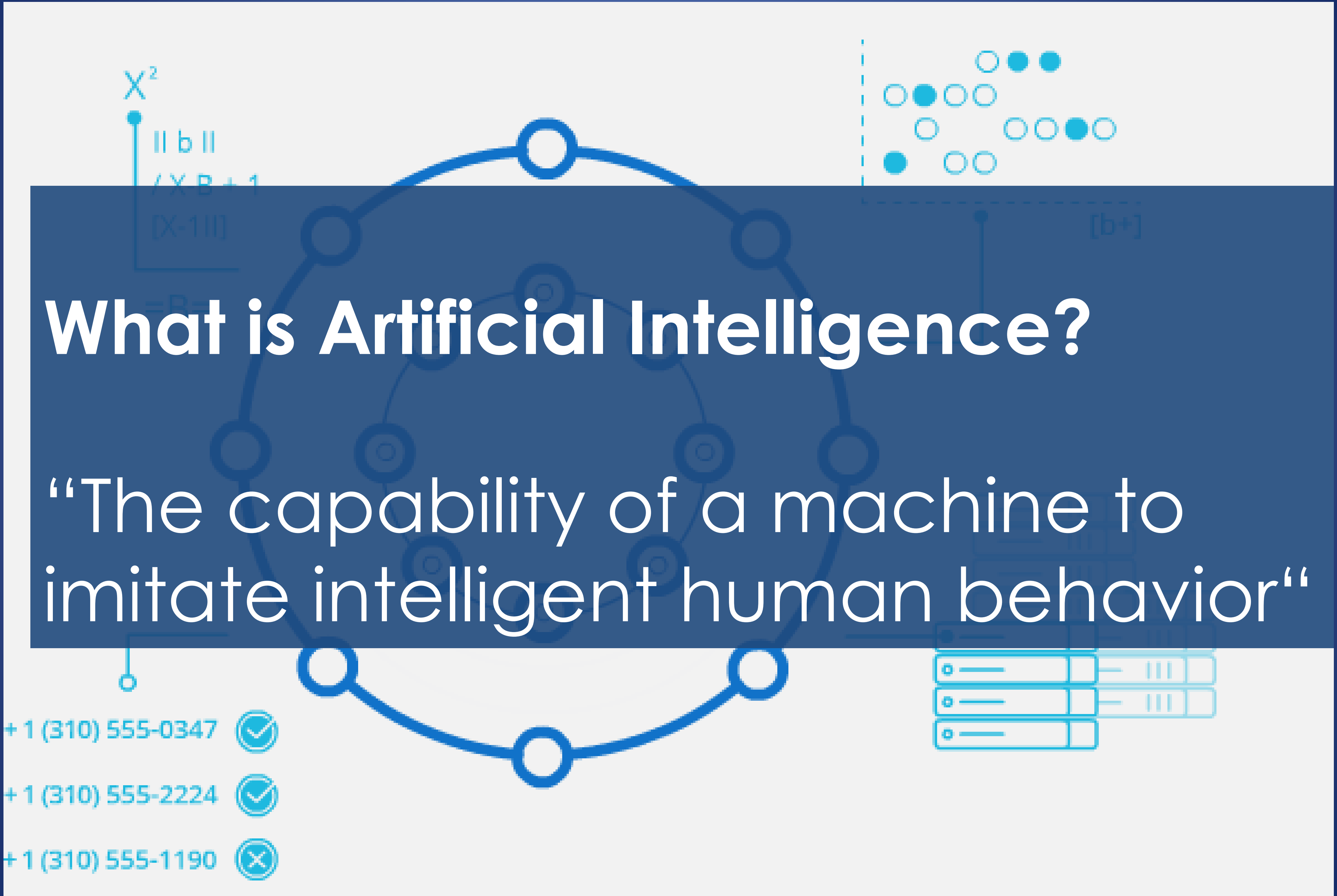
Introduction to Machine Learning

Hello! Instructor Introduction

- Instructor: **Anshu Pandey**
- Microsoft Certified Trainer
- Data Scientist
- Microsoft Certified Azure AI Associate & Data Scientist

- A Data Scientist and AI Architect having 8+ years of experience of working with organizations to develop Data Science and AI Applications and helping them with AI Transformation.

Artificial Intelligence



What is Artificial Intelligence?

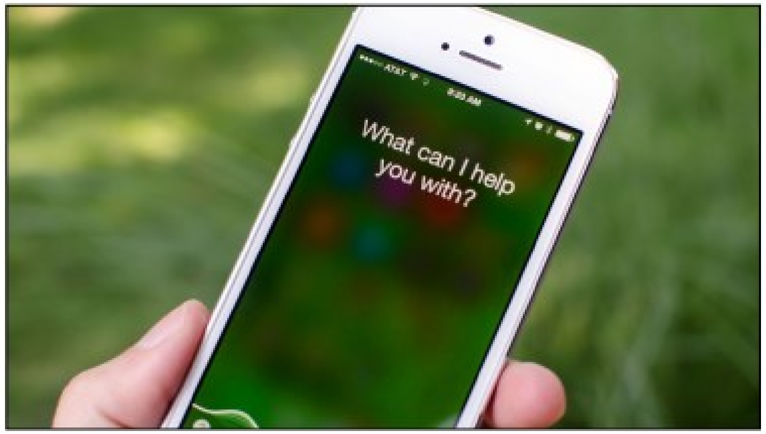
"The capability of a machine to imitate intelligent human behavior"

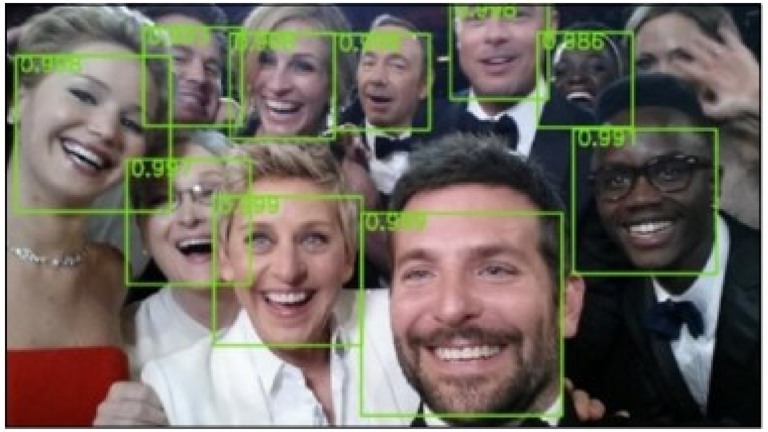
What is Artificial Intelligence?

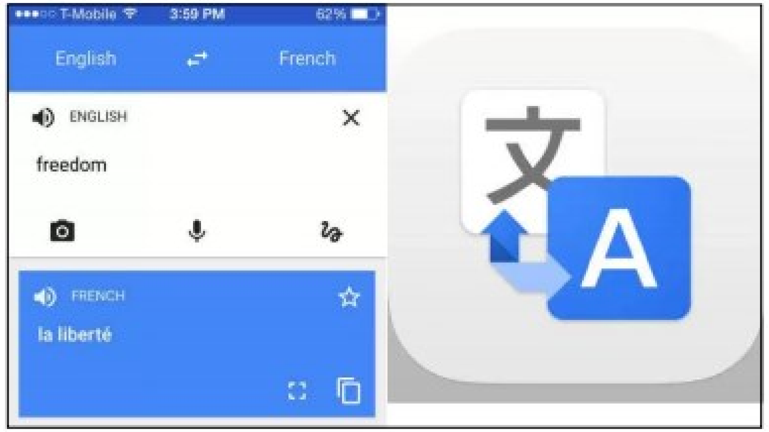
Machine or Computers + Intelligence = Artificial Intelligence

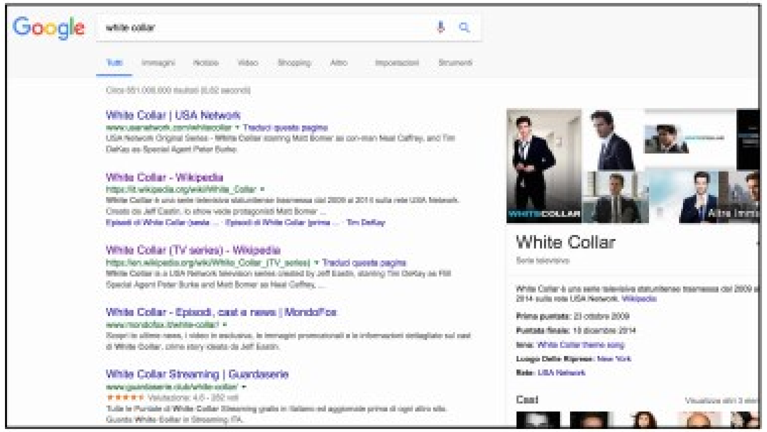
What is Artificial Intelligence?

Artificial Intelligence in everyday products

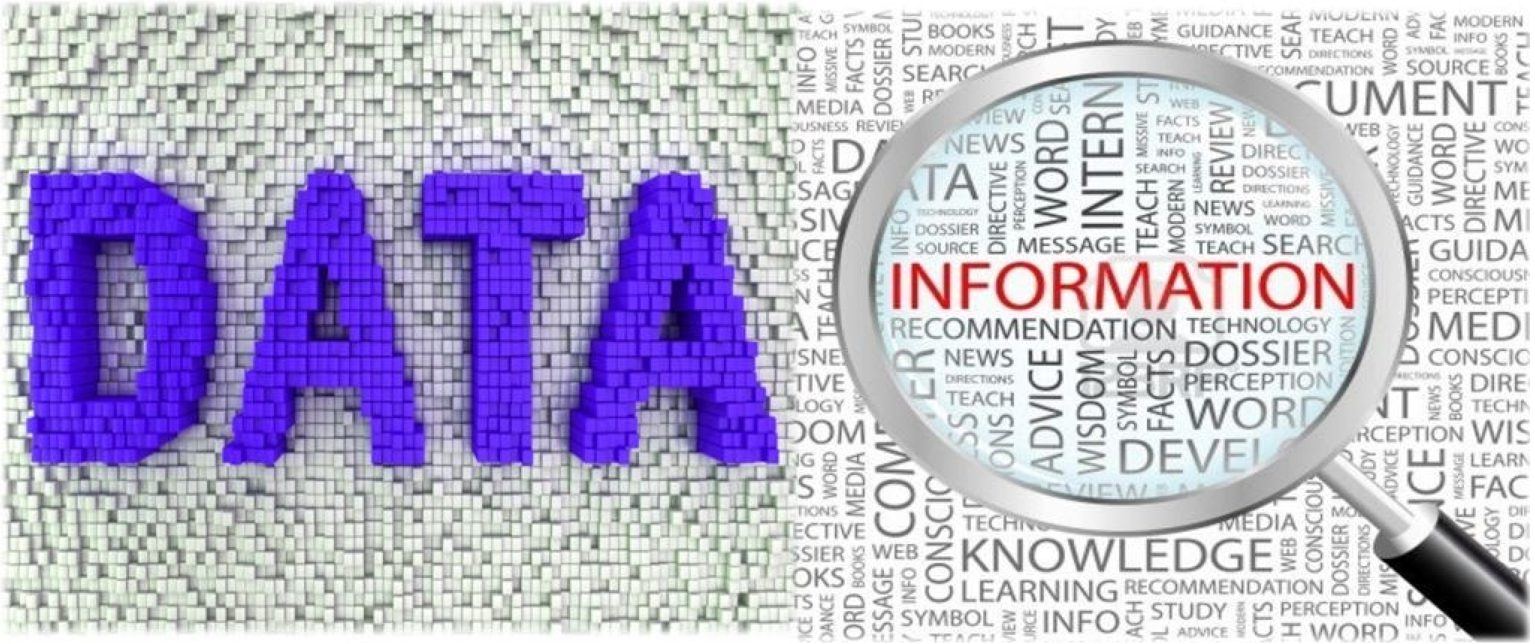






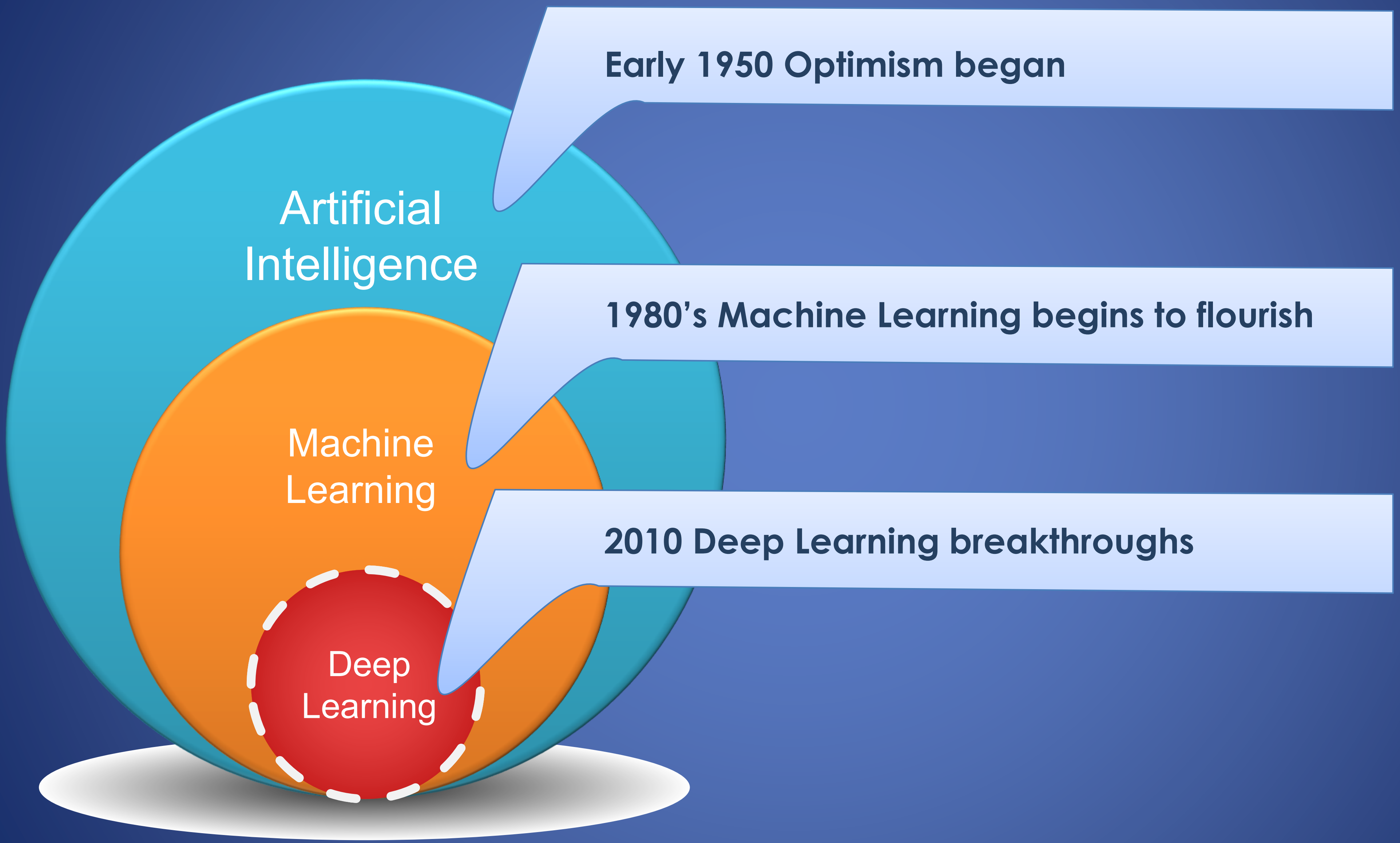


What is Data?

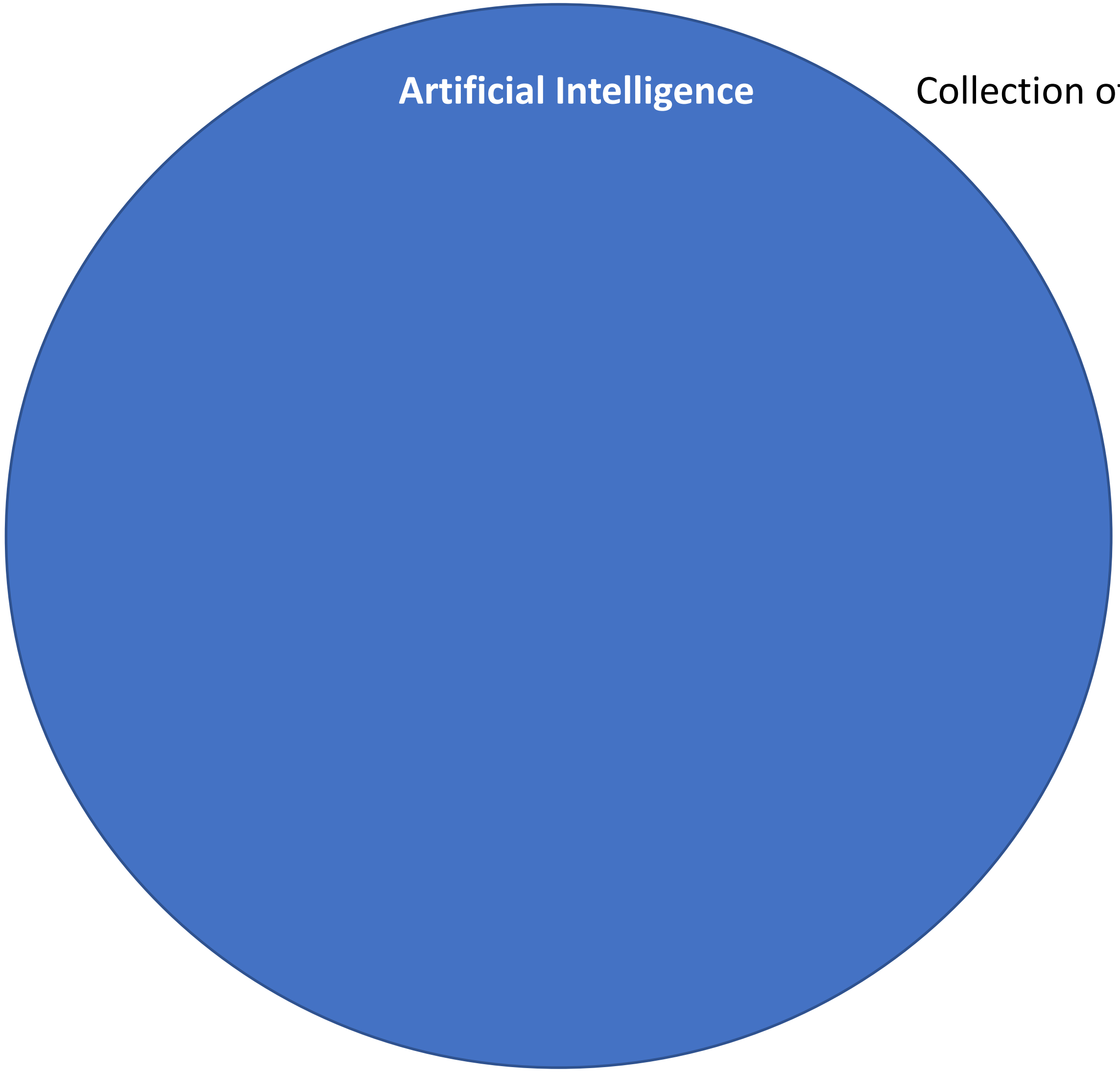


Structured
- Business Data, Excel, CSV

Unstructured
- Text, Images and Speech

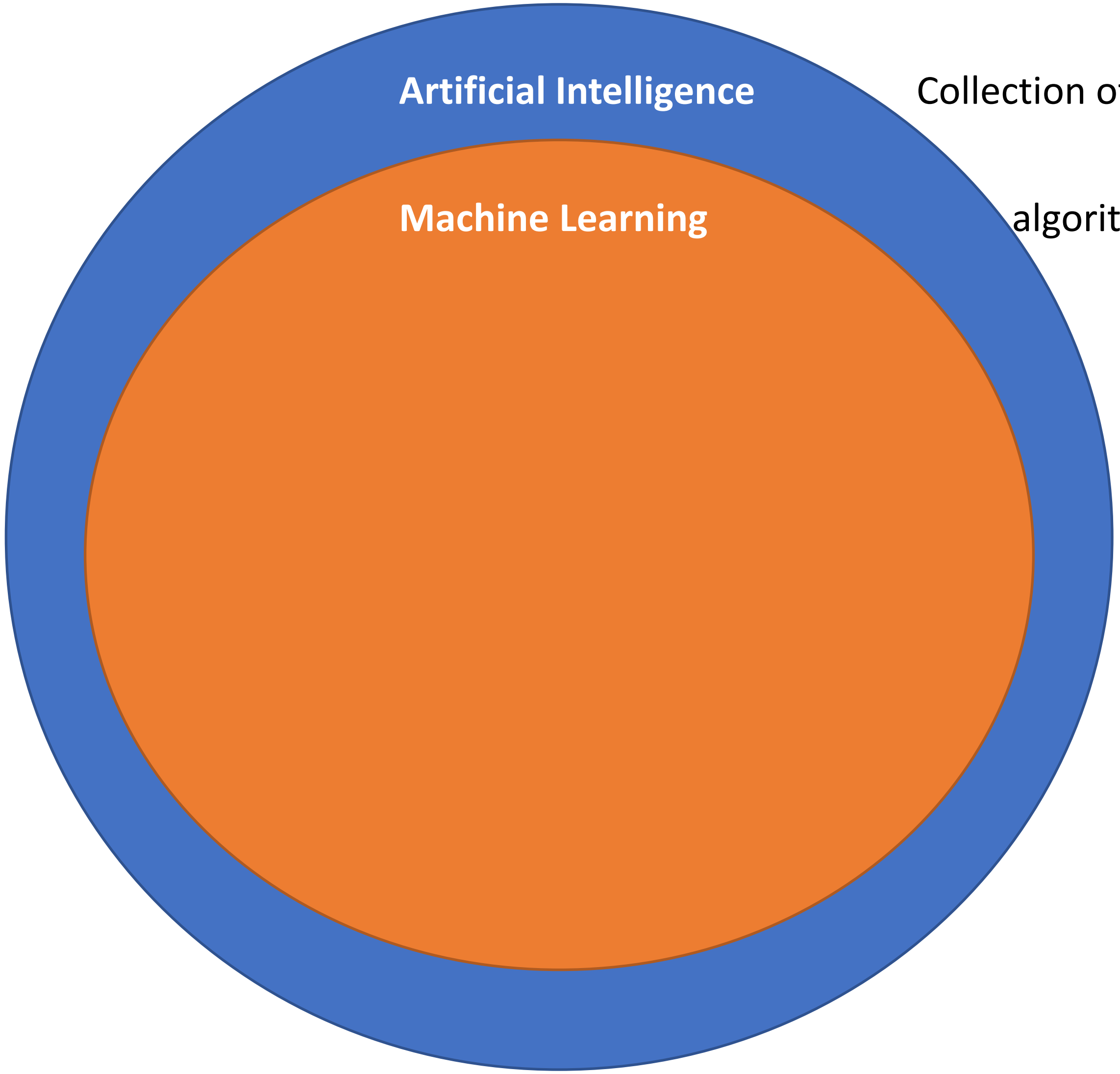

Artificial Intelligence
Machine Learning
Deep Learning
Early 1950 Optimism began
1980's Machine Learning begins to flourish
2010 Deep Learning breakthroughs

AI Landscape



Collection of algorithms used to build intelligence

AI Landscape



Collection of algorithms used to build intelligence

algorithms which use DATA to build intelligence

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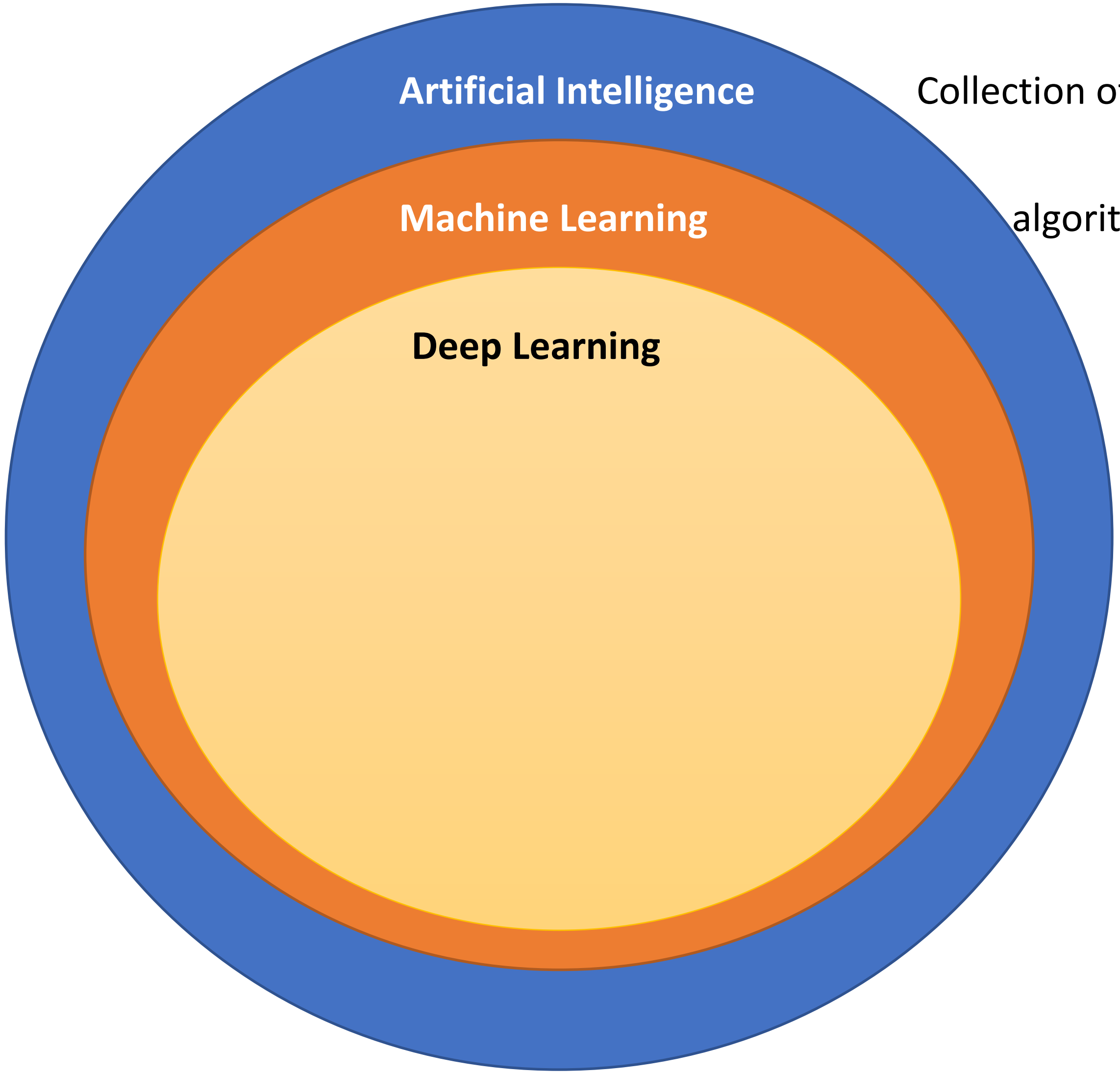

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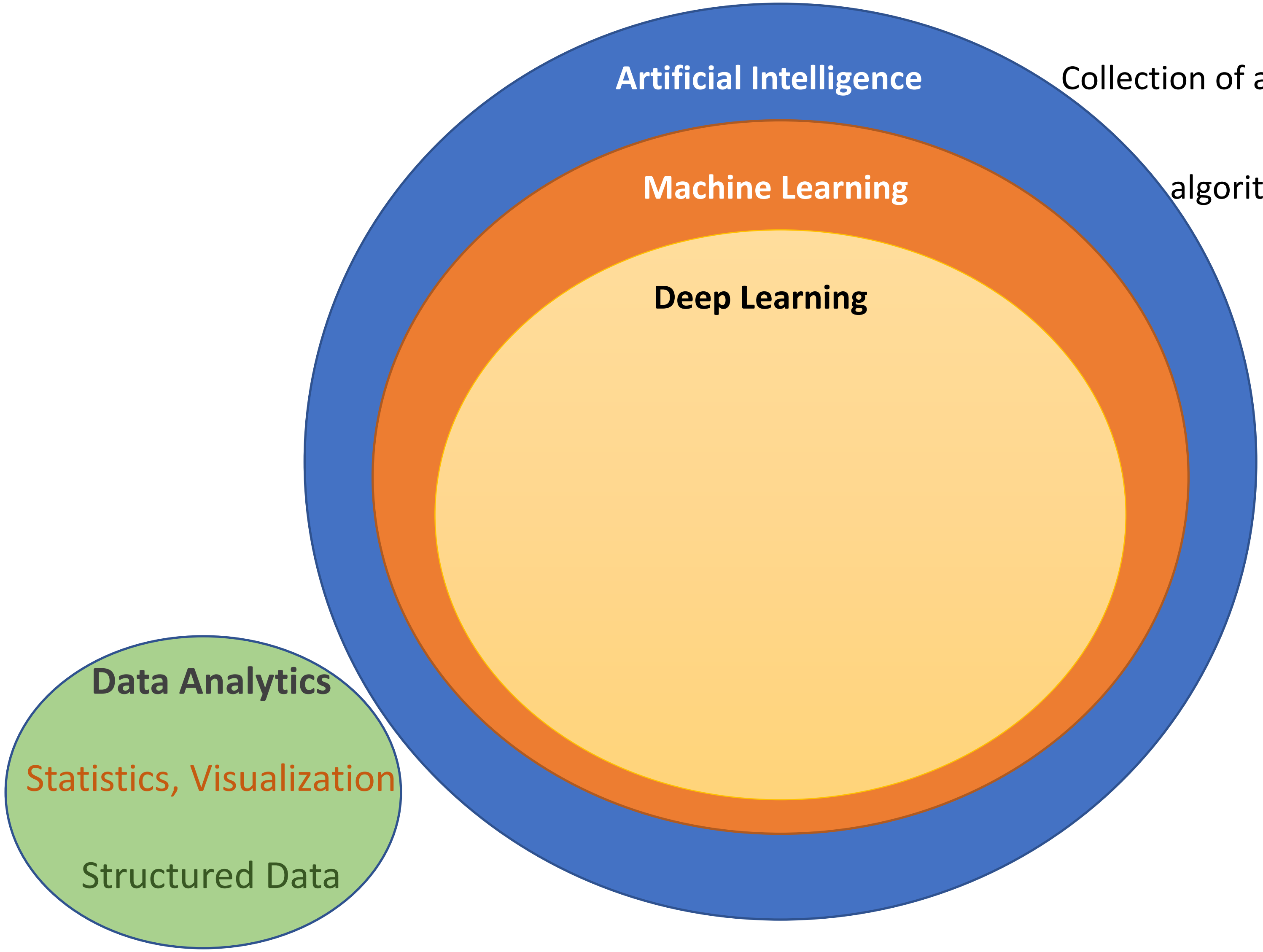
AUTOMATED FEATURE ENGINEERING

AI Landscape



Collection of algorithms used to build intelligence

algorithms which use DATA to build intelligence

AUTOMATED FEATURE ENGINEERING

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
2	1	15634602	Hargrave	619	France	Female	42	2	0	1	1	1	101348.88	1
3	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
4	3	15619304	Onio	502	France	Female	42	8	159660.8	3	1	0	113931.57	1
5	4	15701354	Boni	699	France	Female	39	1	0	2	0	0	93826.63	0
6	5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79084.1	0
7	6	15574012	Chu	645	Spain	Male	44	8	113755.78	2	1	0	149756.71	1
8	7	15592531	Bartlett	822	France	Male	50	7	0	2	1	1	10062.8	0
9	8	15656148	Obinna	376	Germany	Female	29	4	115046.74	4	1	0	119346.88	1
10	9	15792365	He	501	France	Male	44	4	142051.07	2	0	1	74940.5	0
11	10	15592389	H?	684	France	Male	27	2	134603.88	1	1	1	71725.73	0
12	11	15767821	Bearce	528	France	Male	31	6	102016.72	2	0	0	80181.12	0
13	12	15737173	Andrews	497	Spain	Male	24	3	0	2	1	0	76390.01	0
14	13	15632264	Kay	476	France	Female	34	10	0	2	1	0	26260.98	0
15	14	15691483	Chin	549	France	Female	25	5	0	2	0	0	190857.79	0
16	15	15600882	Scott	635	Spain	Female	35	7	0	2	1	1	65951.65	0
17	16	15643966	Goforth	616	Germany	Male	45	3	143129.41	2	0	1	64327.26	0
18	17	15737452	Romeo	653	Germany	Male	58	1	132602.88	1	1	0	5097.67	1
19	18	15788218	Henderson	549	Spain	Female	24	9	0	2	1	1	14406.41	0
20	19	15661507	Muldrow	587	Spain	Male	45	6	0	1	0	0	158684.81	0
21	20	15568982	Hao	726	France	Female	24	6	0	2	1	1	54724.03	0
22	21	15577657	McDonald	732	France	Male	41	8	0	2	1	1	170886.17	0
23	22	15597945	Dellucci	636	Spain	Female	32	8	0	2	1	0	138555.46	0
24	23	15699309	Gerasimov	510	Spain	Female	38	4	0	1	1	0	118913.53	1
25	24	15725737	Mosman	669	France	Male	46	3	0	2	0	1	8487.75	0
26	25	15625047	Yen	846	France	Female	38	5	0	1	1	1	187616.16	0
27	26	15738191	Maclean	577	France	Male	25	3	0	2	0	1	124508.29	0
28	27	15736816	Young	756	Germany	Male	36	2	136815.64	1	1	1	170041.95	0
29	28	15700772	Nebechi	571	France	Male	44	9	0	2	0	0	38433.35	0
30	29	15728693	McWilliams	574	Germany	Female	43	3	141349.43	1	1	1	100187.43	0
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35	34	15659428	Maggard	520	Spain	Female	42	6	0	2	1	1	34410.55	0
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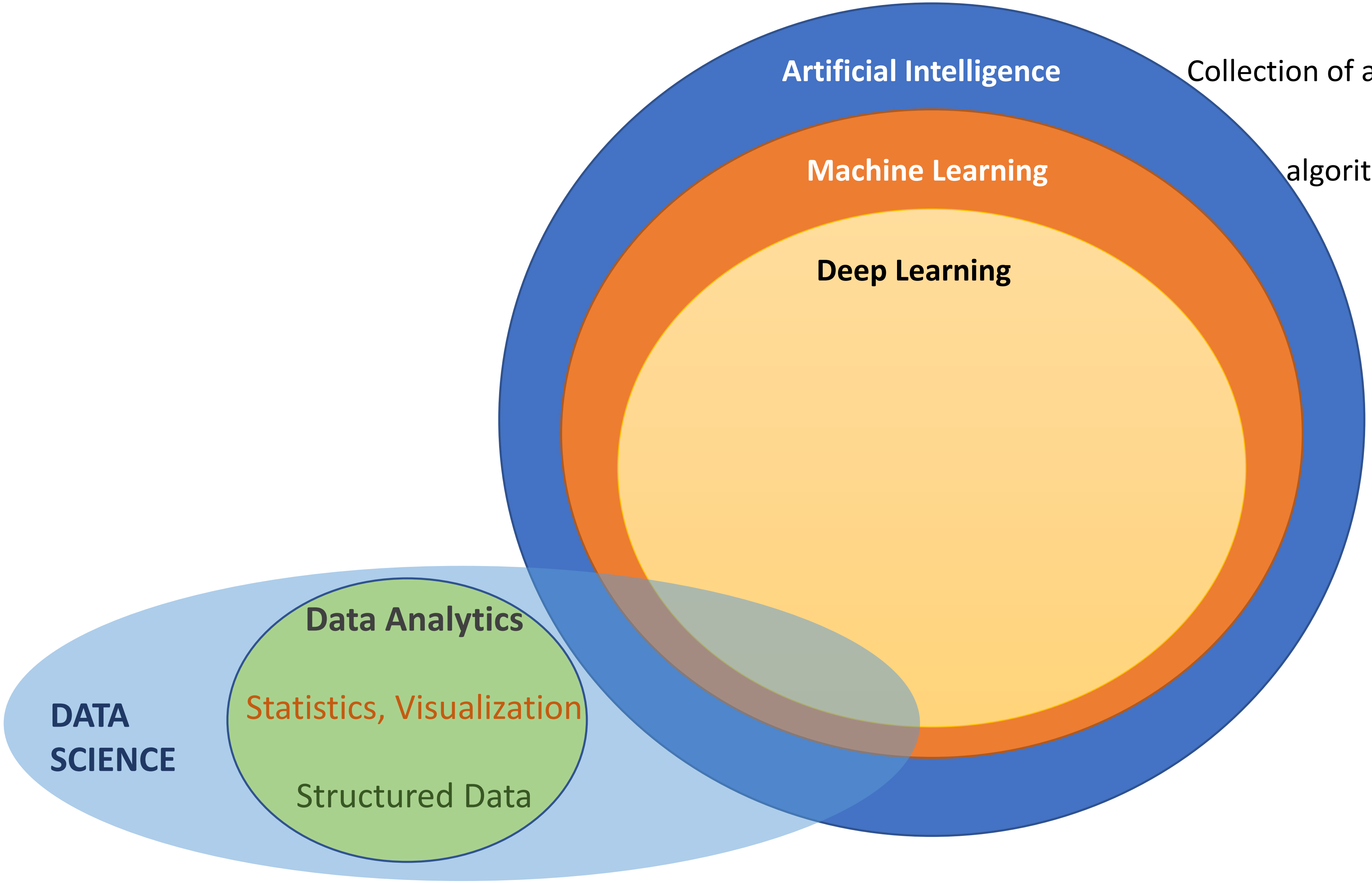
AI Landscape



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algorithms which use DATA to build intelligence

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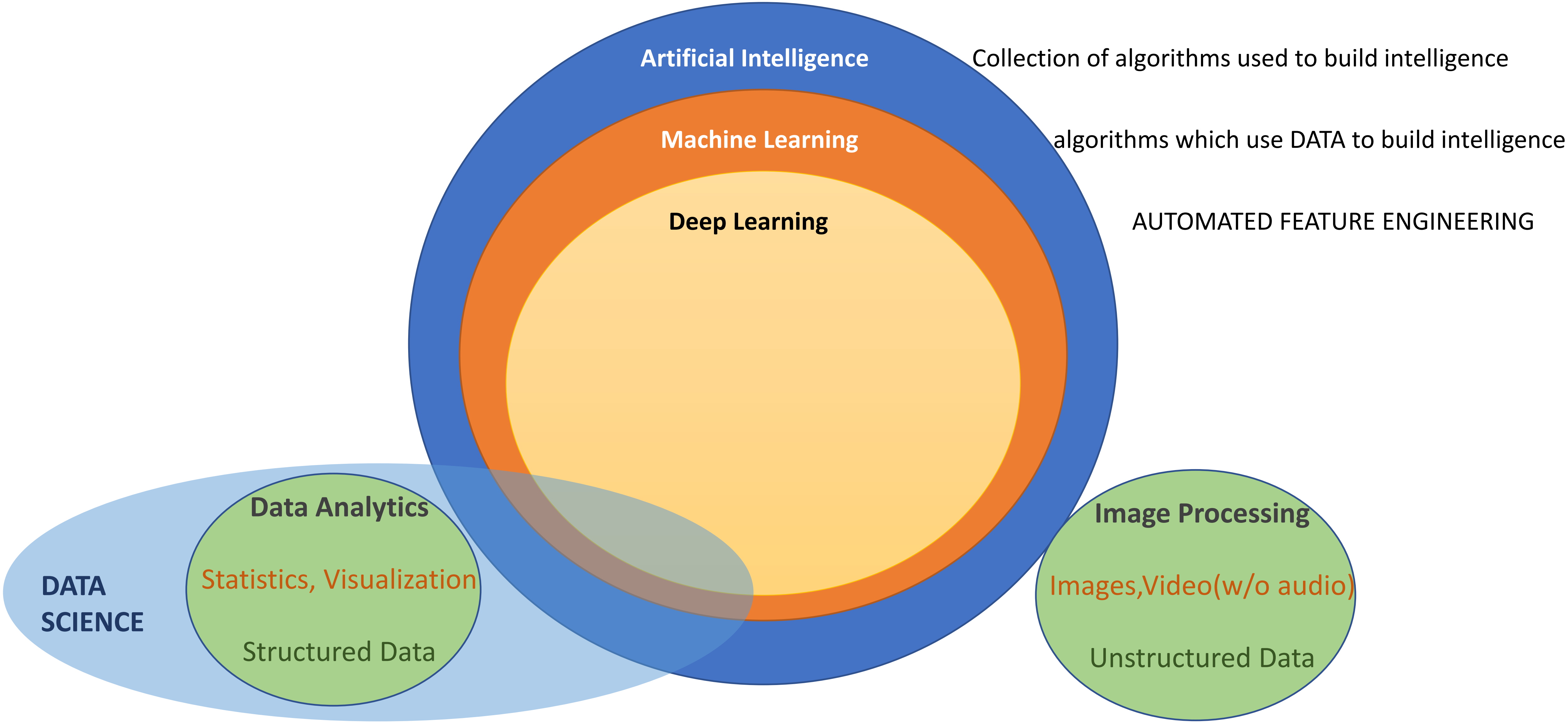

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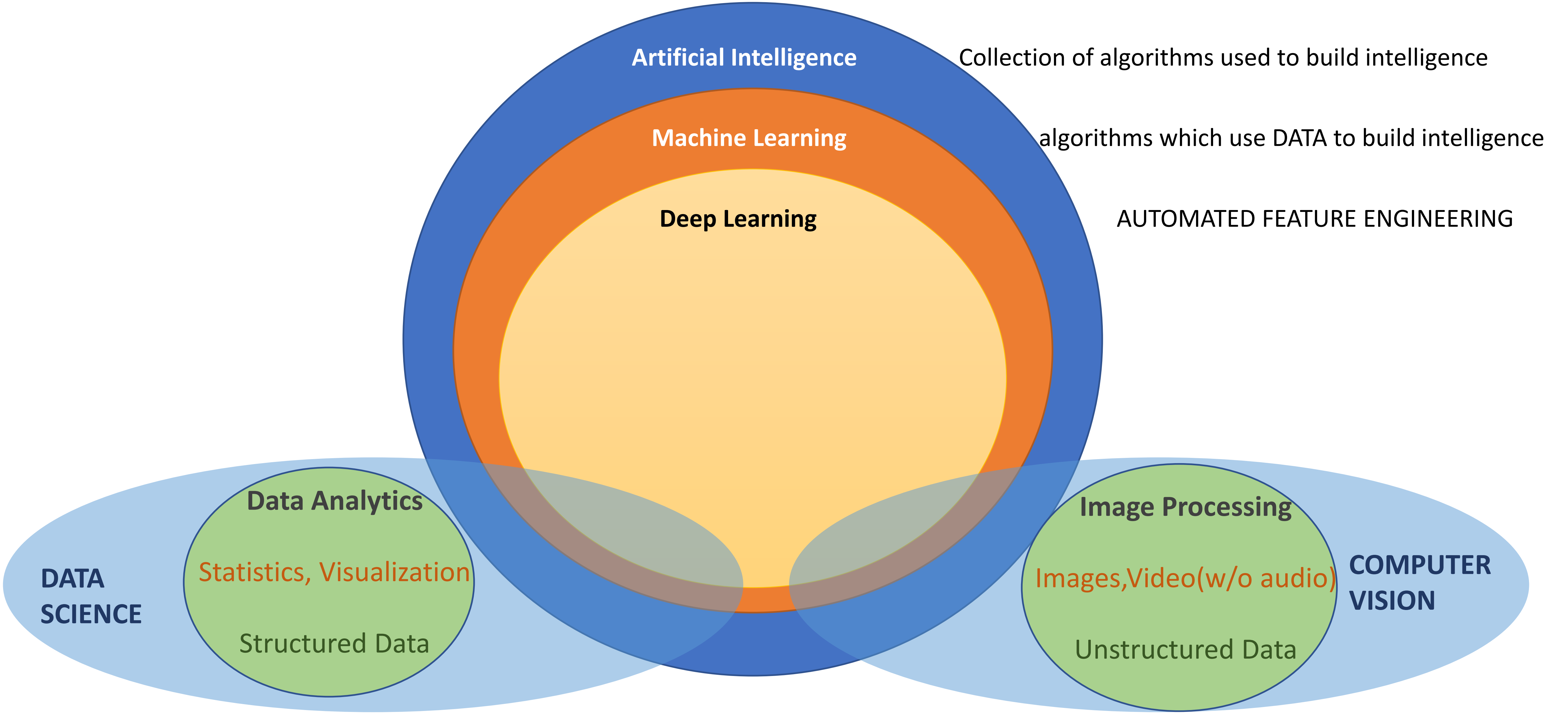

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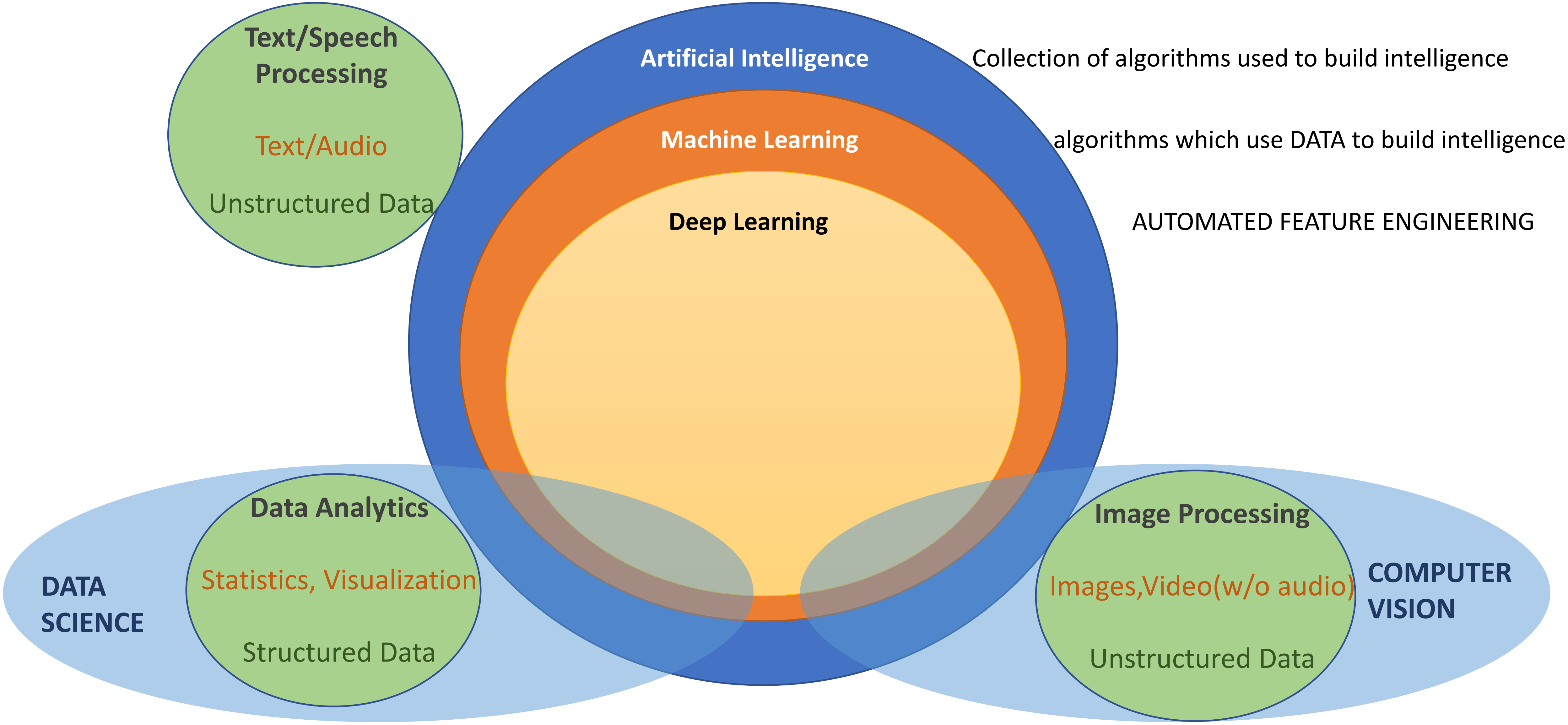

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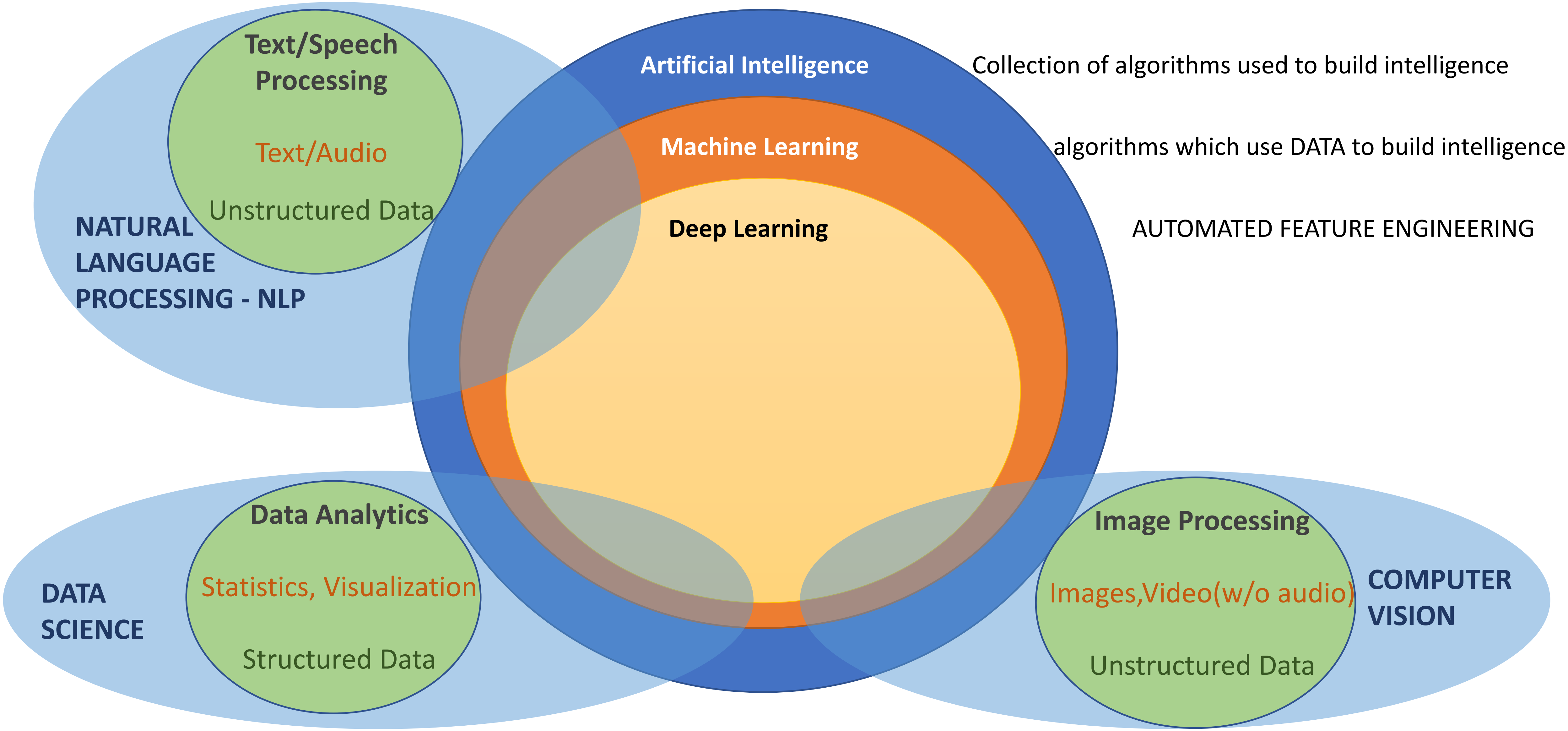
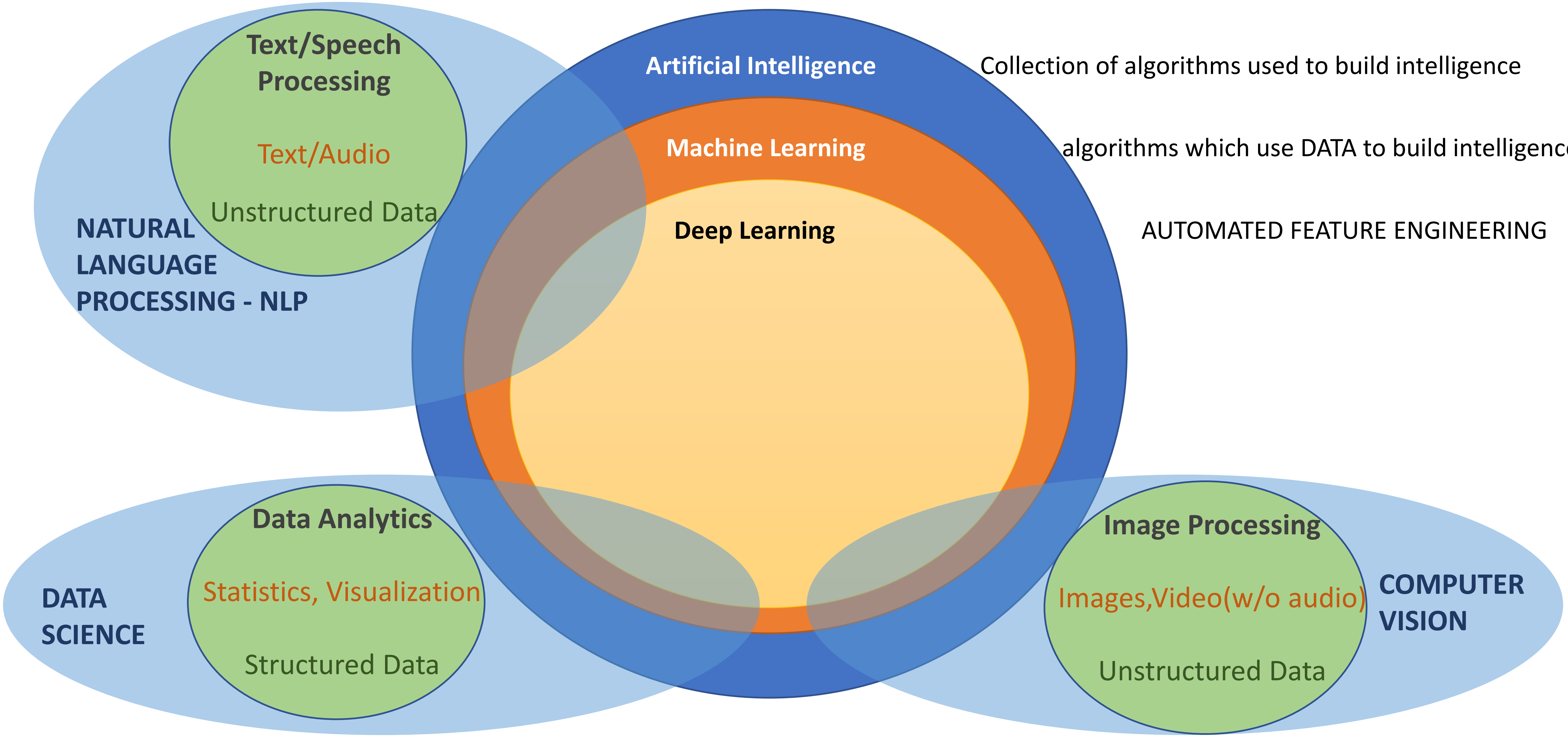


AI Landscape



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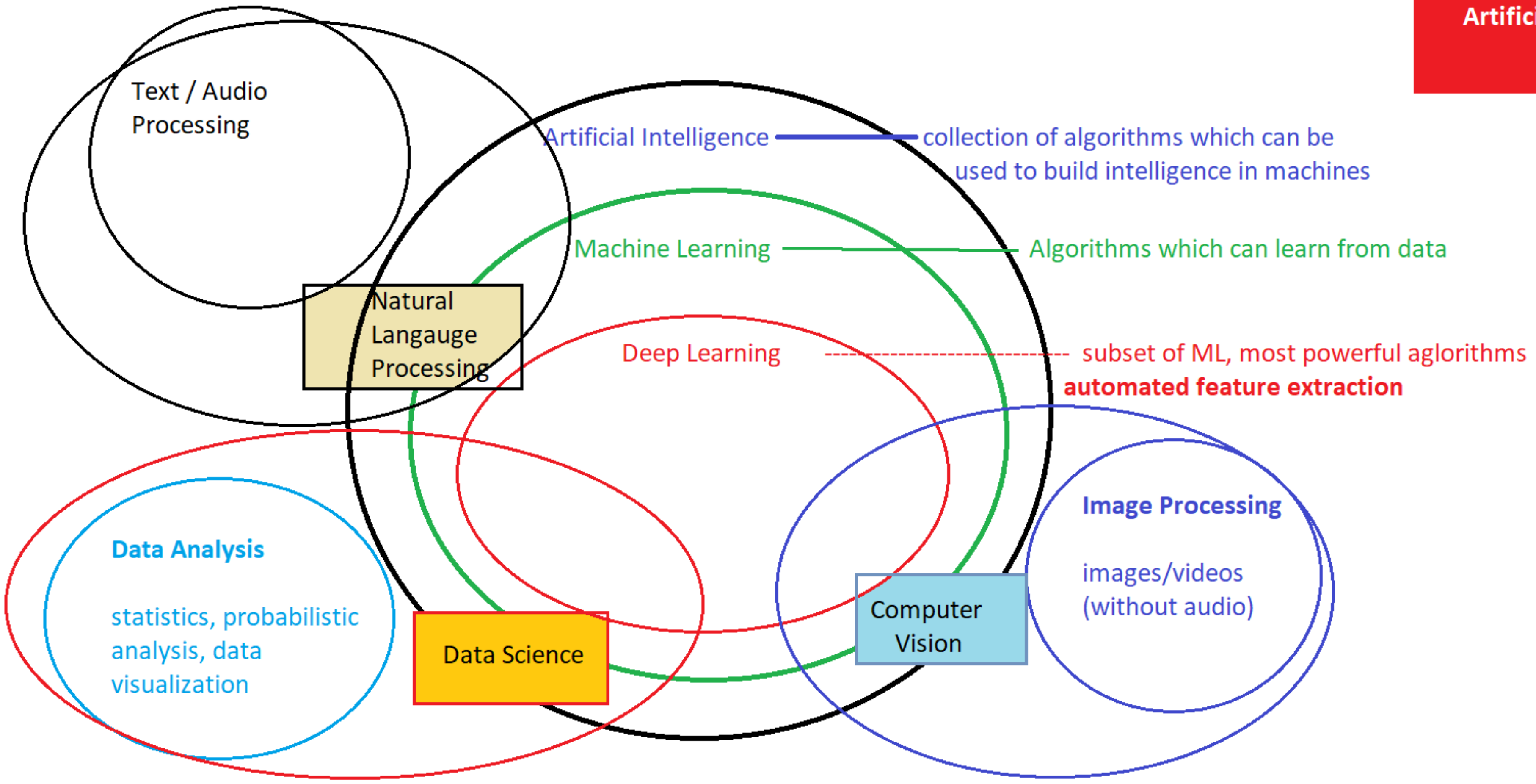
AUTOMATED FEATURE ENGINEERING

AI Stack

Artificial Intelligence Stack



Artificial Intelligence

Data Science

Computer Vision

Natural Language Processing

Artificial Intelligence

Data Science

Computer Vision

Natural Language Processing

- Predicting Stock prices, housing prices or any other item prices based on historical data
- Predicting whether customer will buy a product or not, customer will churn or not
- Classifying the customers in different known groups
- Risk predictions for financial transactions.
- Fraud Detection from transactional data
- Segmentation of customers, stocks and server logs
- Predicting patient readmission into hospital
- Detecting anomalies in access management, data control
- Building product recommendation systems

Artificial Intelligence

- Data Science
- **Computer Vision**
- Natural Language Processing

- Face Recognition, Emotion Recognition
- Optical Character Recognition
- Document verification, authentication
- Object Detection and Classification from images
- Identifying forgery in the images
- Vehicle number plate, type recognition
- Self Driving Cars – lane detection, traffic sign classification, Behavioural Cloning
- Motion Detection from videos
- Image restoration, colouring and pattern transfer
- Action Prediction

Artificial Intelligence

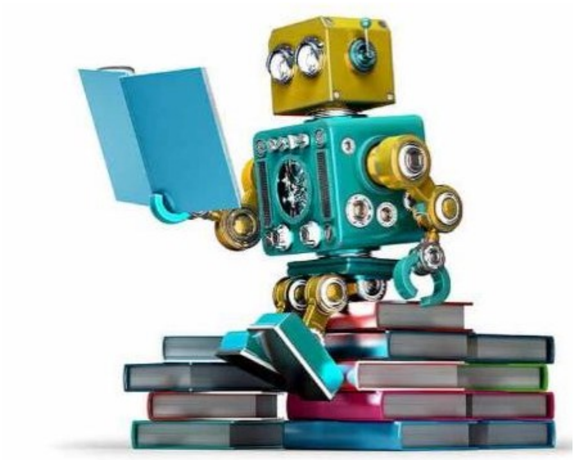
Data Science

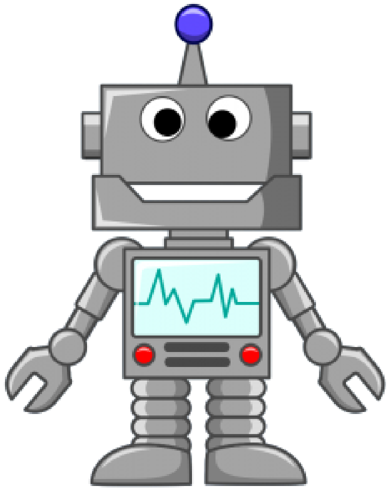
Computer Vision

Natural Language Processing

- Text/document classification
- Social Media Text mining and Analysis
- Speech to Text and Text to Speech conversion
- Caption generation
- Machine Translation
- Sentiment analysis from text
- Chatbots
- Speaker recognition
- Personal Assistant, Sentence Correction
- Text Generation, Similarity Matching, Topic Modelling


AN INTRODUCTION TO
MACHINE LEARNING





“

Machine learning is a field of computer science that gives computers the ability to learn without being explicitly programmed.

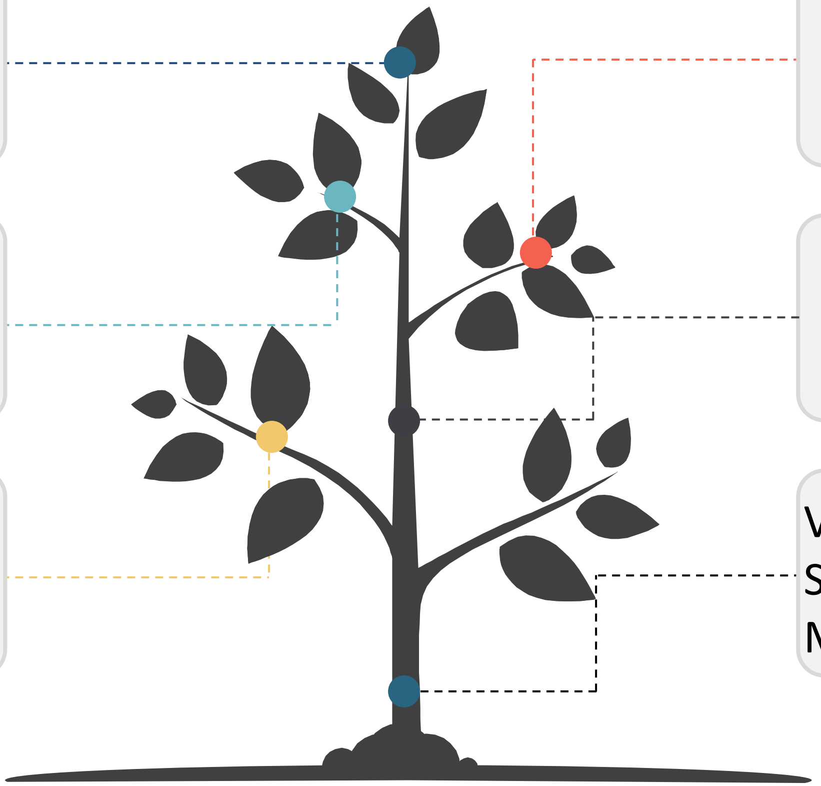
—Arthur Samuel, 1959

Applications of Machine Learning

Financial Predictions,
Fraud Detections
Loan Approval

Predictive Maintenance
Ad plus user information

Churn Prediction,
Customer Segmentation,
Sales Forecasting



Data Mining – Web Click Data, Medical Records, Diagnosis

Computer Vision – Face Recognition, Self Driving Cars, OCR

Voice recognition, Chatbots, Sentiment Analysis, Machine Translation

What Machine Learning Can Do

A simple way to think about supervised learning.

INPUT A	RESPONSE B	APPLICATION
Picture	Are there human faces? (0 or 1)	Photo tagging
Loan application	Will they repay the loan? (0 or 1)	Loan approvals
Ad plus user information	Will user click on ad? (0 or 1)	Targeted online ads
Audio clip	Transcript of audio clip	Speech recognition
English sentence	French sentence	Language translation
Sensors from hard disk, plane engine, etc.	Is it about to fail?	Preventive maintenance
Car camera and other sensors	Position of other cars	Self-driving cars

Source – ANDREW NG

Point your camera at the menu during your next trip to Taiwan and the restaurant's selections will magically appear in English via the Google Translate app.

Google Translate overlaying English translations on a drink menu in real time using convolutional neural networks.

Manufacturing	Retail	Financial Services
Predictive maintenance or condition monitoring Warranty reserve estimation Propensity to buy Demand forecasting Process optimization Telematics	Predictive inventory planning Recommendation engines Upsell and cross-channel marketing Market segmentation and targeting Customer ROI and lifetime value	Risk Analytics and Regulations Customer Segmentation Cross-selling and up-selling Sales and marketing campaign management Credit worthiness evaluation

Travel and Hospitability	Health Care and Life Sciences	Energy, Feedstock and Utility
Aircraft scheduling Dynamic pricing Social media — consumer feedback and interaction analysis Customer complaint resolution Traffic patterns and congestion management	Alerts and diagnostics from real-time patient data Disease identification and risk stratification Patient triage optimization Proactive health management Healthcare provider sentiment analysis	Power usage analytics Seismic data processing Carbon emissions and trading Customer-specific pricing Smart grid management Energy demand and supply optimization

Netradyne

Netradyne’s Driveri, a powerful camera that analyses driving patterns and can help determine the cause of an accident. The soap-bar-sized device is attached to a vehicle’s rear-view mirror and rests on the inside of the windscreen, pointing towards the road.

Programming Languages -

Python	R

Machine Learning Cloud Platforms -

Microsoft Azure ML Studio
https://azure.microsoft.com/en-us/services/machine-learning-studio/

Amazon Machine Learning
https://aws.amazon.com/aml/

SAP Leonardo Machine Learning
https://www.sap.com/india/products/leonardo/machine-learning.html

Google ML Platform
https://cloud.google.com/products/machine-learning/

IBM Machine Learning
https://www.ibm.com/analytics/data-science/machine-learning

What to learn in machine Learning?

Programming
and
Tools

Python/R, spark etc.

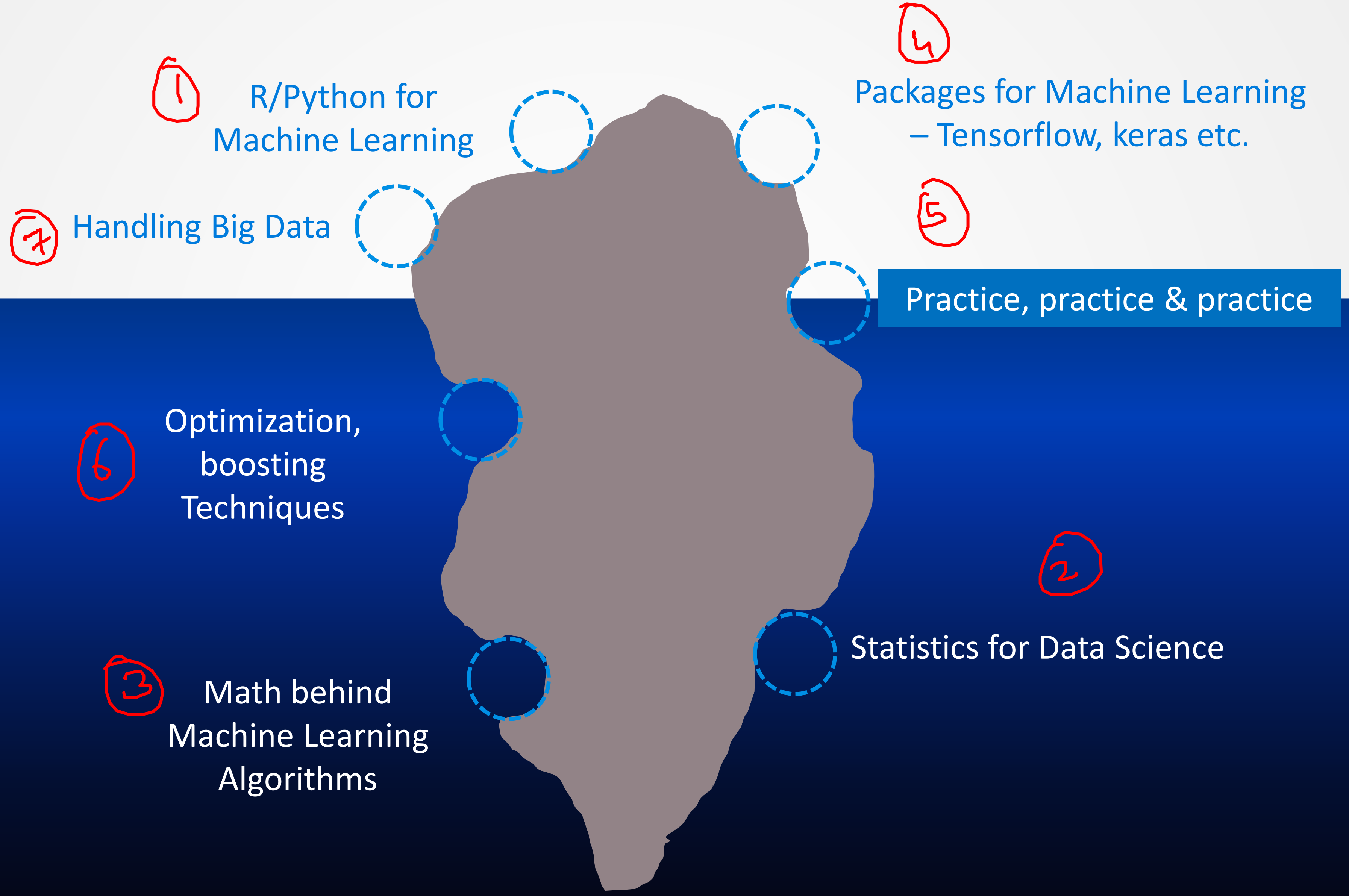
30%

The Math
behind
Machine
Learning

Probabilistic
Theory, Statistics
and Linear Algebra

70%

What to learn in Machine Learning?



Machine Learning Techniques

Anshu Pandey

Supervised Learning	Unsupervised Learning	Reinforcement Learning
Learning with a labeled training set. Email spam detector with training set of already labeled emails.	Discovering patterns in unlabeled data. Cluster similar documents based on the text content.	Learning based on feedback or reward. Learn to play chess by winning or losing.

Supervised Learning

- We know what we are trying to predict. We use some examples that we (and the model) know the answer to, to “train” our model. It can then generate predictions to examples we don’t know the answer to.

- Examples: Predict the price a house will sell at. Identify the gender of someone based on a photograph.

Unsupervised Learning

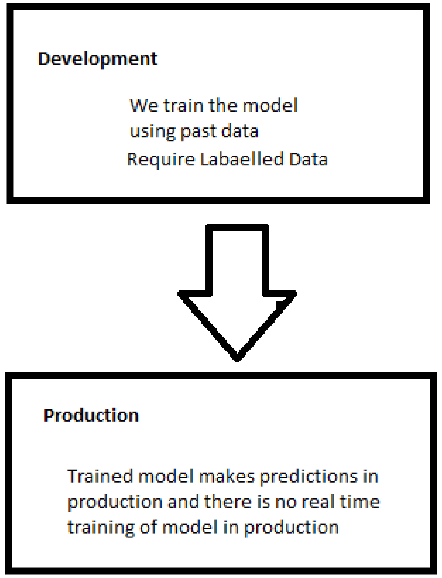
- We don't know what we are trying to predict. We are trying to identify some naturally occurring patterns in the data which may be informative.

- Examples: Try to identify "clusters" of customers based on data we have on them

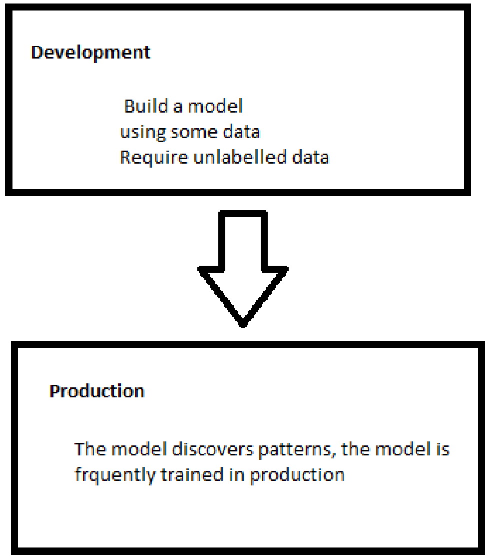
Supervised Learning

Unsupervised Learning

Supervised and Unsupervised Learning



Supervised Learning



Unsupervised Learning

Bank Churn Prediction

Two class classification problem

New Customer
- 0 - Not Leave the bank
- 1 - leave the bank

Oct 2019 - accuracy = 95%

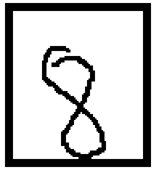
oct 2020 - accuracy = 70%

Development

Deployemeny

Pull Back

Recognizing digits on vehicle number plates



0
1
2
3
.
.
.
8
9

2019 - Accuracy - 95%

2025 - Accuracy - 95%

Development

Deployement

Forget

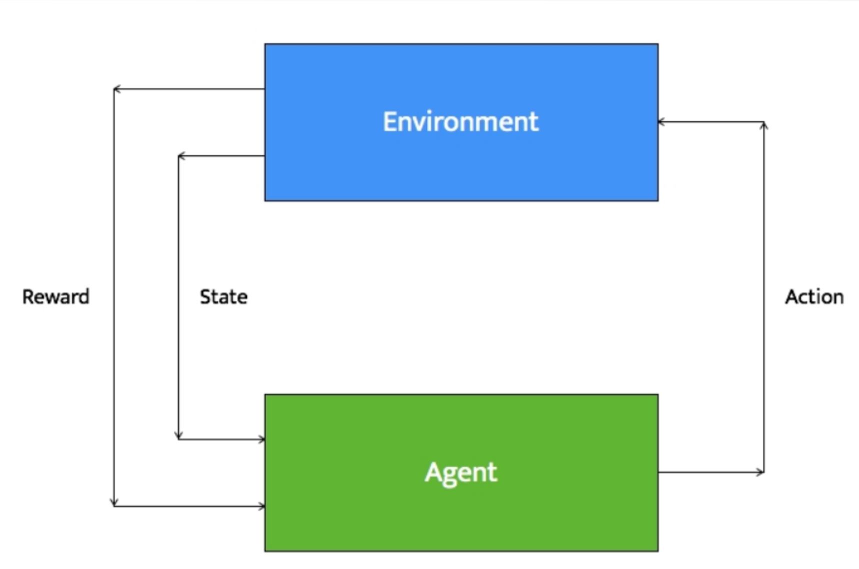
Supervised Learning

Supervised Learning models learn from labelled data, a trained model is deployed in production, but based on the dynamicness of business case, the trained model needs to be pulled back from production, retrained and redeployed.

Reinforcement Learning

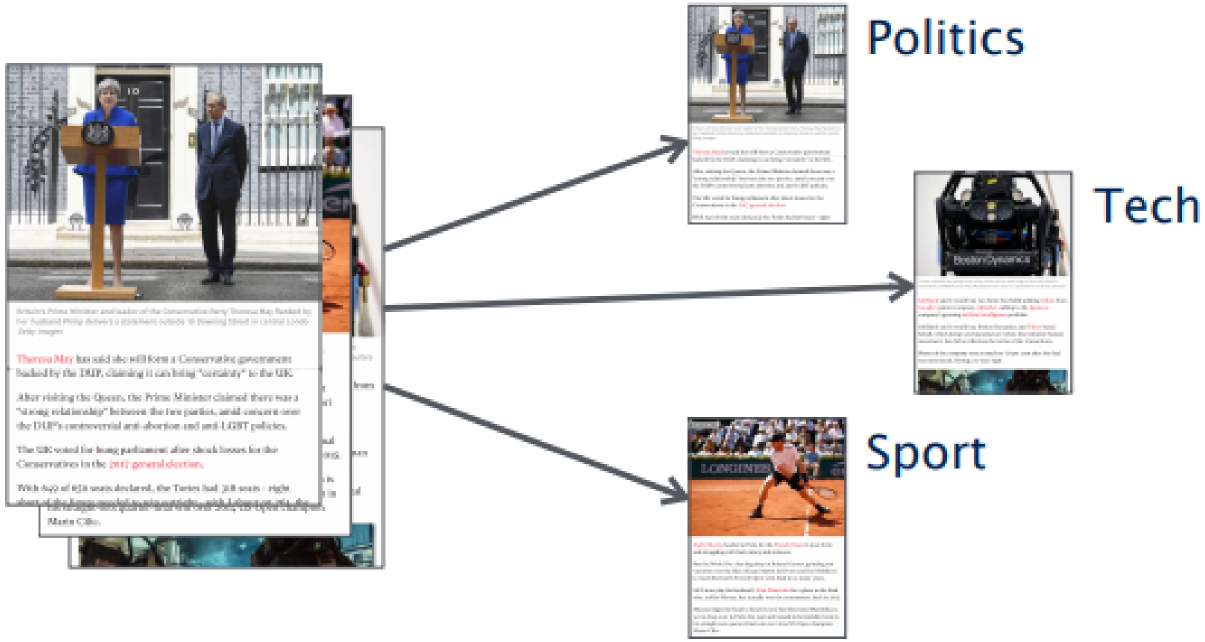
- Reinforcement learning systems can do multiple things simultaneously -- learn by performing a trial and error search, learn the model of the environment it is in, and then use that model to plan the next steps.

- Example: Let's consider a robot whose job is to explore a new building. It has to make sure it has enough power left to come back to the base station. This robot has to decide if it should make decisions by considering the trade off between the amount of information collected and the ability to reach back to base station safely.



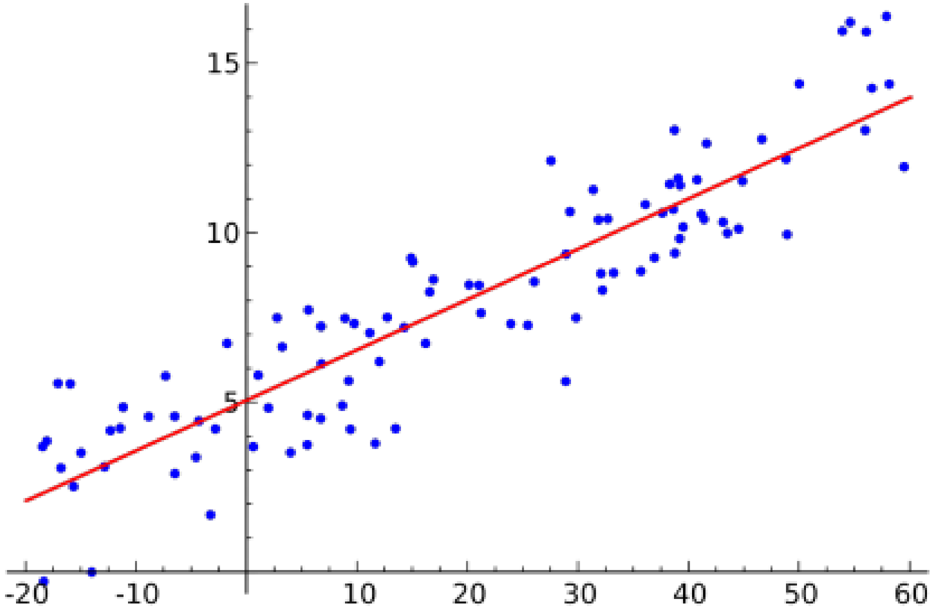
Types of Problems in Machine Learning

Types of Problems in Supervised Machine Learning -



Classification

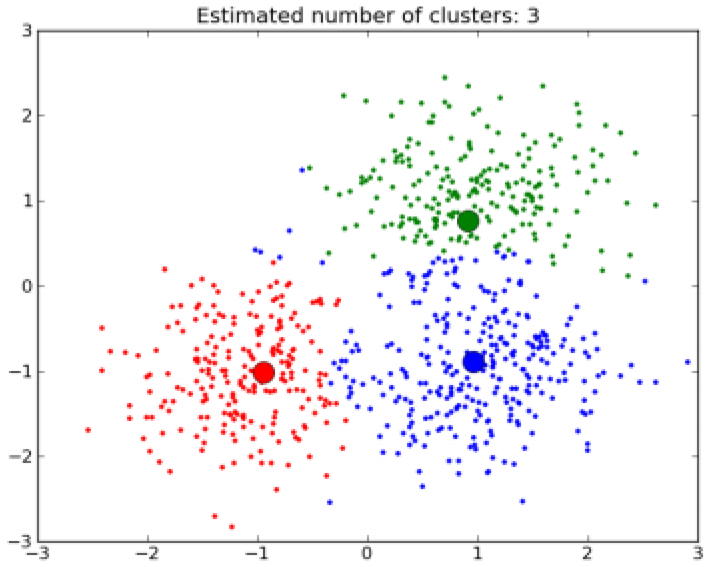
(discrete set of possible outcomes)

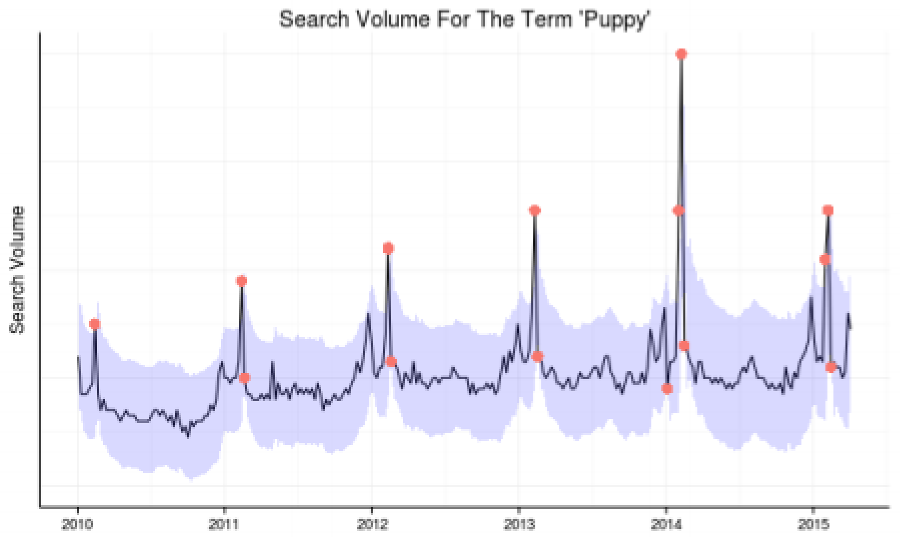


Regression

(possible outcome can by any numerical value with in a particular continuous range)

Types of Problems in Unsupervised Machine Learning -





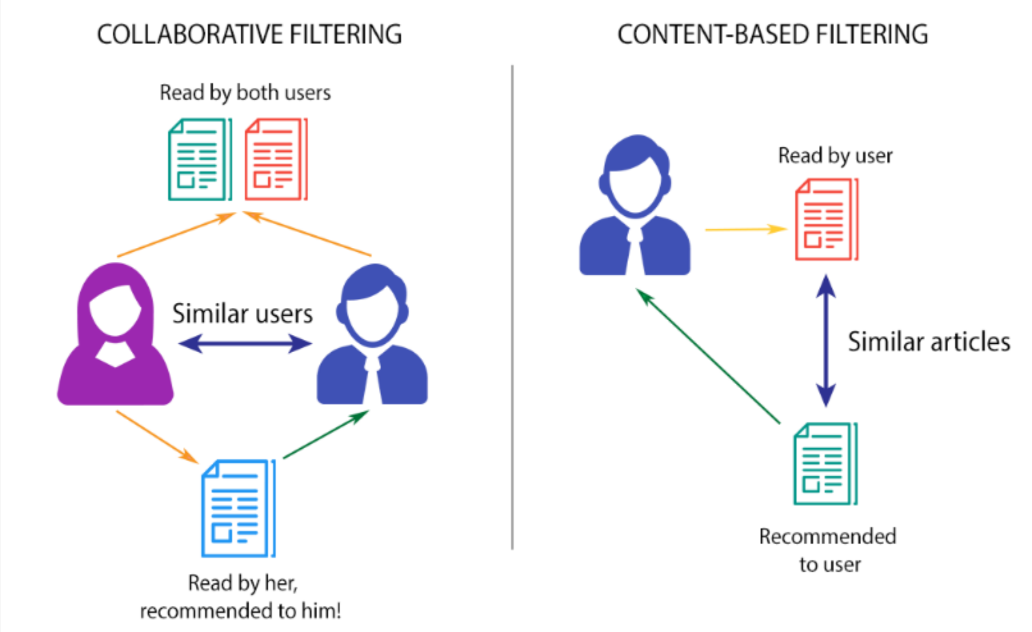
Clustering

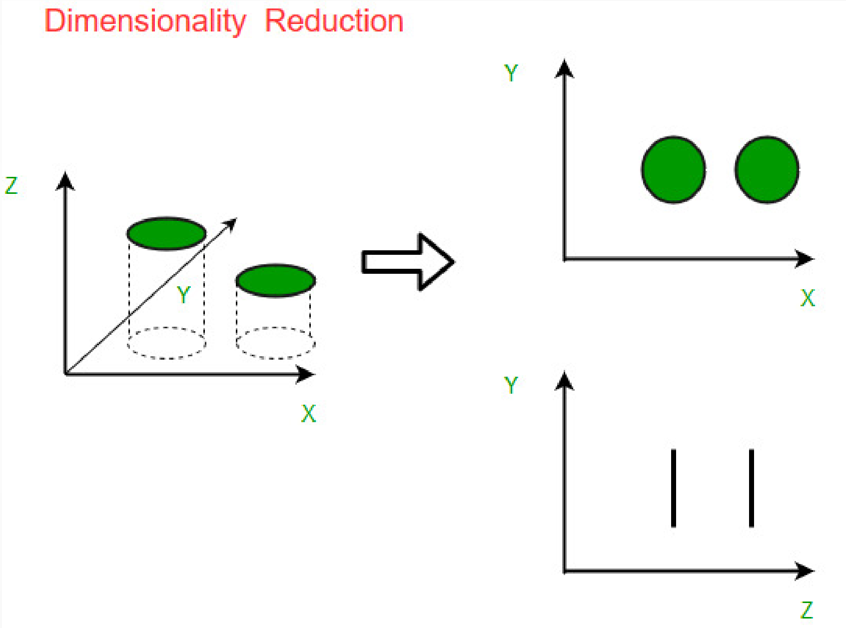
(categorization of samples based on similarity in features)

Anomaly Detection

(detecting an anomaly in a general pattern)

Types of Problems in Unsupervised Machine Learning -

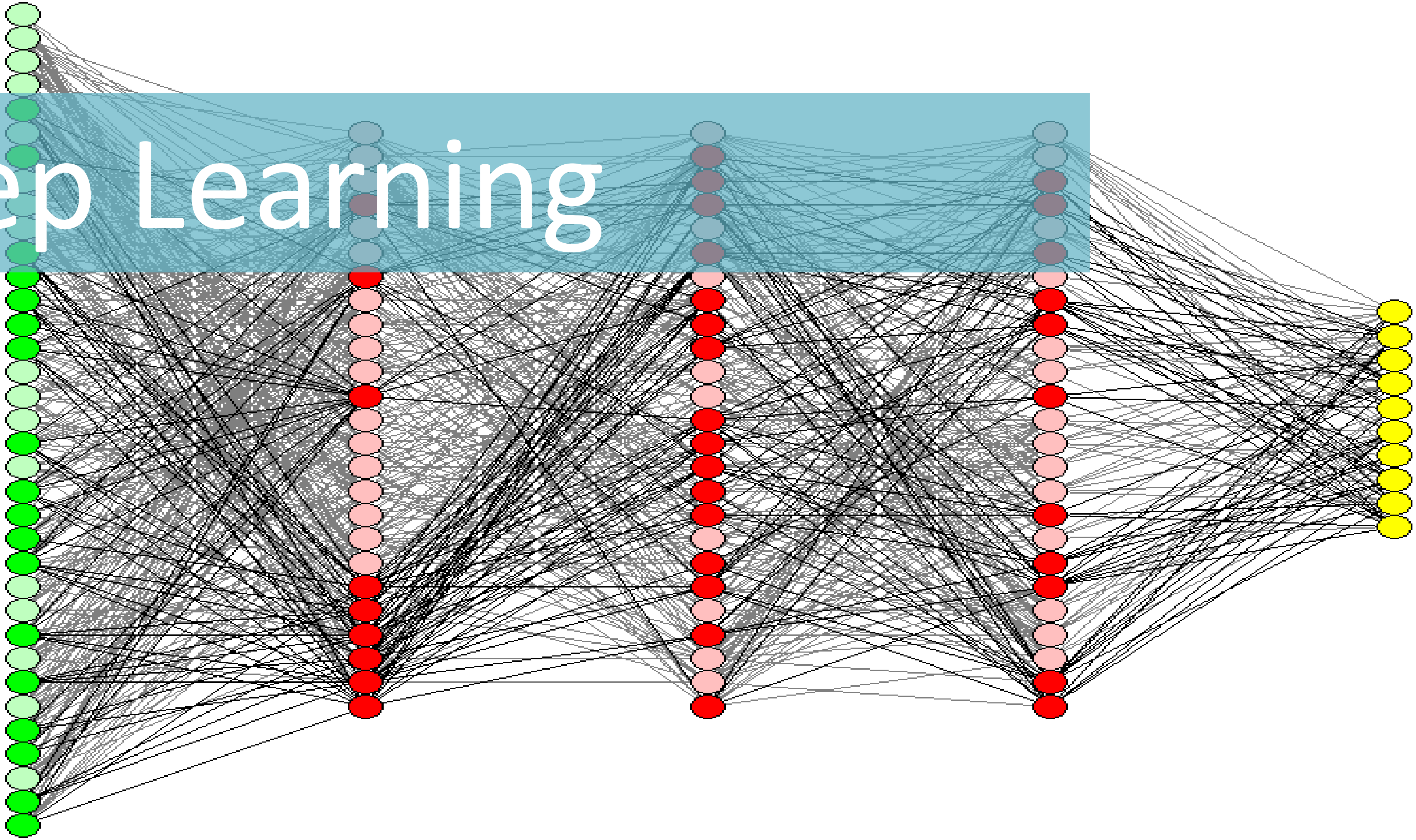




Recommendation Systems
(profiling of users and items and recommending relevant items to user)

Dimensionality Reduction
(Reducing dimensionality/size of data)

Deep Learning



Deep Learning

Deep Learning is part of the machine learning field of learning representations of data. Exceptional effective at learning patterns.

Deep Learning in one slide

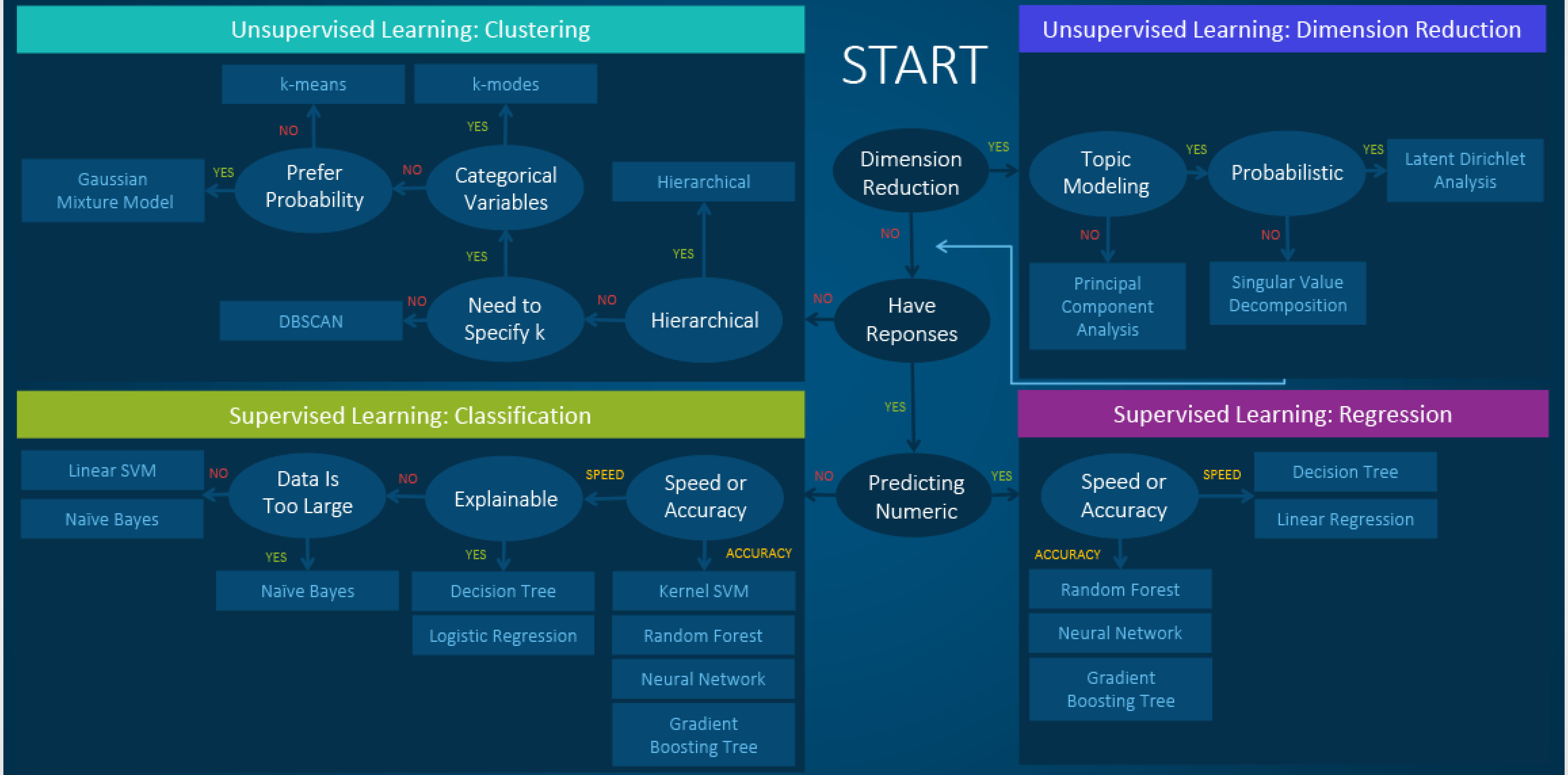
- **What is it:**
  Extract useful patterns from data.
- **How:**
  Neural network + optimization
- **How (Practical):**
  Python + TensorFlow & friends
- **Hard Part:**
  Good Questions + Good Data
- **Why now:**
  Data, hardware, community, tools, investment
- **Where do we stand?**
  Most big questions of intelligence have not been answered nor properly formulated

- **Exciting progress:**
- Face recognition
- Image classification
- Speech recognition
- Text to speech generation
- Handwriting transcription
- Machine translation
- Medical diagnosis
- Cars: drivable area, lane keeping
- Digital assistants
- Ads, search, social recommendations
- Game playing with deep RL

What we can't do with Deep Learning?

- Mirrors
- Sparse information
- 3D Structure
- Physics
- What's on peoples' minds?
- What happens next?
- Humor

Machine Learning Algorithms Cheat Sheet



Happy Learning!

Stay Tuned for next exciting sessions on diving deeper into Supervised Learning