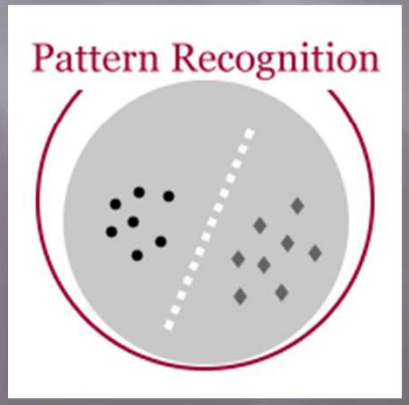
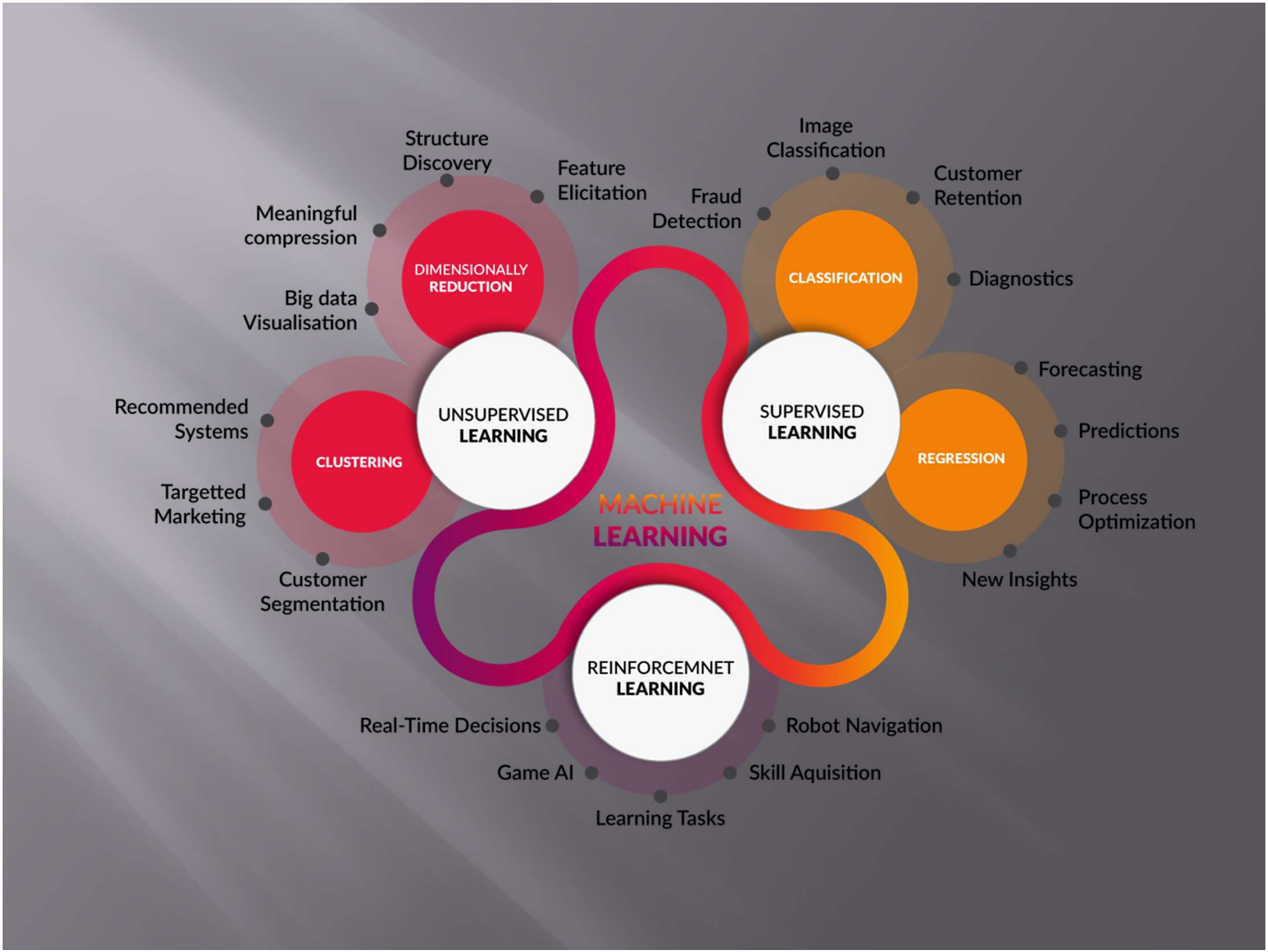
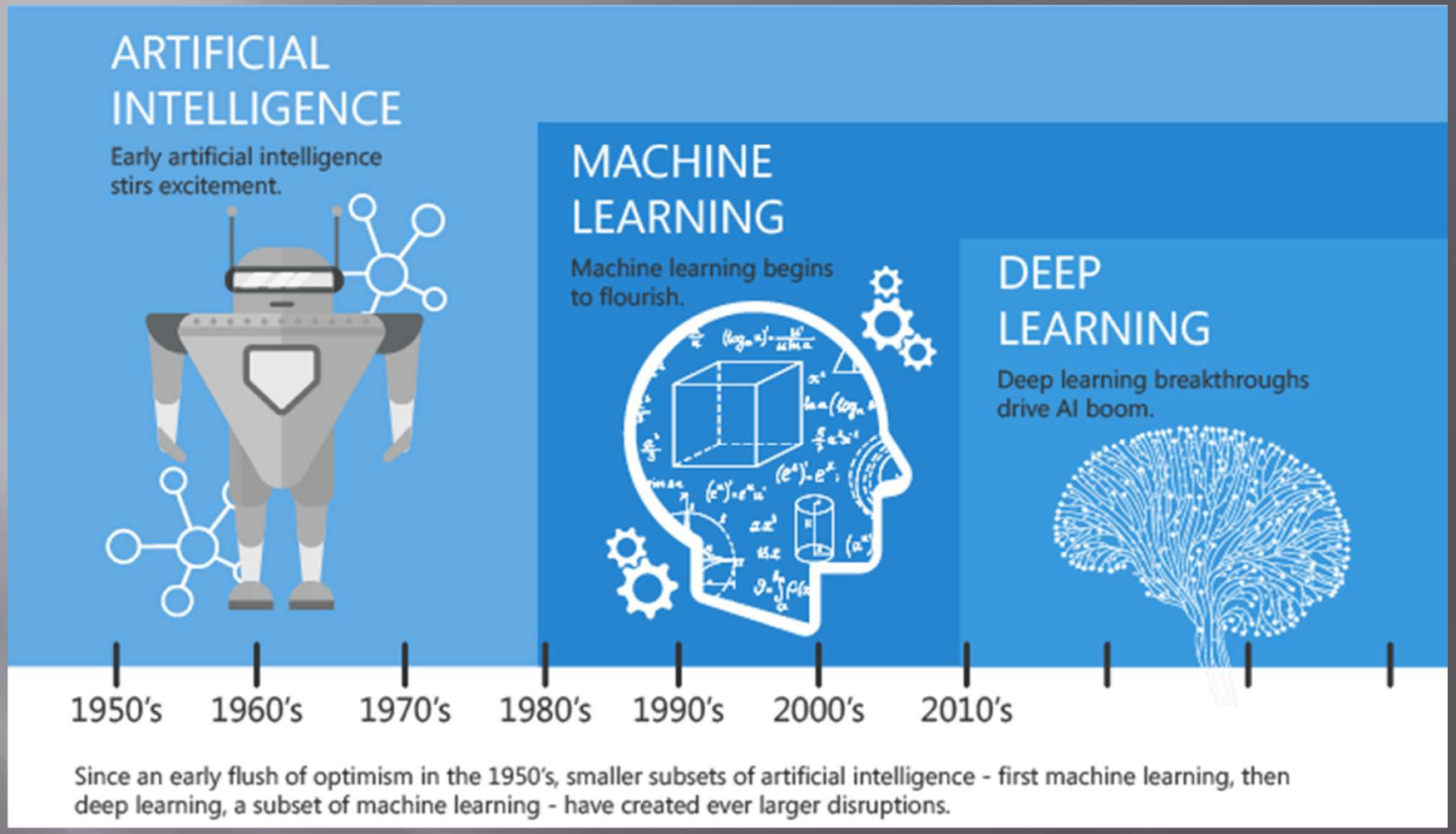
WHAT IS MACHINE LEARNING?



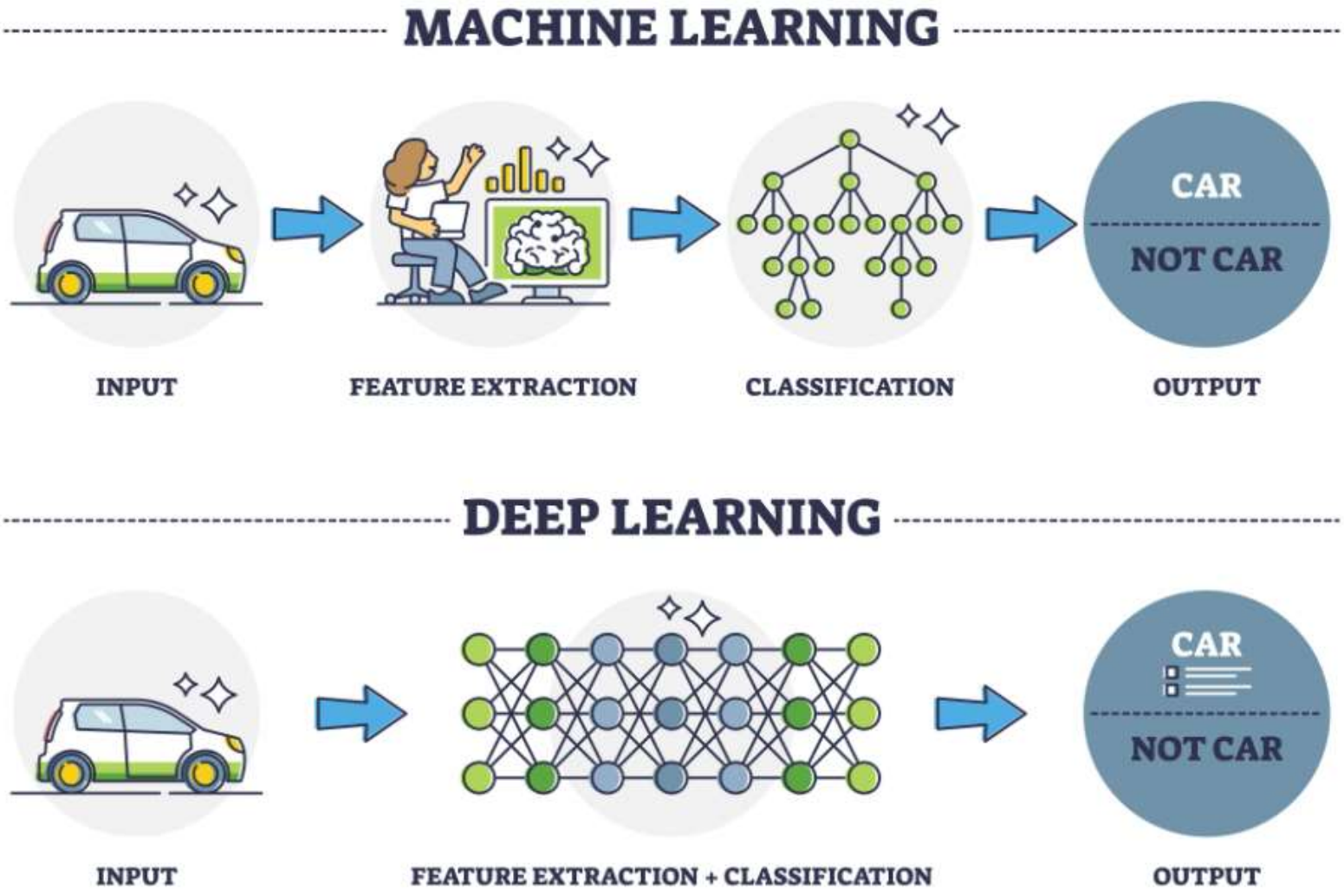
WHAT IS PATTERN RECOGNITION?

When the monster came, Lola, like the peppered moth and the arctic hare, remained motionless and undetected. Harold, of course, was immediately devoured.

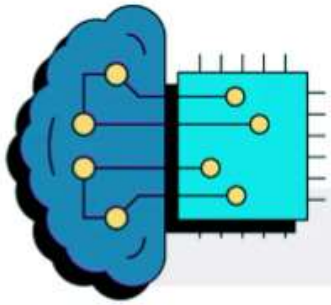

MACHINE LEARNING
UNSUPERVISED LEARNING
DIMENSIONALLY REDUCTION
Structure Discovery
Feature Elicitation
Meaningful compression
Big data Visualisation
CLUSTERING
Recommended Systems
Targetted Marketing
Customer Segmentation
SUPERVISED LEARNING
CLASSIFICATION
Image Classification
Customer Retention
Fraud Detection
Diagnostics
REGRESSION
Forecasting
Predictions
Process Optimization
New Insights
REINFORCEMNET LEARNING
Real-Time Decisions
Robot Navigation
Game AI
Skill Aquisition
Learning Tasks


ARTIFICIAL INTELLIGENCE
Early artificial intelligence stirs excitement.
MACHINE LEARNING
Machine learning begins to flourish.
DEEP LEARNING
Deep learning breakthroughs drive AI boom.
1950's
1960's
1970's
1980's
1990's
2000's
2010's
Since an early flush of optimism in the 1950's, smaller subsets of artificial intelligence - first machine learning, then deep learning, a subset of machine learning - have created ever larger disruptions.

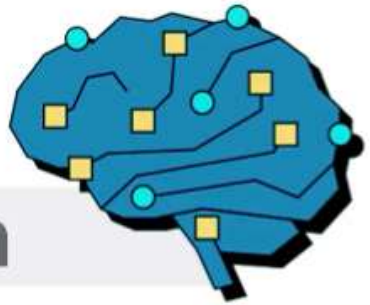
What is Deep Learning?



Deep learning vs machine learning



Key Differentiation



Machine Learning	Factors	Deep Learning
Manual Extraction	Problem-Solving Approach	Minimal Human Intervention
Supervised & Reinforcement Learning	Training Methods	Autoencoders & Generative Adversarial Networks
Diverse Models	Complexity of Algorithms	Interconnected Neurons
Relies on Structured Data	Interpretability	Leverages Artificial Neural Networks
Distributed Across a Server Cluster	Infrastructure & Data	Reliance on Larger Datasets

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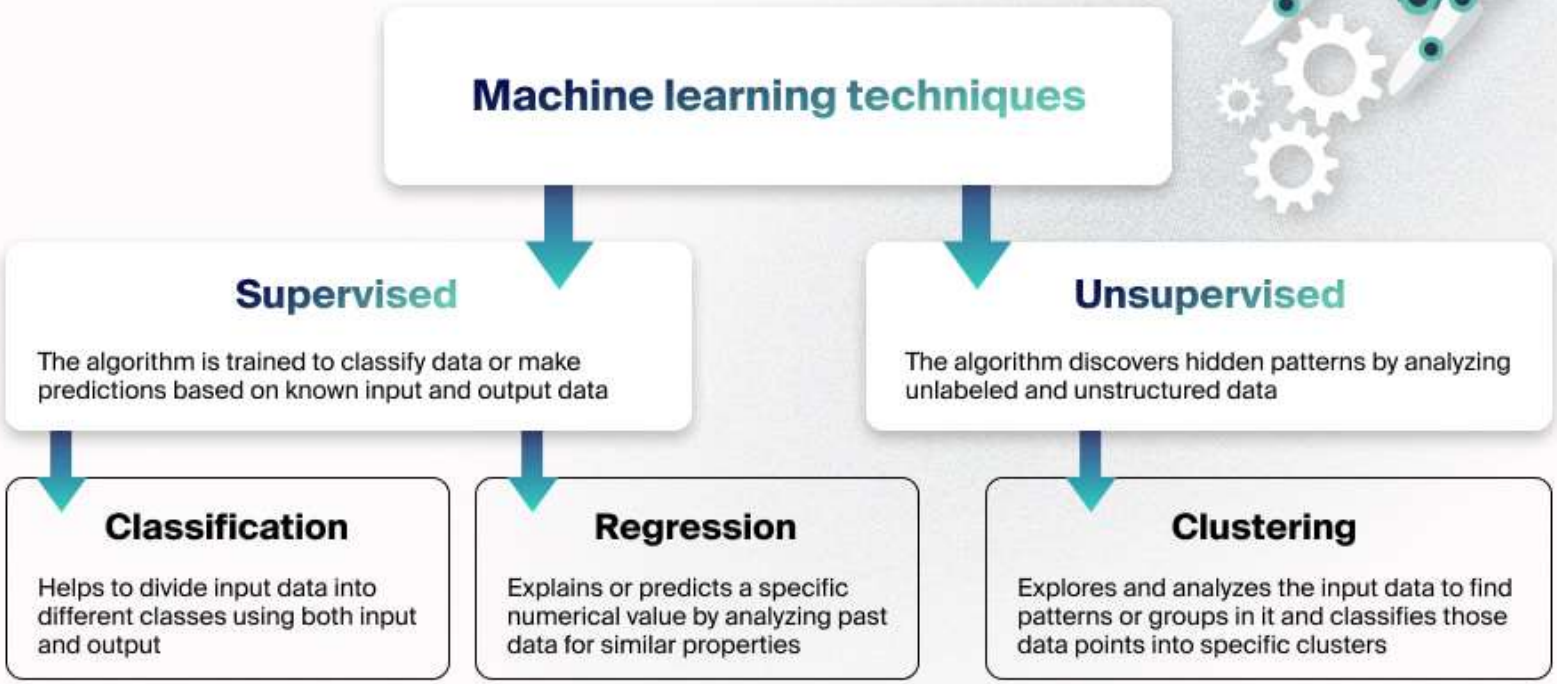
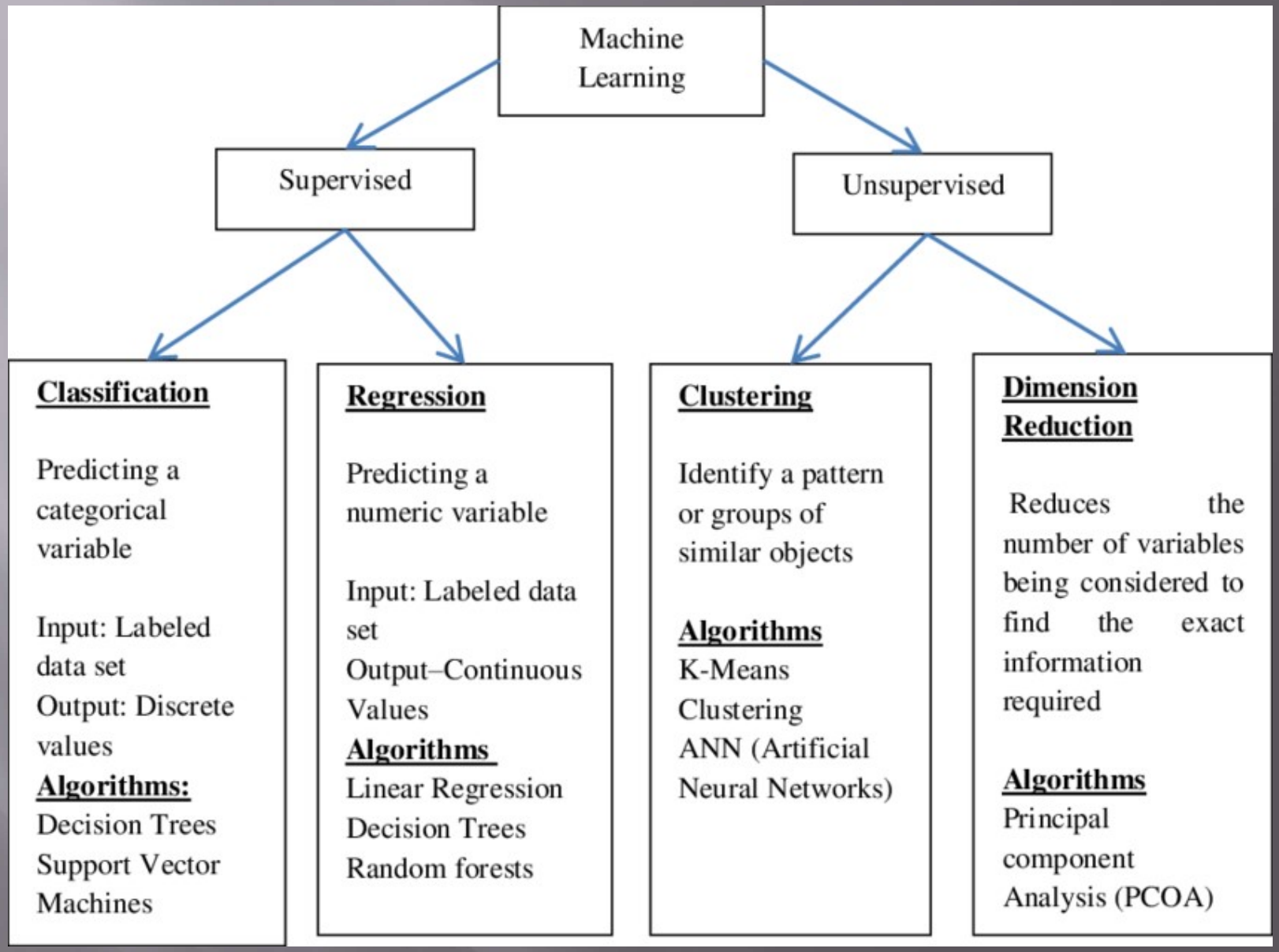
Machine learning **techniques**



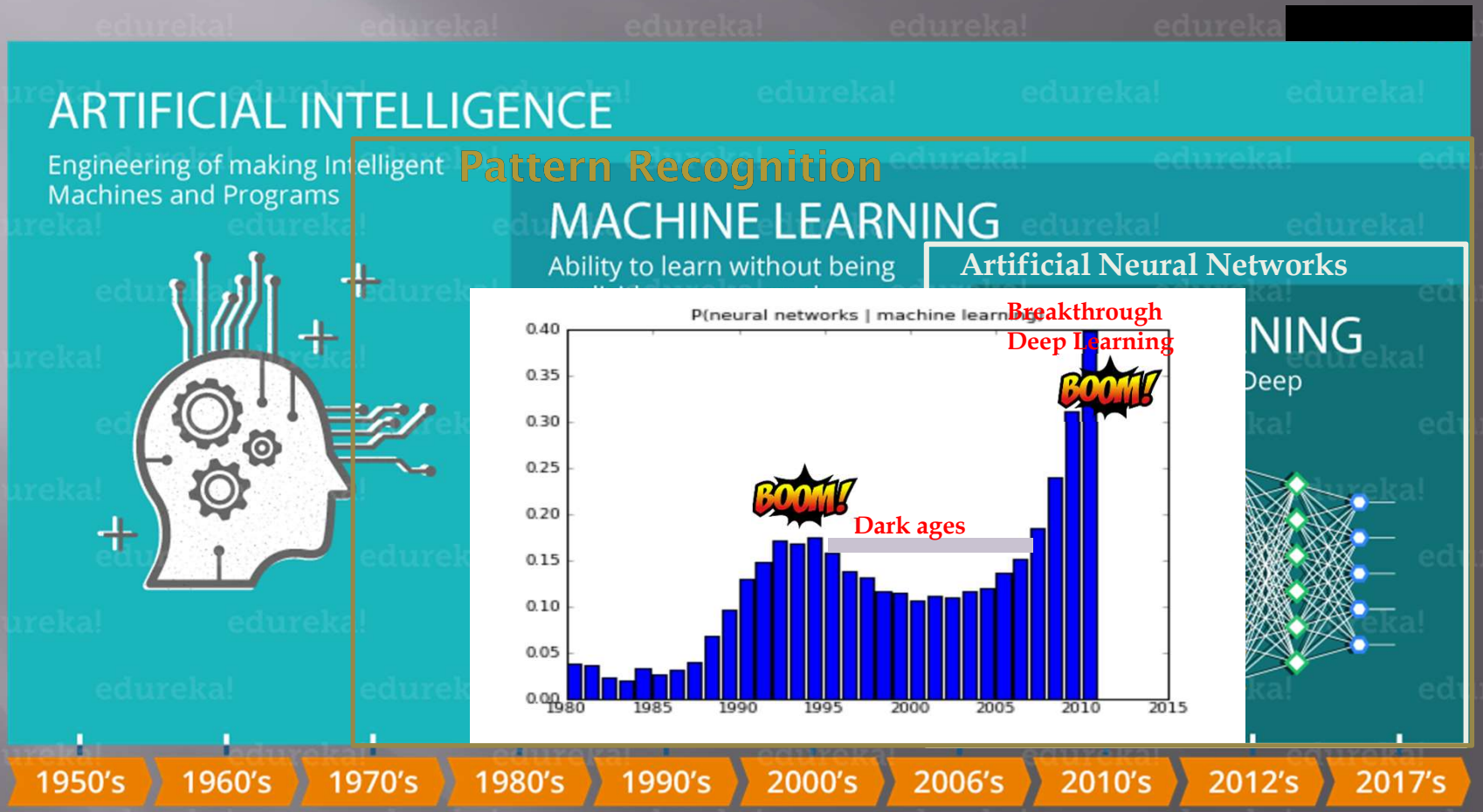

Machine Learning
Supervised
Unsupervised
Classification
Predicting a categorical variable
Input: Labeled data set
Output: Discrete values
Algorithms:
Decision Trees
Support Vector Machines
Regression
Predicting a numeric variable
Input: Labeled data set
Output–Continuous Values
Algorithms
Linear Regression
Decision Trees
Random forests
Clustering
Identify a pattern or groups of similar objects
Algorithms
K-Means Clustering
ANN (Artificial Neural Networks)
Dimension Reduction
Reduces the number of variables being considered to find the exact information required
Algorithms
Principal component Analysis (PCOA)

Common **machine learning algorithms** and their use cases

pixelplex

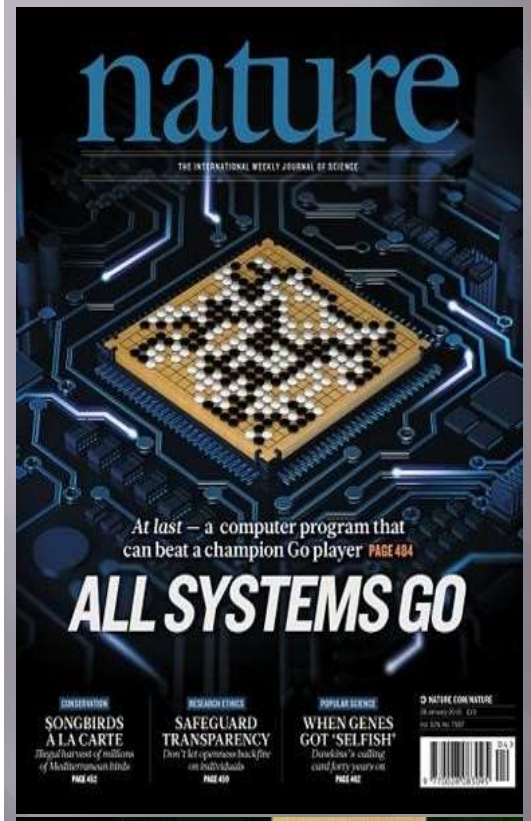
	SVM	NAIVE BAYES	LINEAR REGRESSION	NEURAL NETWORKS	K-MEANS
Type of ML technique	Classification	Classification	Regression	Regression, clustering	Clustering
Use cases	• Data classification • Facial expression classification • Text classification • Speech recognition • Handwriting recognition • Cancer detection and diagnosis	• Spam filtering • Document classification • Supply chain stock management	• Sales forecasting • Investment evaluation • Stock price forecasting • Real estate price analysis and prediction	• Google search algorithm • Fraud detection • Virtual assistant services • Financial risk assessment • Machine translation	• Customer segmentation • Document clustering • Recommendation systems • Clustering social networks users by various parameters

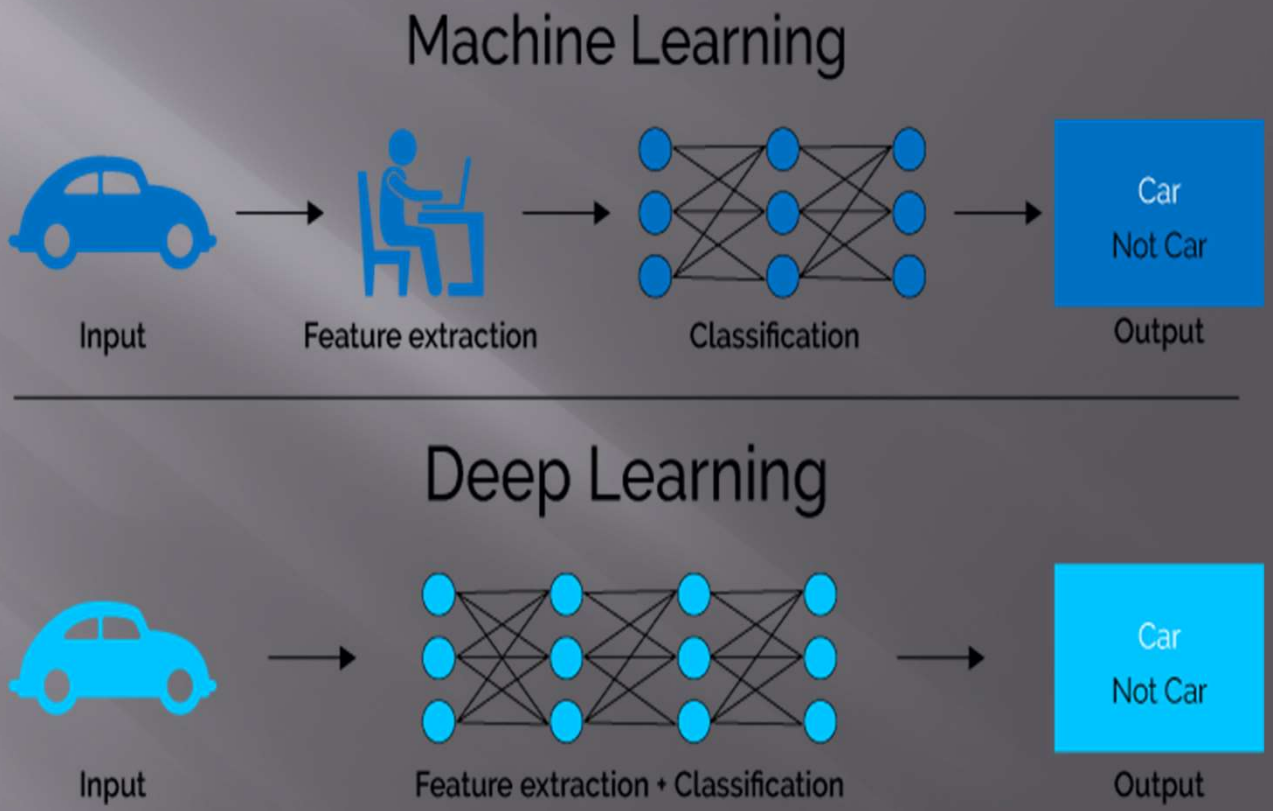
AI, Machine Learning & Deep Learning



http://houseofbots.com/news-detail/2754-1-a-take-on-deep-learning

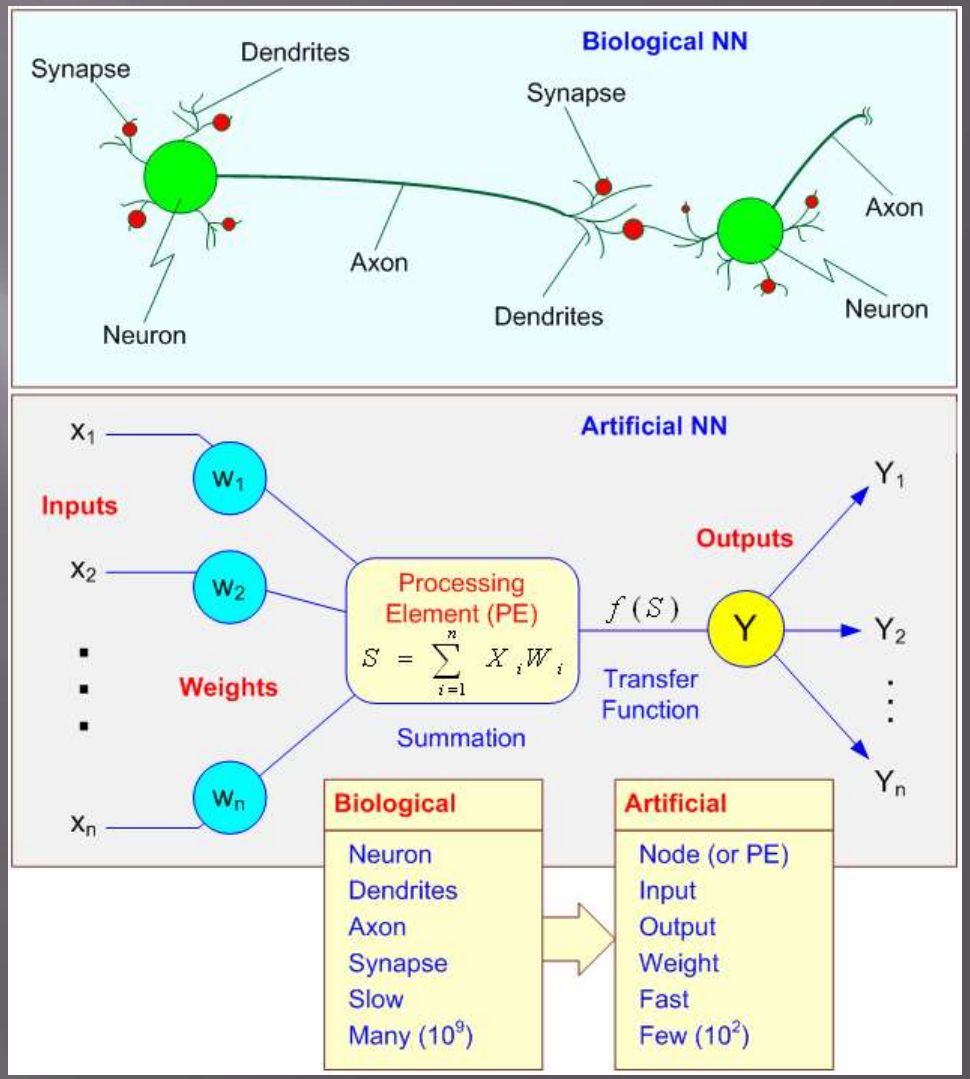
Paradigm Shift in Machine Learning





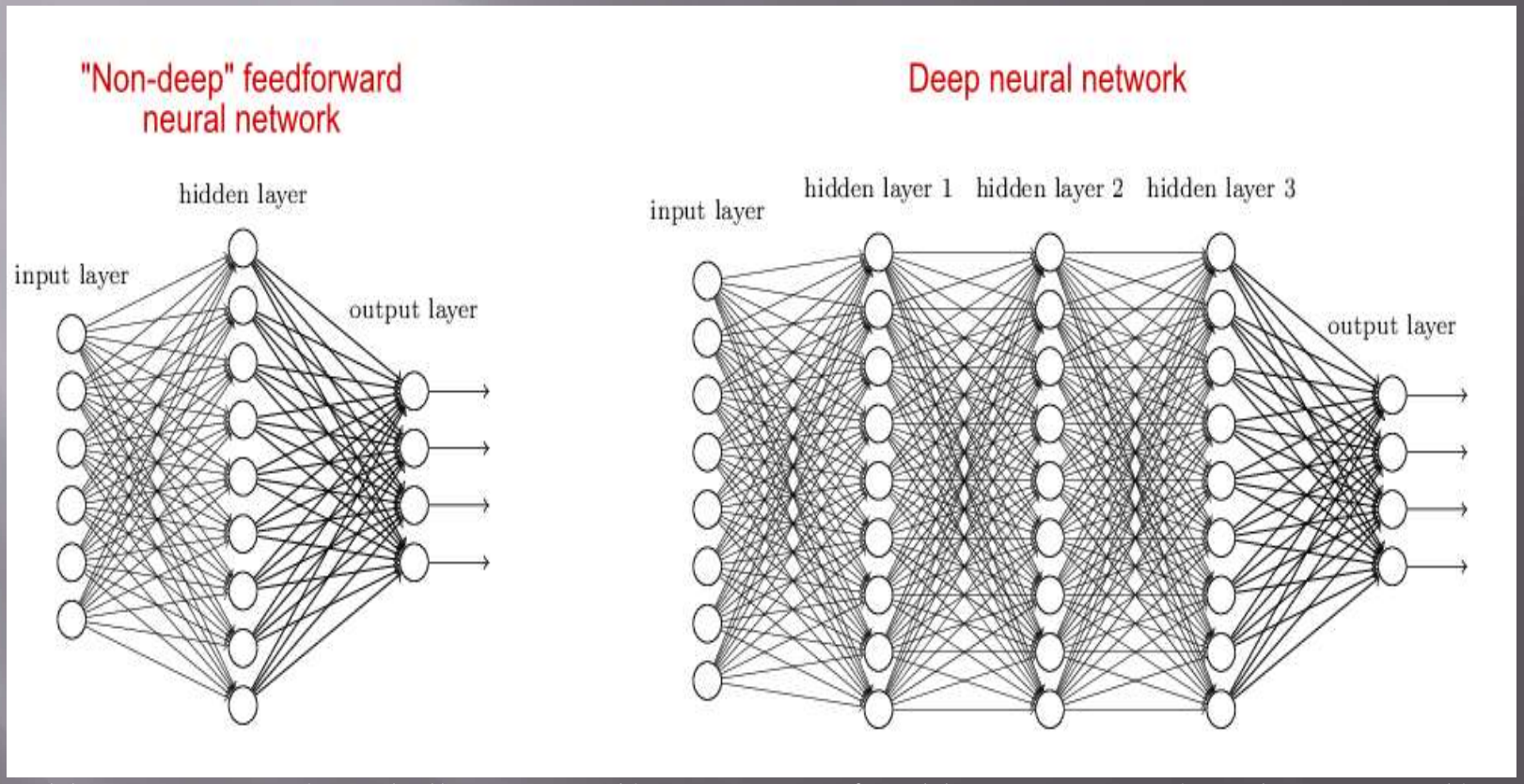
Deep Learning

- Deep learning refers to artificial neural networks that are composed of many layers.
- Deep learning is just another name for artificial neural networks (ANN)



Shallow Network vs. Deep Network

20 Years



# of Hidden Layer <= 1 (i.e., shallow network)

# of Hidden Layer >= 2 (i.e., deep network)

Pattern Classification vs. Machine Learning

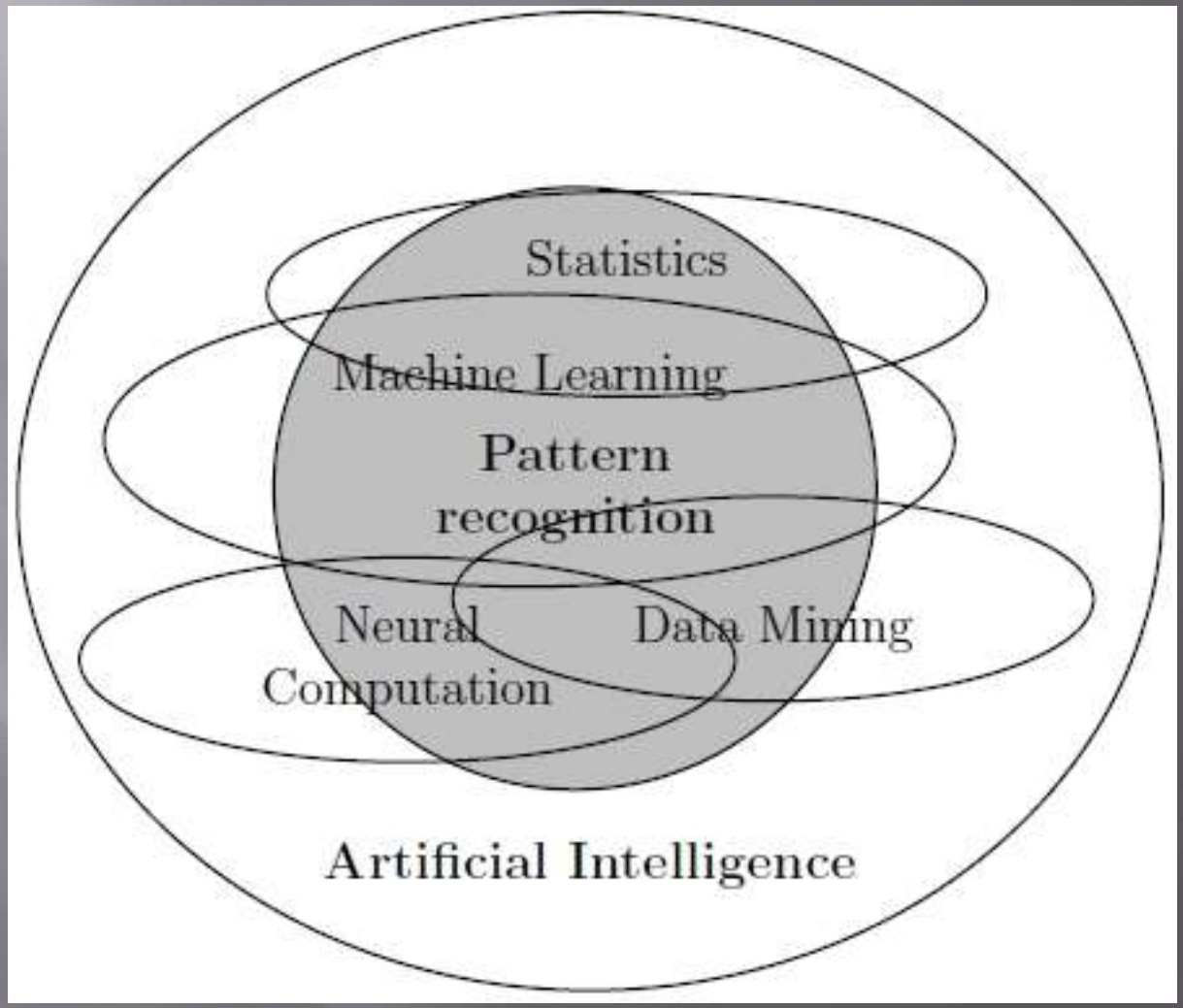
- "Pattern recognition has its origin in engineering whereas machine learning grew out of computer science." –Christopher M. Bishop, Author of Pattern Recognition and Machine Learning
- Both can be viewed as two facets of the same field
- Both undergone significant developments in the past ten years

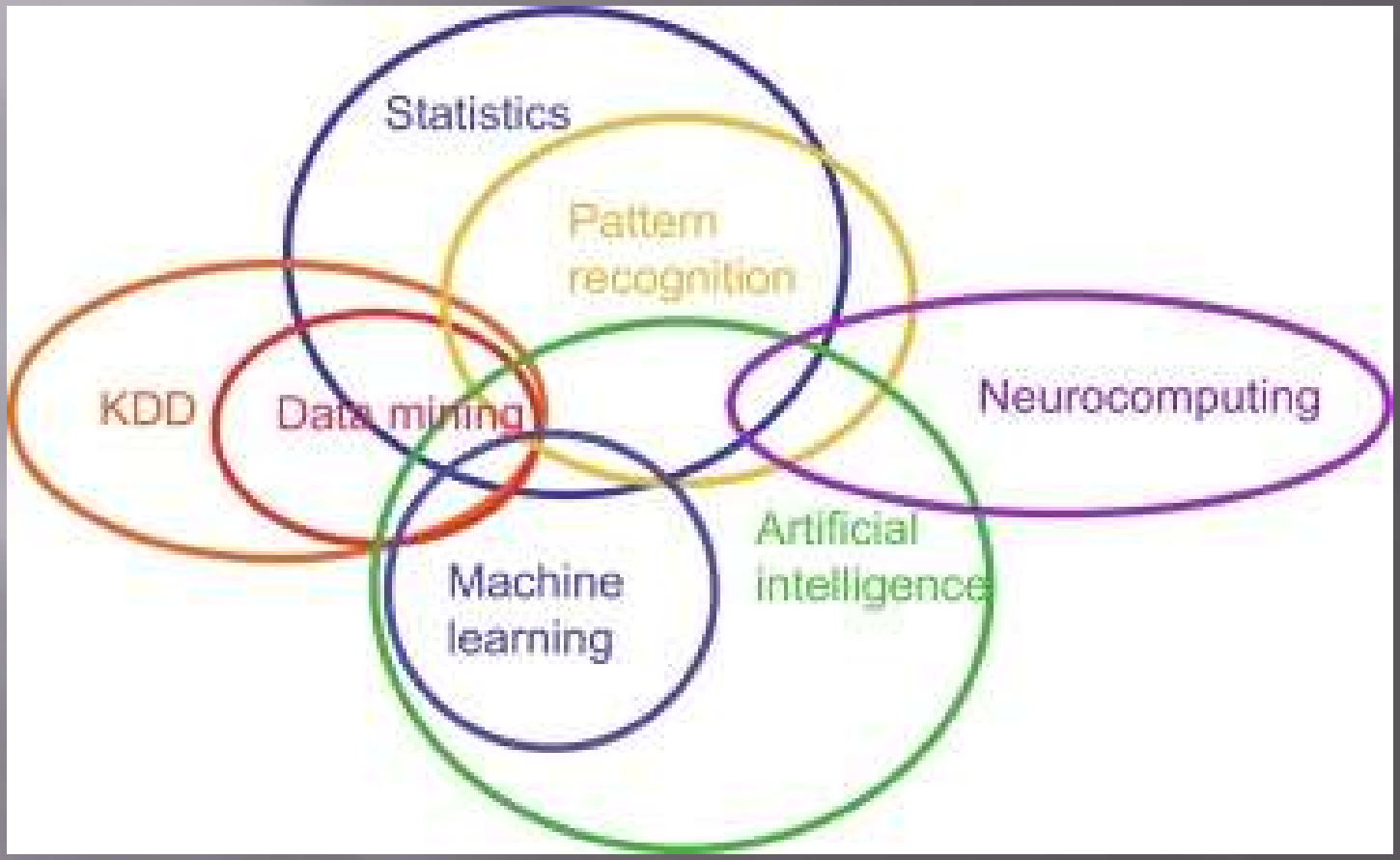
What is Machine Learning?

- Machine learning is a scientific discipline that is concerned with the design and development of algorithms that allow computers to learn based on data from sensors or databases.
- Major focus of ML is to automatically learn to recognize complex patterns and make intelligent decisions based on data.
- ML is closely related to statistics, probability theory, data mining, pattern recognition, artificial intelligence, adaptive control, and computer science.

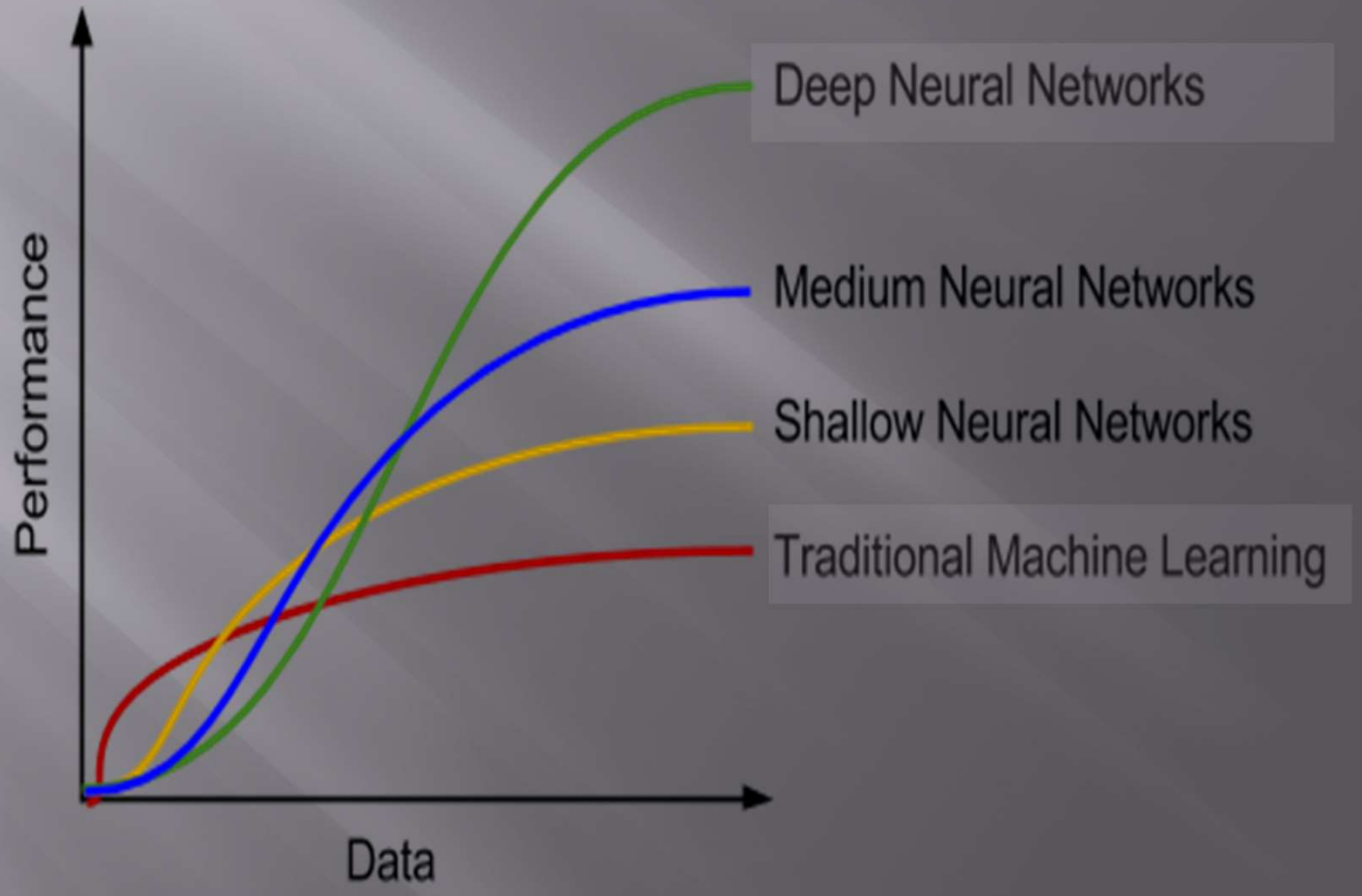
What is Pattern Recognition?

- Pattern recognition is the act of taking in raw data and taking an action based on the category of the data
- Largely divided into supervised learning and unsupervised learning.
- It aims to classify data based on a priori knowledge or on statistical information extracted from the patterns.
- The pattern classified are groups of measurements or observations, defining points in a multidimensional space.


Statistics
Machine Learning
Pattern
recognition
Neural
Computation
Data Mining
Artificial Intelligence

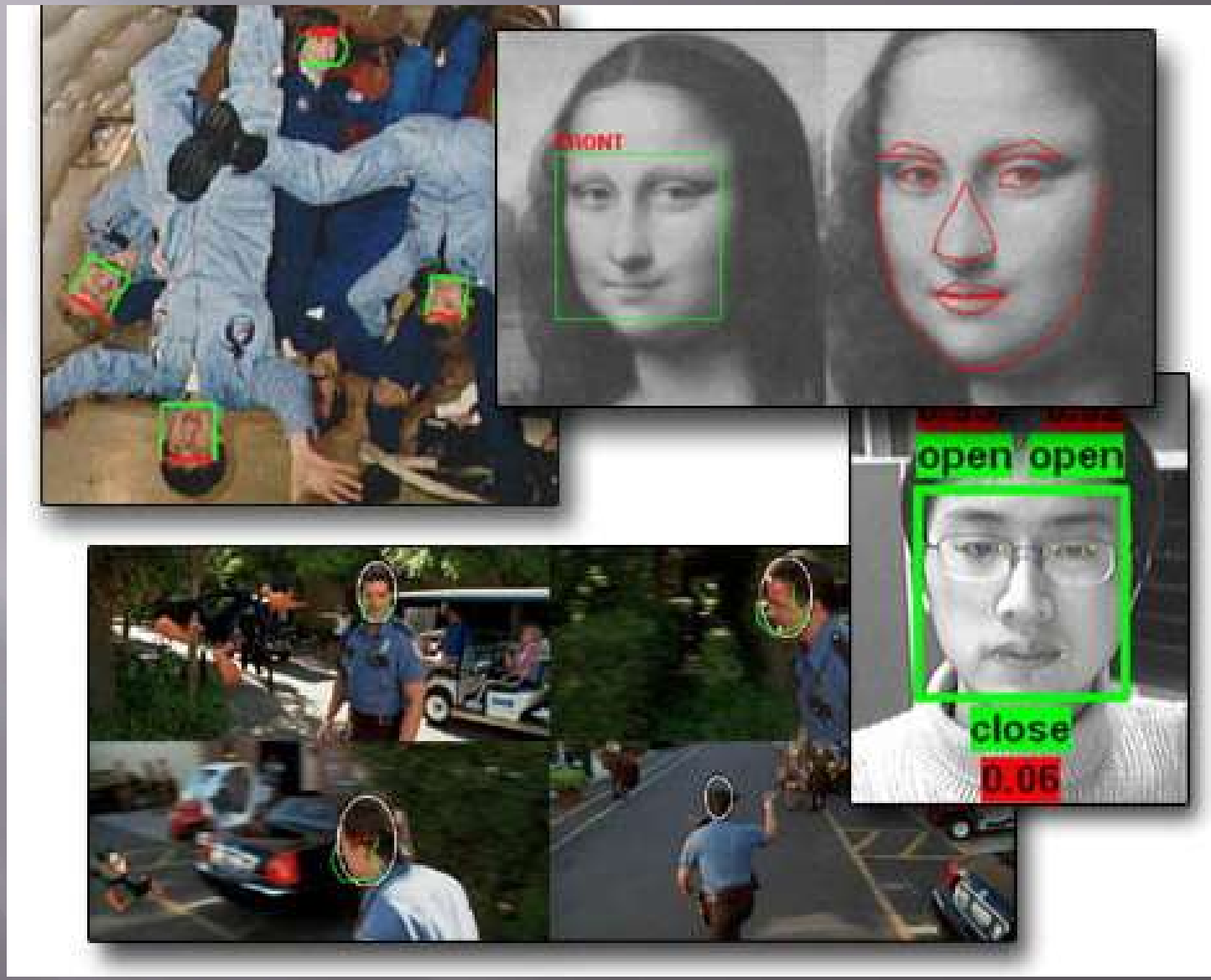

Statistics
Pattern recognition
KDD
Data mining
Neurocomputing
Machine learning
Artificial intelligence

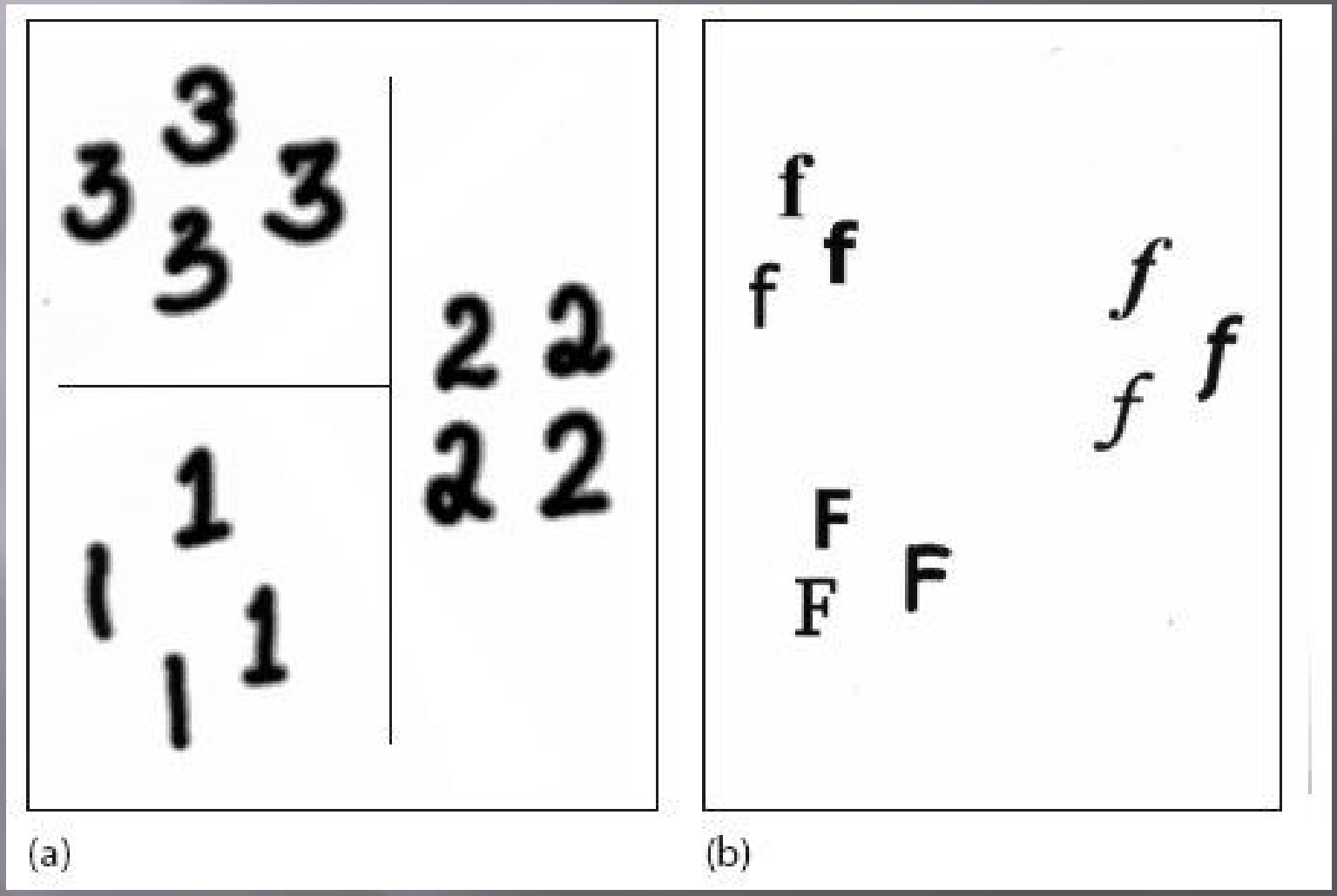
Data vs. Performance of Machine Learning & Deep Learning



Where PR and ML Used?

- In medical science, computer-aided diagnosis
- Speech recognition
- Text classification (spam vs. non-spam)
- Human face recognition
- Image analysis
- Data mining
- Predictive analysis (stock pricing)
- Machine intelligence
- Artificial Intelligence
- Deep Learning
- You name it


open open
close
0.06



(a) (b)

VeriFinger Demo, Evaluation Version - Identification
File Mode View Tools Help
Waiting for image(s)
Extraction complete: OK. Time: 271 ms
Matching speed: 440 fingerprints per second
3 scanners found
G Result Similarity
126 OK 410
Records in the database: 78


CMA - COMERICA INC-COM - Daily
PatternExplorer.com - Chart Pattern Recognition 1 - CMA - Daily 22.02.2007 Open 62.9, Hi 63.28, Lo 62.69,
Close 62.97 (-0.3%) , Pattern: Rising Wedge, Sensitivity = 15
65.0
64.0
62.97
62.0
61.0
60.4342
60.0
59.0
58.6118
58.0
57.0
56.0
November
December
2007
February
Sheet 1
Sheet 2
Sheet 3
Sheet 4
Sheet 5
Sheet 6
Sheet 7

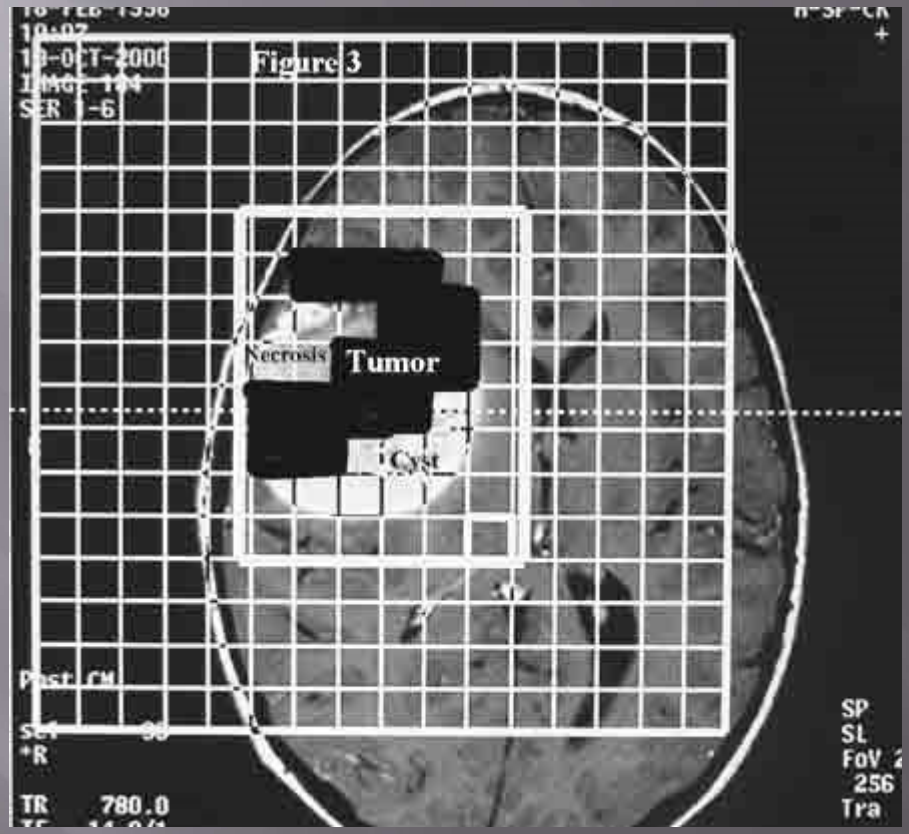
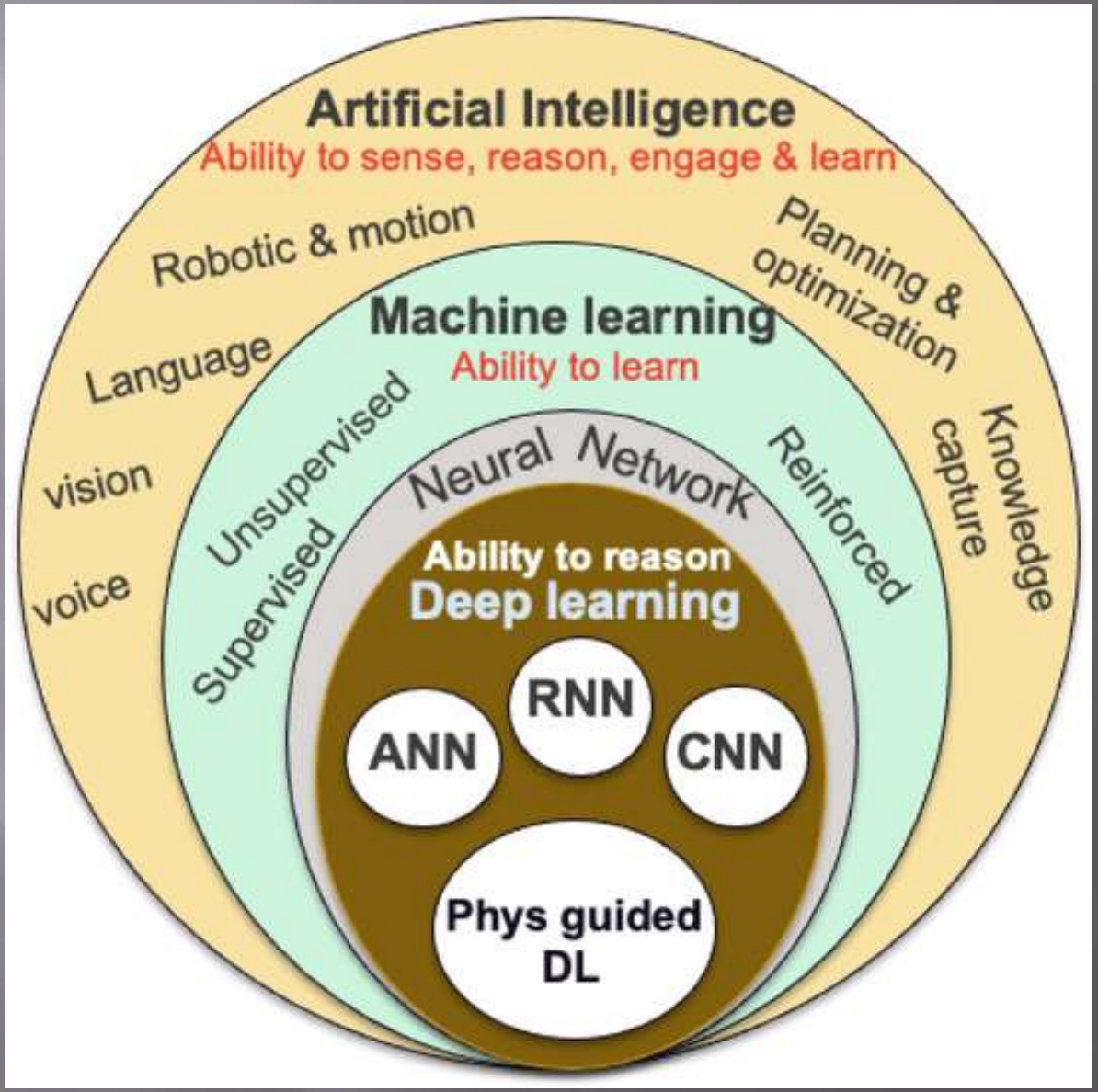


Figure 3
Necrosis
Tumor
Cyst
SP
SL
256
Tra
TR 780.0


Artificial Intelligence
Ability to sense, reason, engage & learn
Robotic & motion
Planning & optimization
Language
vision
voice
Knowledge capture
Machine learning
Ability to learn
Unsupervised
Supervised
Reinforced
Neural Network
Ability to reason
Deep learning
RNN
ANN
CNN
Phys guided DL