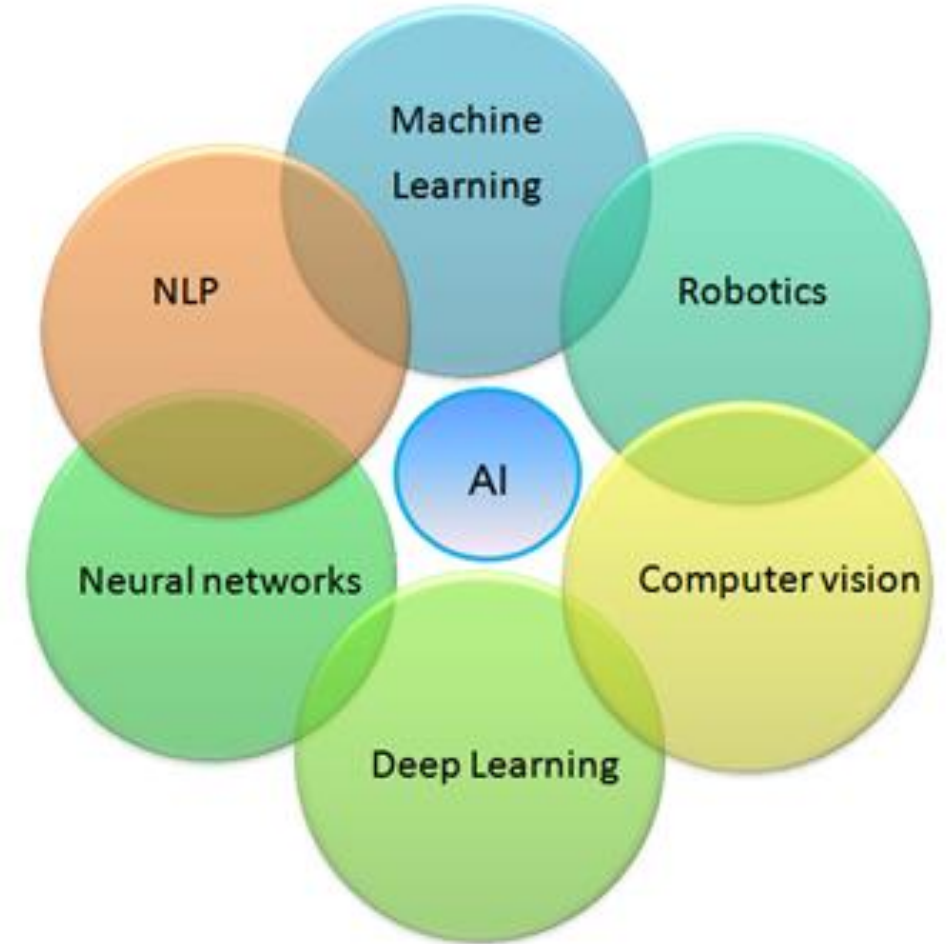
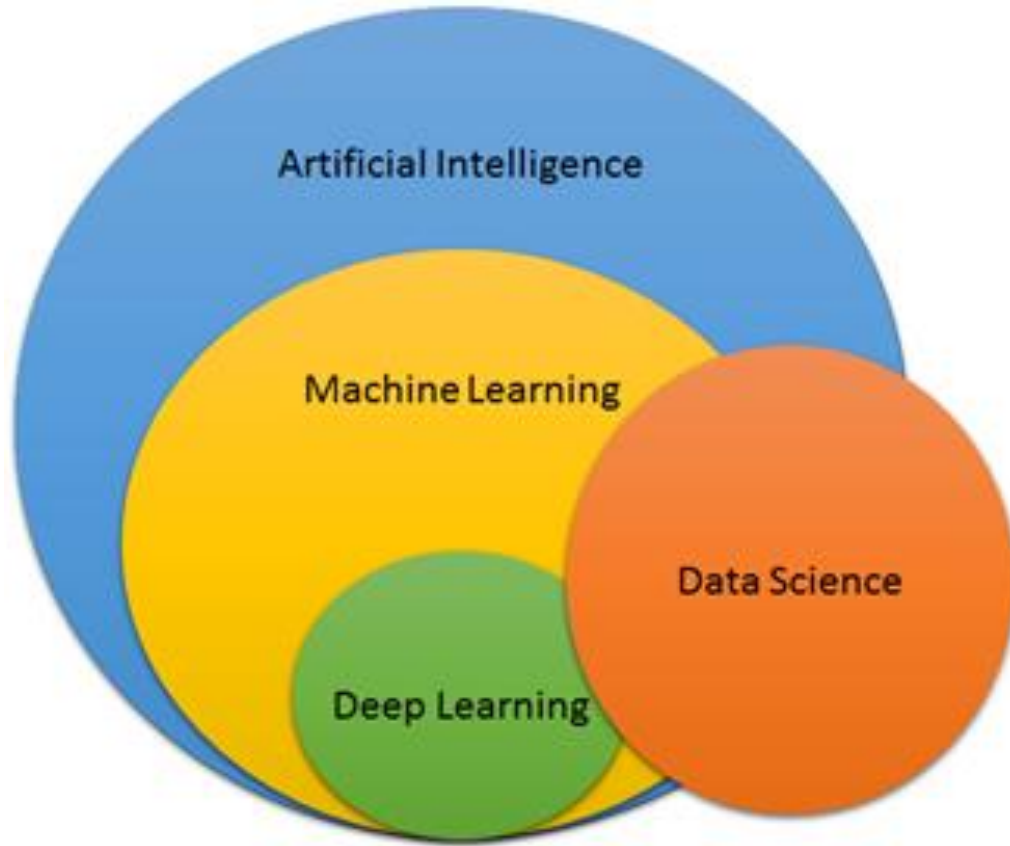


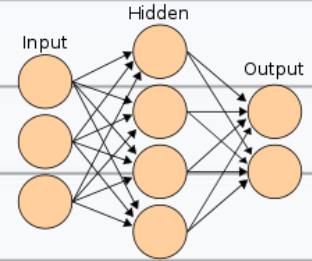
# Introduction to ML

**Hafiz Muhammad Attaullah**

# ARTIFICIAL INTELLIGENCE & ITS DOMAINS



Decade ♦	Summary ♦
<1950s	Statistical methods are discovered and refined.
1950s	Pioneering machine learning research is conducted using simple algorithms.
1960s	Bayesian methods are introduced for probabilistic inference in machine learning. <sup>[1]</sup>
1970s	'AI Winter' caused by pessimism about machine learning effectiveness.
1980s	Rediscovery of backpropagation causes a resurgence in machine learning research.
1990s	Work on machine learning shifts from a knowledge-driven approach to a data-driven approach. Scientists begin creating programs for computers to analyze large amounts of data and draw conclusions – or "learn" – from the results. <sup>[2]</sup> Support vector machines (SVMs) and <sup>[3]</sup> recurrent neural networks (RNNs) become popular. The fields of <sup>[4]</sup> computational complexity via neural networks and super-Turing computation started.
2000s	Support Vector Clustering <sup>[5]</sup> and other Kernel methods <sup>[6]</sup> and unsupervised machine learning methods become widespread. <sup>[7]</sup>
2010s	Deep learning becomes feasible, which leads to machine learning becoming integral to many widely used software services and applications.



# The concept of learning in a ML system

- Learning = Improving with experience at some task
  - Improve over task  $T$ ,
  - With respect to performance measure,  $P$
  - Based on experience,  $E$

# Learning

- “Learning denotes changes in a system that ... enable a system to do the same task ... more efficiently the next time.” - **Herbert Simon**
- “Learning is constructing or modifying representations of what is being experienced.” - **Ryszard Michalski**
- “Learning is making useful changes in our minds.” - **Marvin Minsky**

*“Machine learning refers to a system capable of the autonomous acquisition and integration of knowledge.”*

# Learning Element

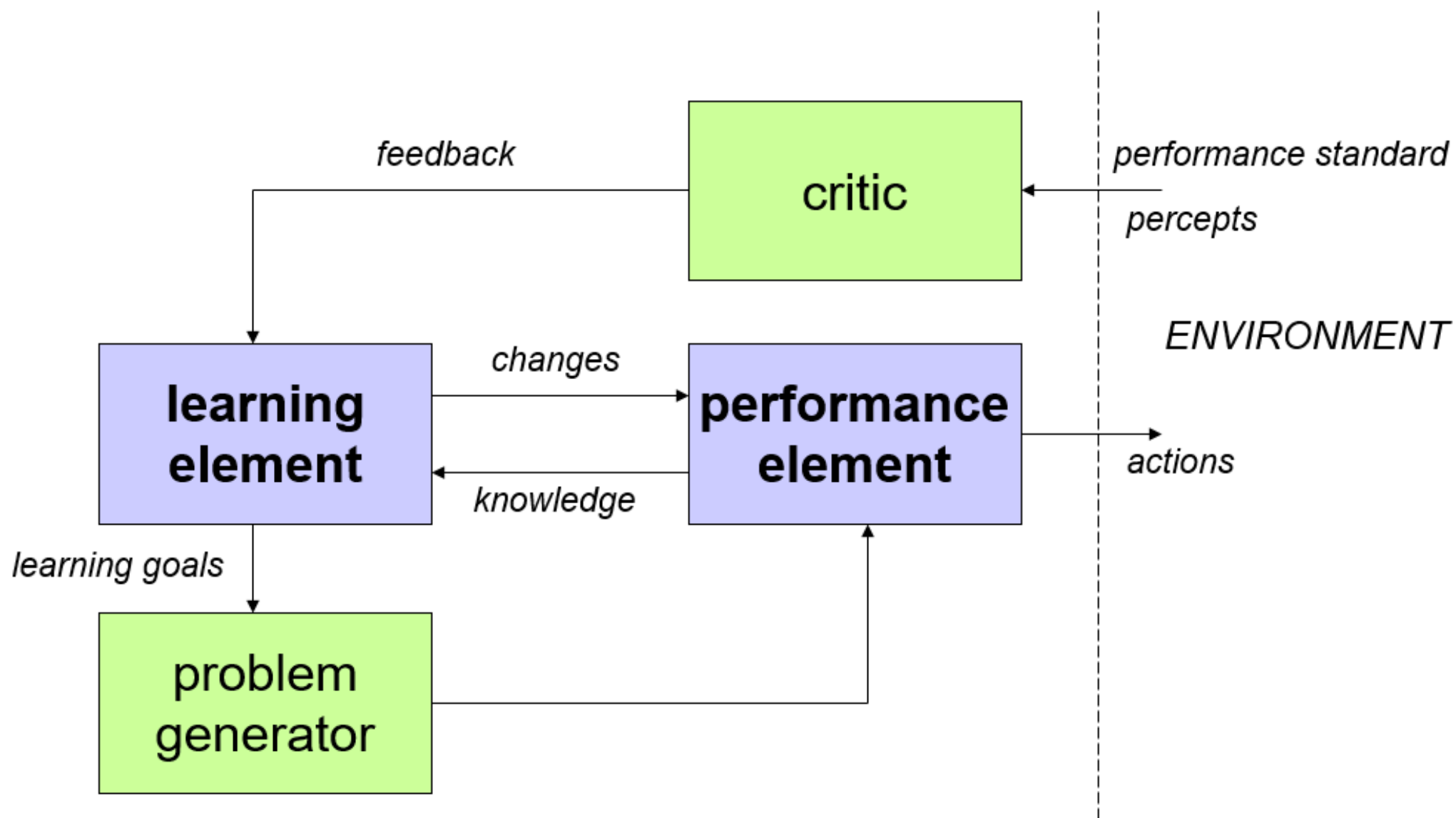
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Design affected by:

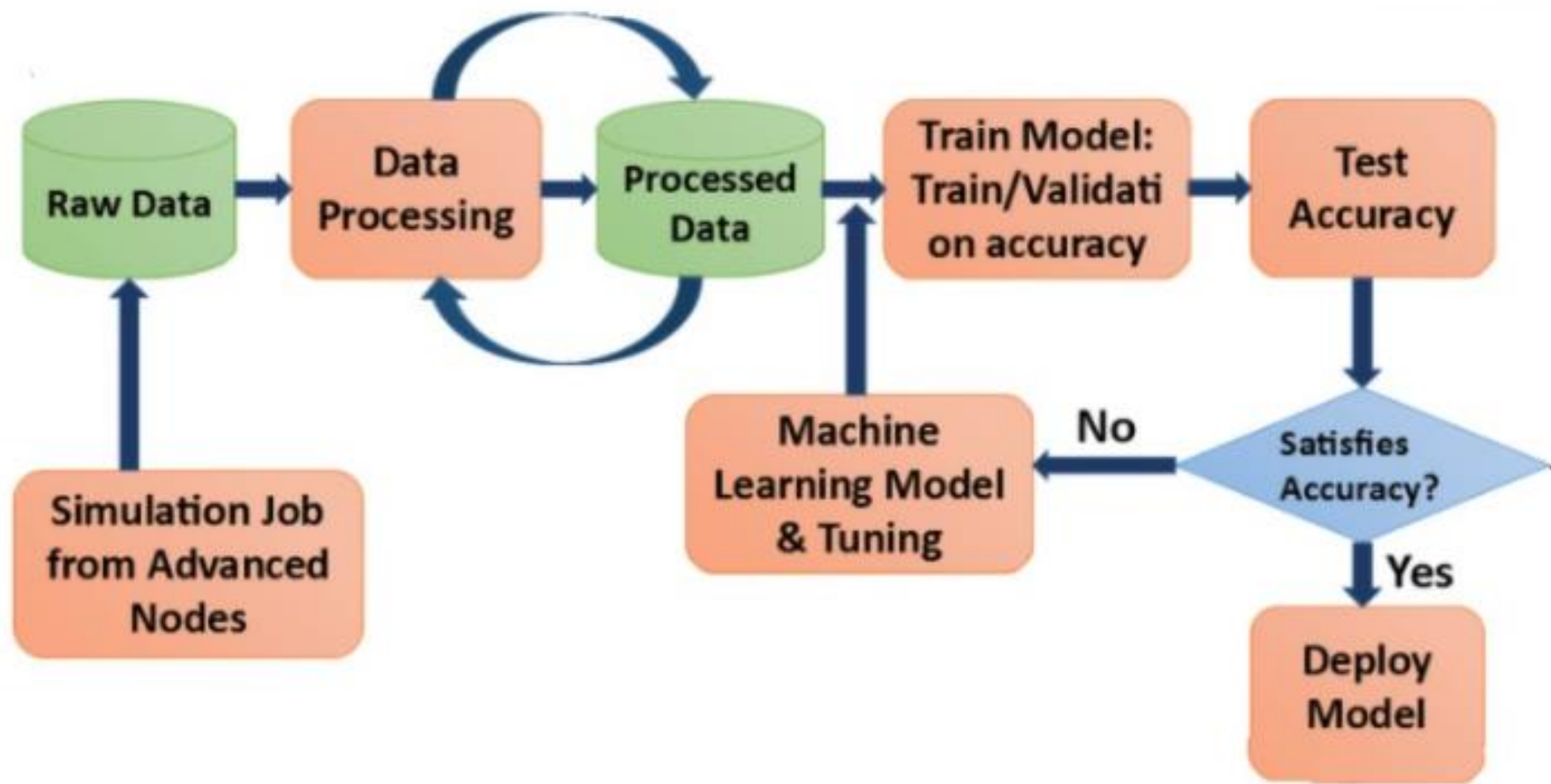
- *performance element* used
  - e.g., utility-based agent, reactive agent, logical agent
- *functional component* to be learned
  - e.g., classifier, evaluation function, perception-action function,
- *representation* of functional component
  - e.g., weighted linear function, logical theory, HMM
- *feedback* available
  - e.g., correct action, reward, relative preferences

# Architecture of a Learning System

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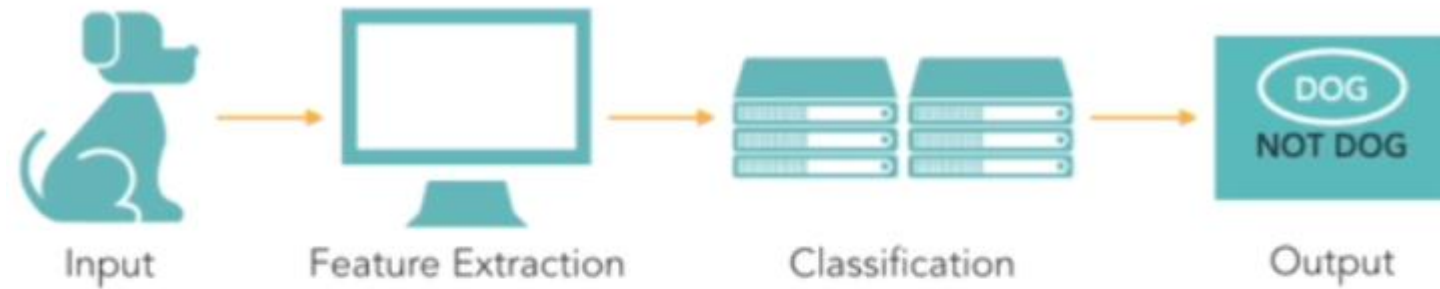








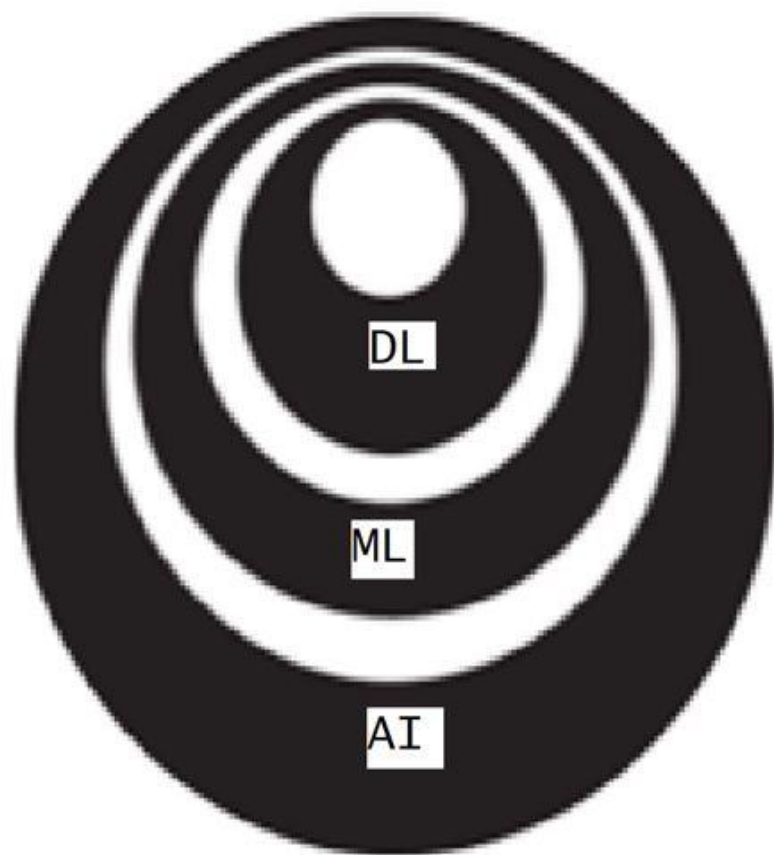
# MACHINE LEARNING VS DEEP LEARNING



## DEEP LEARNING



# Introduction to AI



2000 - Igor Aizenberg

Learning based on  
Deep Neural  
Network

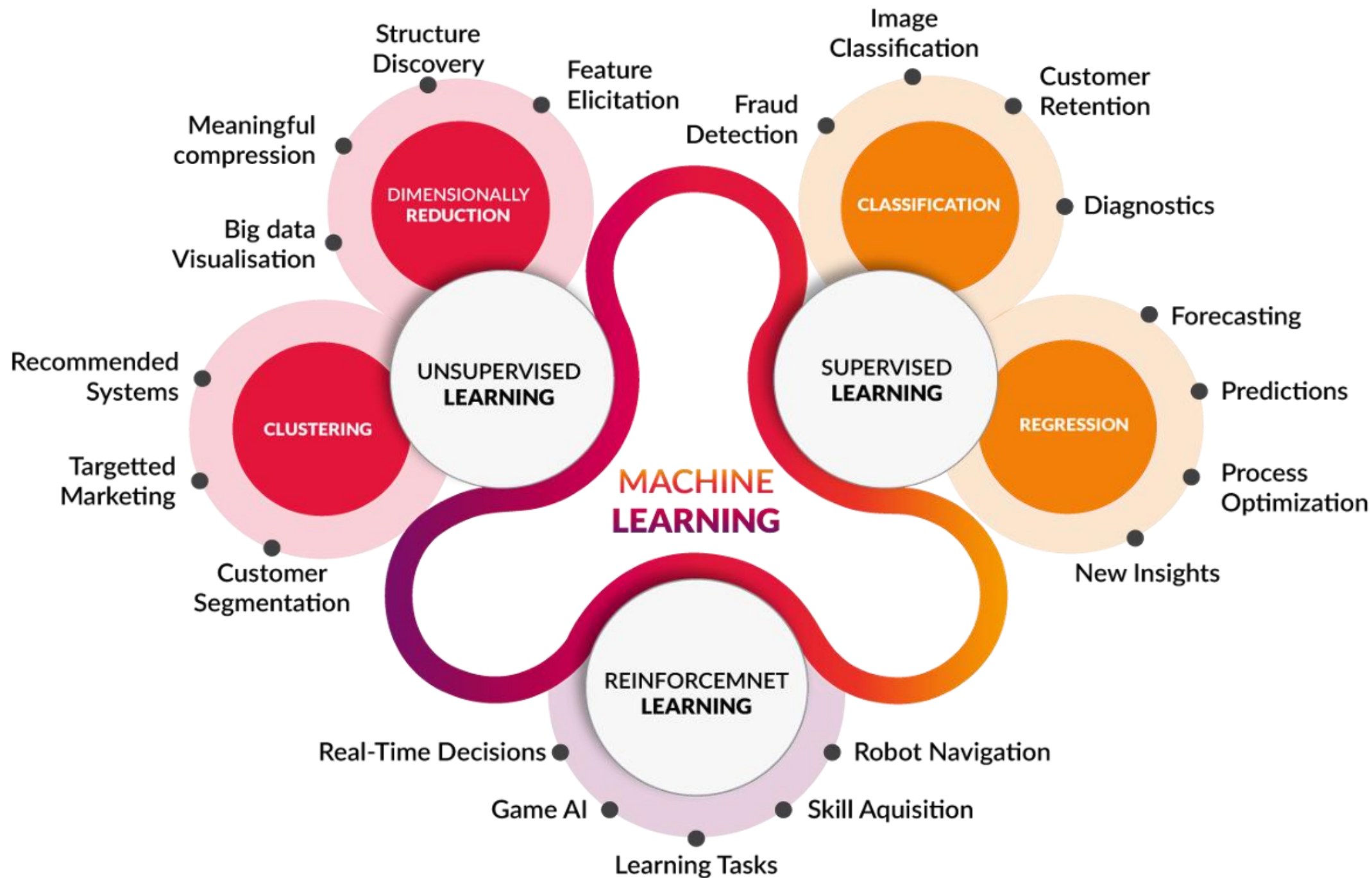
1959 - Arther Samuel

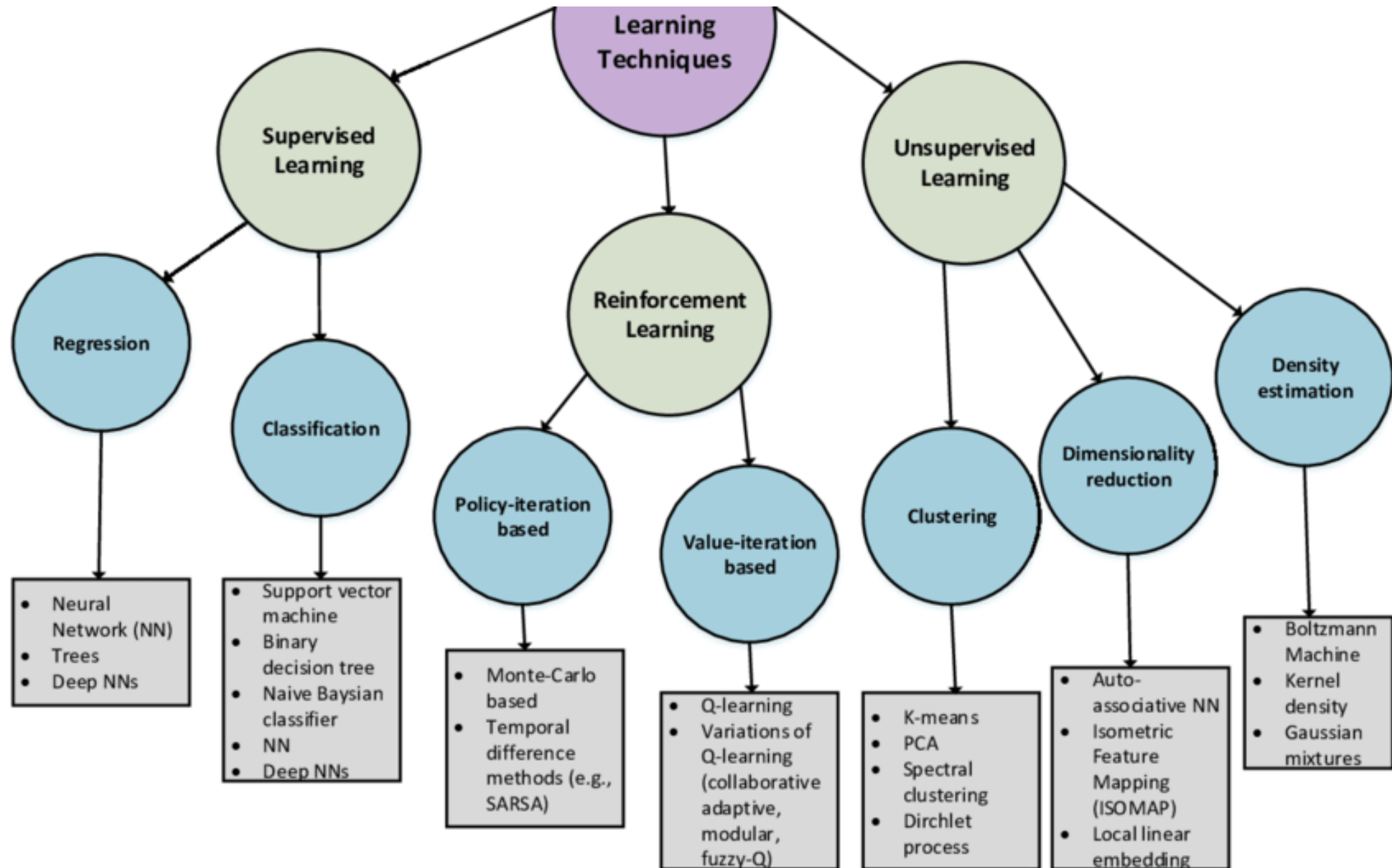
Ability to learn  
without being explicitly  
programmed

1956 - John MacCarthy

Engineering of  
making Intelligent  
Machines and Programs







# Machine Learning Algorithms *(sample)*

	<u>Unsupervised</u>	<u>Supervised</u>
<u>Continuous</u>	<ul style="list-style-type: none"><li>• Clustering &amp; Dimensionality Reduction<ul style="list-style-type: none"><li>○ SVD</li><li>○ PCA</li><li>○ K-means</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Regression<ul style="list-style-type: none"><li>○ Linear</li><li>○ Polynomial</li></ul></li><li>• Decision Trees</li><li>• Random Forests</li></ul>
<u>Categorical</u>	<ul style="list-style-type: none"><li>• Association Analysis<ul style="list-style-type: none"><li>○ Apriori</li><li>○ FP-Growth</li></ul></li><li>• Hidden Markov Model</li></ul>	<ul style="list-style-type: none"><li>• Classification<ul style="list-style-type: none"><li>○ KNN</li><li>○ Trees</li><li>○ Logistic Regression</li><li>○ Naive-Bayes</li><li>○ SVM</li></ul></li></ul>

# 1. Supervised learning

empirical learning (knowledge-free)

analytical learning (knowledge-guided)

# 2. Unsupervised learning

## 3. *Semi-Supervised*

# 3. Reinforcement learning

**Performance evaluation**

**Computational learning theory**



# Types of Machine Learning – At a Glance

## Supervised Learning

- Makes machine Learn explicitly
- Data with clearly defined output is given
- Direct feedback is given
- Predicts outcome/future
- Resolves classification and regression problems



## Unsupervised Learning

- Machine understands the data (Identifies patterns/structures)
- Evaluation is qualitative or indirect
- Does not predict/find anything specific



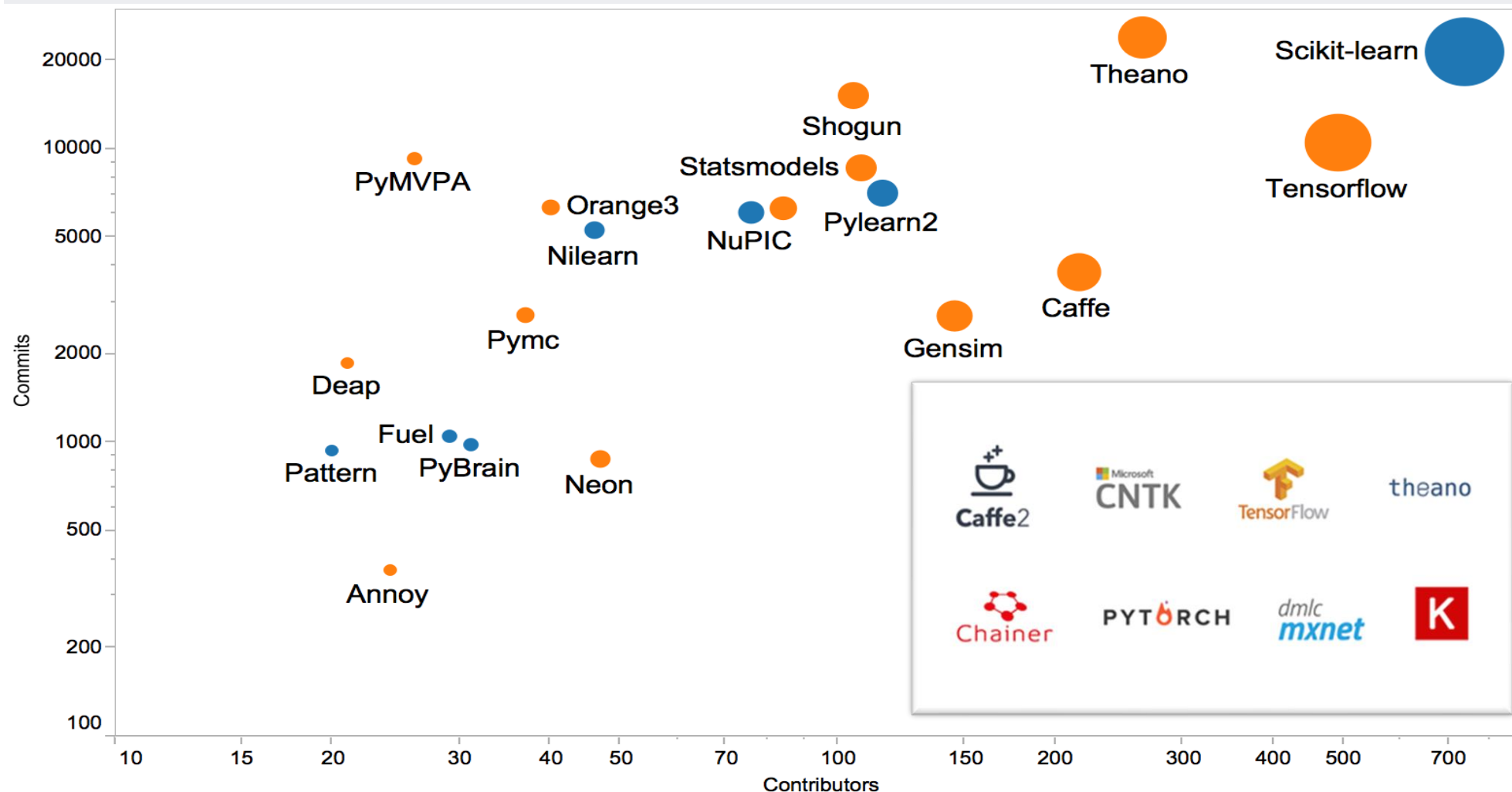
## Reinforcement Learning

- An approach to AI
- Reward based learning
- Learning from +ve & -ve reinforcement
- Machine Learns how to act in a certain environment
- To maximize rewards










Top 20 Python Machine Learning Open Source Projects, 2016

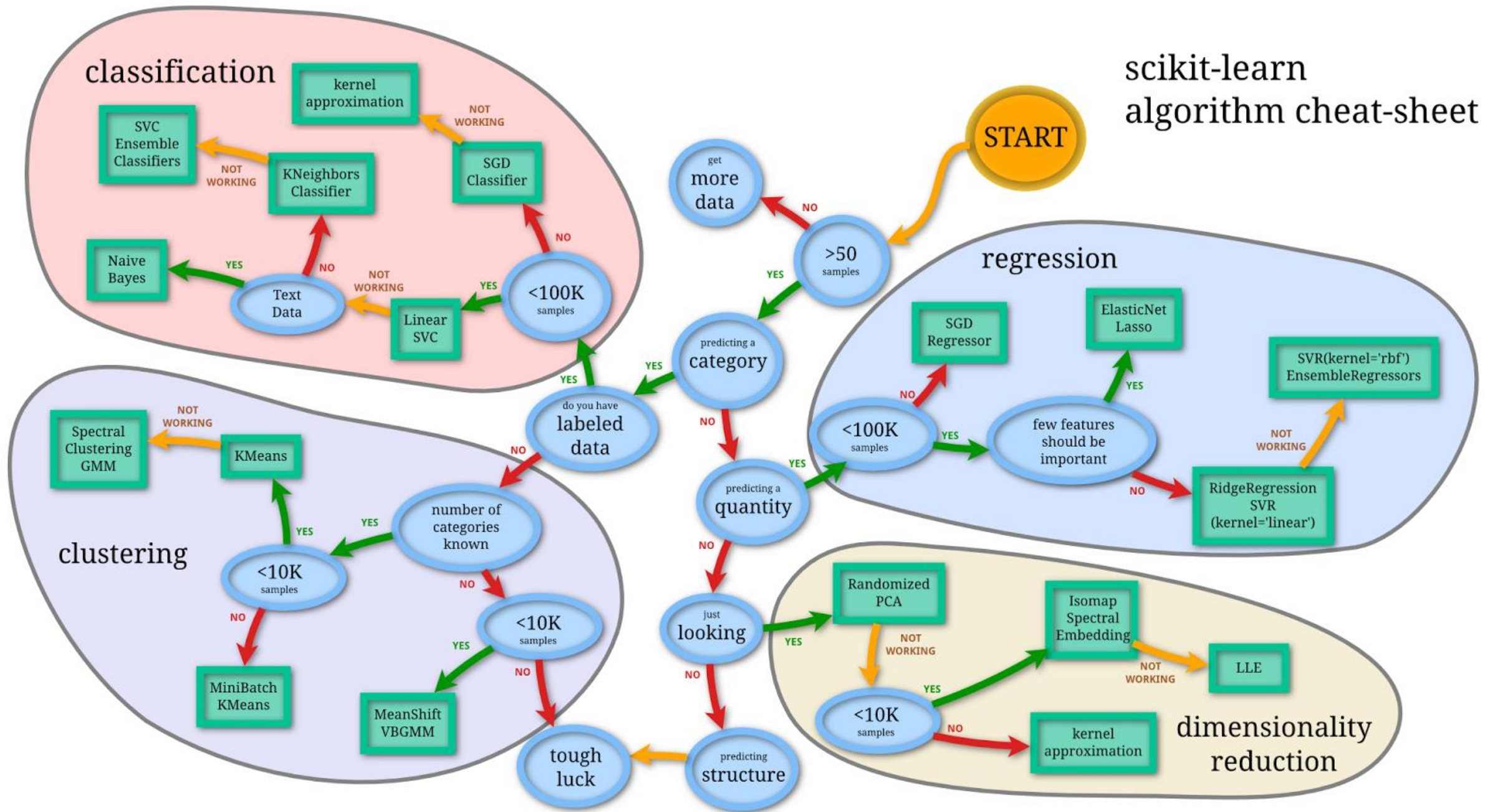




Artificial Intelligence and Machine Learning SkillsFuture Courses and Training

 Vision	 Speech	 Language	 Knowledge	 Search
Computer Vision	Bing Speech	Bing Spell Check	Academic Knowledge	Bing Web Search
Content Moderator	Speaker Recognition	Language Understanding	Knowledge Exploration	Bing Image Search
Face	Custom Speech	Linguistic Analysis	Entity Linking	Bing Video Search
Emotion		Text Analytics	QnA Maker	Bing News Search
Video		Translator	Recommendations	Bing Autosuggest
		Web Language Model		

# scikit-learn algorithm cheat-sheet





# Dlib C++ Library

## Machine Learning Guide

