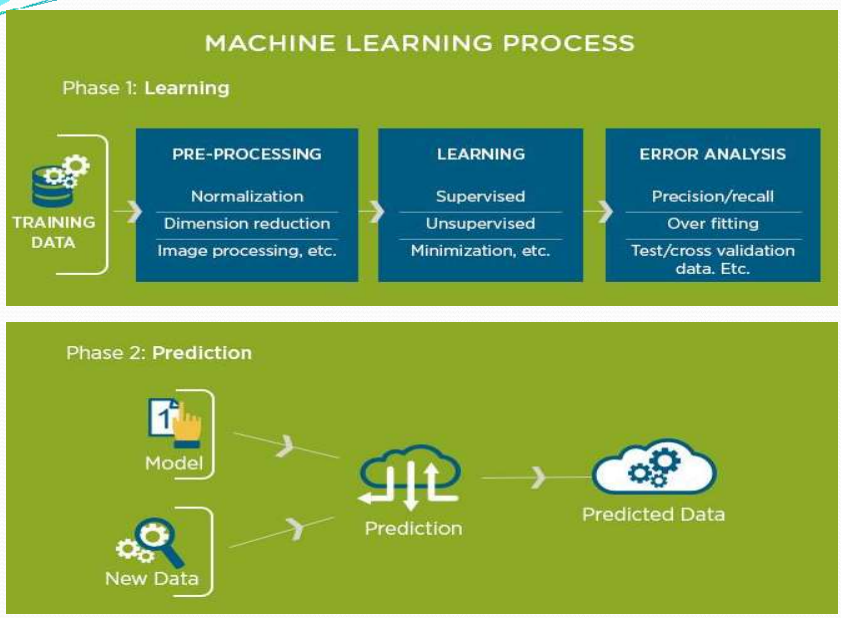
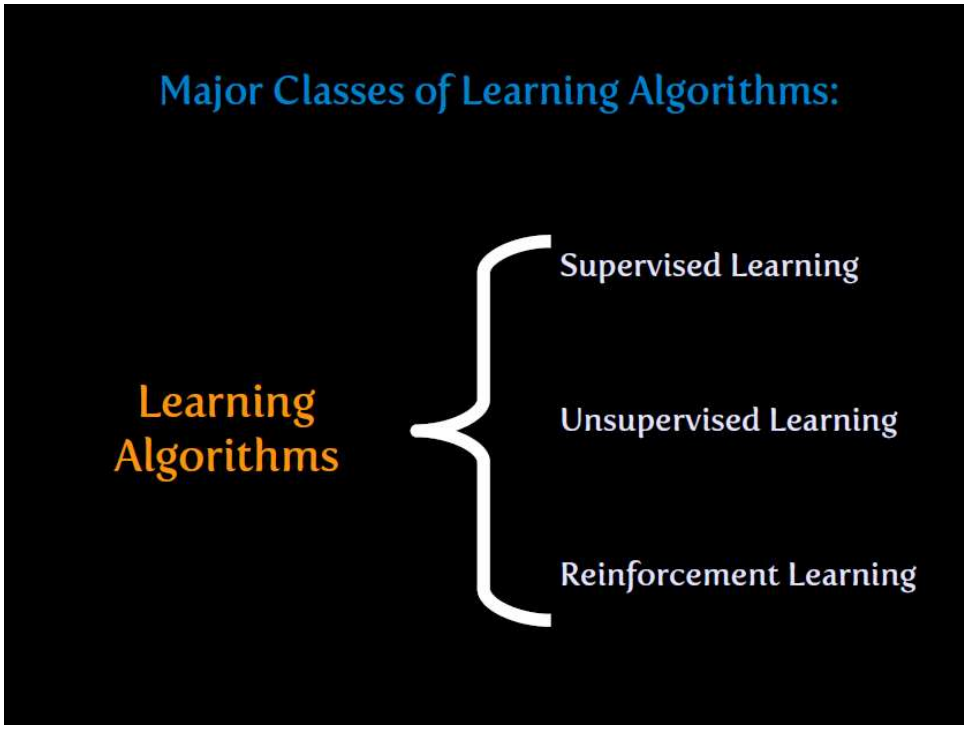
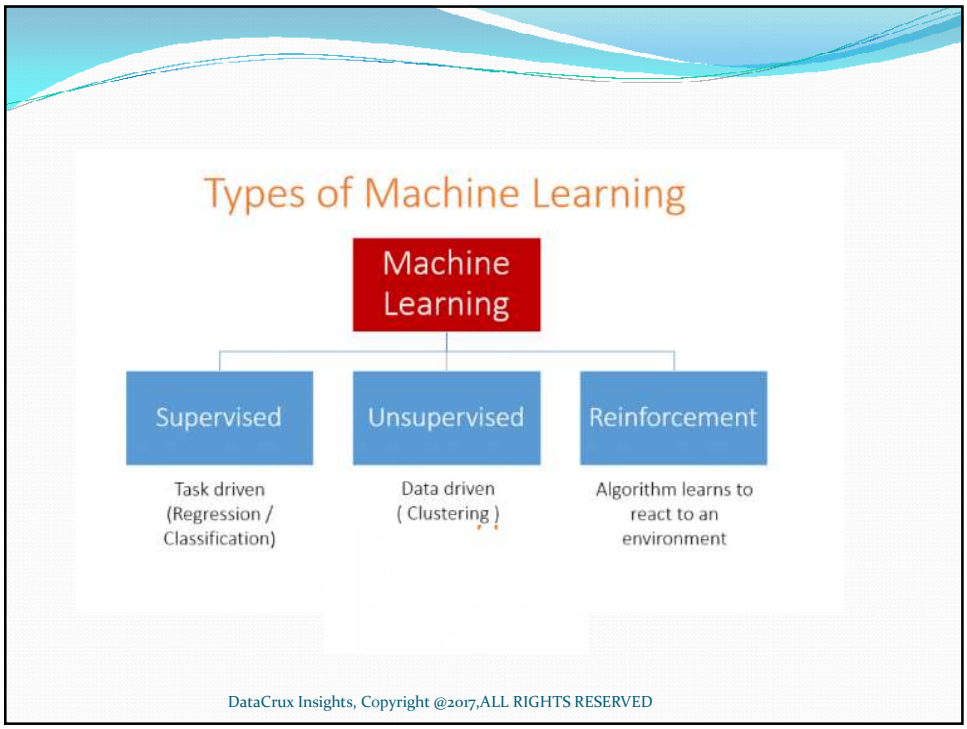
Machine Learning – Learning Types

Manisha V Jadhav




Major Classes of Learning Algorithms:
Learning Algorithms
Supervised Learning
Unsupervised Learning
Reinforcement Learning


Types of Machine Learning
Machine Learning
Supervised
Unsupervised
Reinforcement
Task driven (Regression / Classification)
Data driven (Clustering)
Algorithm learns to react to an environment
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Types of Learning

- **Supervised (inductive) learning**
  - Training data includes desired outputs
  - Eg. Classification, regression
- **Unsupervised learning**
  - Training data does not include desired outputs
  - Eg. Clustering dimensionality reduction, Associations
- **Reinforcement learning**
  - Rewards from sequence of actions
  - Q-Learning, State-Action-Reward-State-Action (SARSA), Deep Q Network (DQN), Markov Decision Process

Inductive learning

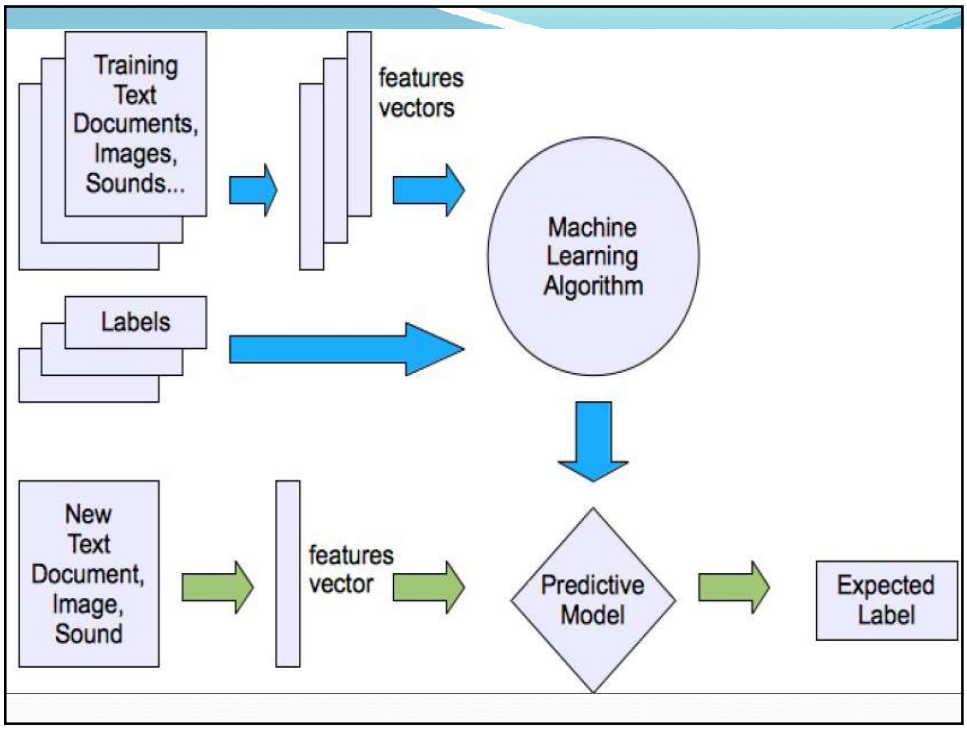
- Data produced by "target".
- Hypothesis learned from data in order to "explain", "predict","model" or "control" target.
- Generalisation ability is essential.

Inductive learning hypothesis:

"If the hypothesis works for enough data
then it will work on new examples."

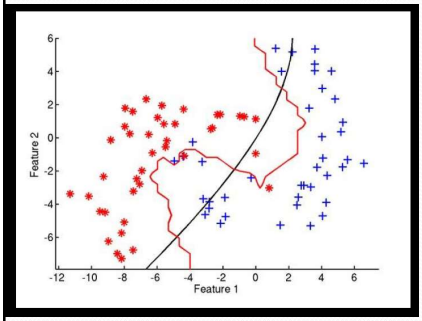
Supervised Learning: Uses

- Prediction of future cases
- Knowledge extraction
- Compression
- Outlier detection



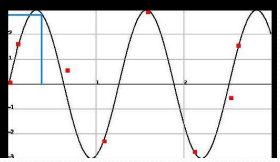
Supervised Learning

- Regression Problems
- Classification Problems



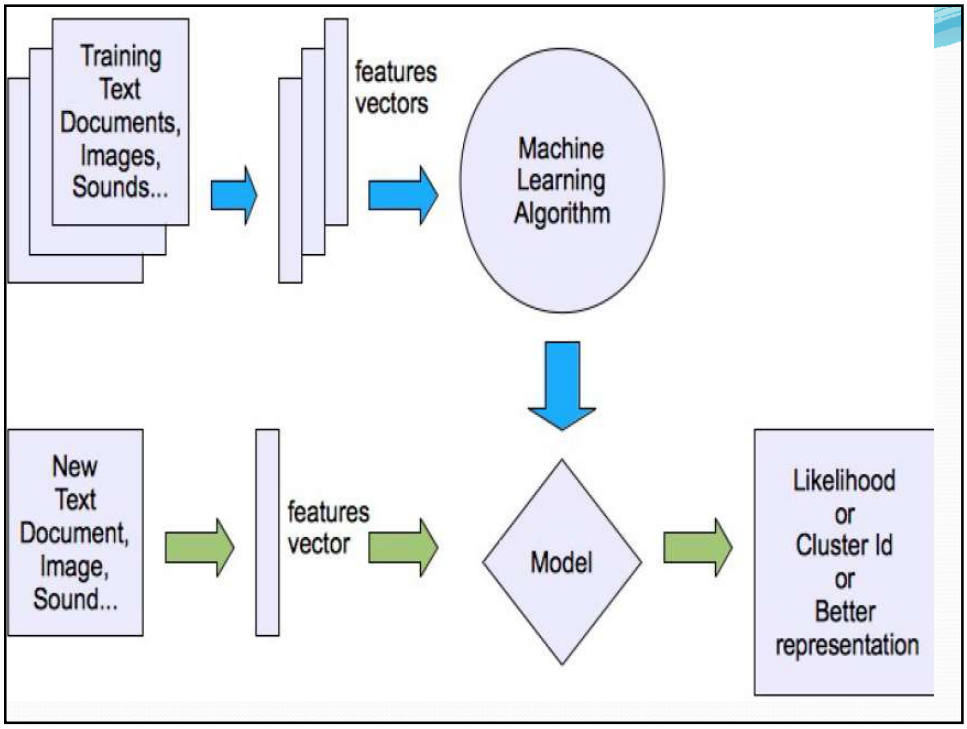
x	y
0	0
0.5236	1.5
1.5708	3.0
2.0944	-2.5981
2.6180	1.5
2.6180	1.5
3.1416	0

To Find: y at x =0.44



Unsupervised Learning

- Clustering: grouping similar instances
- Example applications
  - Customer segmentation in CRM
  - Learning motifs in bioinformatics
  - Clustering items based on similarity
  - Clustering users based on interests



Reinforcement Learning

- *The environment is a modeled as a stochastic finite state machine with inputs (actions sent from the agent) and outputs (observations and rewards sent to the agent*
- Learning a policy: A sequence of outputs
- No supervised output but delayed reward
- Game playing

- **Robotics and industrial automation**
- chatbots

- Deep learning is very very complex function approximation, for image recognition, speech (supervised) as well as for dimension reduction and deep network pretraining (unsupervised).

  Reinforcement learning is actually more in line with optimal control, where an agent learns to develop an optimal policy of sequential actions to take by interacting with an environment. There are various branches within RL, such as temporal difference, Monte Carlo and dynamic programming.

Platforms

Topic	Deepmind lab	Gym	Universe	Vizia	Project Malmo
Open Source	Yes	Yes	Yes	Yes	Yes
Game integration	Tightly	Tightly	Superficial	Tightly	Tightly
Game customization	Yes	Yes	No	Yes	Yes
Release organization	DeepMind	OpenAI	OpenAI	Poznan University of Technology, Poland	Microsoft
Language	python, lua	python	python	C++, python, Lua and Java	python, lua, C++, C#, Java
Game diversity	Limited	Limited	Unlimited*	Only Doom	Only Minecraft

Gaming…