

What is ML?

uses ML algorithms / techniques

data →

Computer

- learns itself from data
- improves its performance of task based on previous experience

Why?

to build machines more human like in their behaviour and decision making

how?

by giving computer the ability to learn from data with minimum human intervention  
(no explicit programming)

Every ML algorithm must have 3 components

- Representation
- Evaluation
- Optimization

### ① Representation:

- it is a space of possible models  
allowed

techniques:

- Decision trees
- Set of Rules / logic programs
- Instances
- Graphical Models (Bayes / Markov nets)
- Neural Networks
- SVM
- etc

② Evaluation:  
- how we prefer one model vs another by means of a function

techniques:

- Accuracy
- precision and recall
- squared error
- Likelihood
- cost/utility
- Margin
- Entropy
- etc

utility function

- (or) loss function
- (or) scoring function
- (or) fitness function

③ Optimization: to obtain better evaluation

techniques — stochastic gradient descent  
— genetic algorithms

three types of optimisation

① combinatorial optimisation  
e.g., Greedy Search

② convex optimization  
e.g., Gradient descent

③ Constrained optimization  
e.g., linear programming

ML is multidisciplinary field.

ML uses mechanisms / techniques / algorithms from

- Artificial Intelligence
- probability & statistics
- complexity theory
- control theory
- information theory
- philosophy
- psychology
- neurobiology
- and other fields

Learning = improving with experience at some task

i.e.,  $\rightarrow$  improve over task  $T$   
 $\rightarrow$  with respect to  
performance measure  $P$   
 $\rightarrow$  based on experience  $E$

Learning =  $(T, P, E)$

- $\uparrow$
- Classification
- Categorization / clustering
- planning / control
- prediction
- others

