

CO70050 Introduction to Machine Learning

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1 Definitions

1. **Artificial Intelligence:** Techniques that enable computers to mimic human behaviour and intelligence. It could be using logic, if-then rules, machine learning, etc.
2. **Machine Learning(ML):** Subset of AI techniques using statistical methods that enable the systems to learn and improve with experience.
 - More data means more accurate predictions.
 - Select/Extract good features for predictions. more feature \nRightarrow better prediction (curse of dimensionality: increased computational complexity, data sparsity, overfitting)
 - Pipeline: feature encoding, ML algorithm, and evaluation.
3. **Deep Learning:** Subset of machine learning techniques using multi-layer Artificial Neural Networks(ANN) and vast amounts of data for learning.
4. **Supervised learning:** Take input variables and correct output labels as inputs, feed them into a supervised learning algorithm to generate a model which can be used to estimate labels of other input variables.
 - **Semi-supervised learning:** Some data have labels, some do not.
5. **Weakly-supervised learning:** Inexact output labels.
5. **Unsupervised learning:** Take input variables only, feed them into an unsupervised learning algorithm to generate a model which can be used to estimate labels of other input variables.
 - discover hidden/latent structure within the data (“lossy data compression”)
6. **Reinforcement learning:** Largely the same as unsupervised learning, except that the estimated labels at the end “interact with an environment” and send reward signal back to the reinforcement learning algorithm such that the algorithm will take the reward signal into consideration when learning the model next time.
 - find which action an agent should take, depending on its current state, to maximise the received rewards (Policy search)
7. **Classification:** The task of approximating a mapping function from input variables to discrete output variables.
8. **Regression:** The task of approximating a mapping function from input variables to continuous output variables.
9. **Lazy Learner:** Stores the training examples and postpones generalising beyond these data until an explicit request is made at test time.
10. **Eager Learner:** Constructs a general, explicit description of the target function based on the provided training examples.

11. **Non-parametric model:** Assume that data distribution cannot be defined in terms of a finite set of parameters. It can be viewed as having infinitely many parameters.
12. **Underfitting/high bias:** a lot of errors, oversimplified assumptions.
13. **Overfitting/high variance:** fits “perfectly” the training data, and may not fit the test data well.