19Z601- Machine Learning

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Syllabus

INTRODUCTION : Types of Learning - Designing a learning system - concept learning - **Find-s Algorithm - Candidate Elimination** - Data Preprocessing - Cleaning - Data Scales - Transformation - **Dimensionality Reduction**. (9)

LINEAR MODELS : Linear Regression Models ,Maximum Likelihood Estimation - Least Squares - Bias-Variance Decomposition - Bayesian Linear Regression - **Linear Models for Classification**, **Probabilistic Generative Models - Probabilistic Discriminative Models** - **Linear Discriminant Analysis** (9)

Syllabus

NEURAL NETWORKS AND DECISION TREES : **Feed-forward Networks - Network Training - Delta Rule- Gradient Descent – Error Backpropagation - Regularization in Neural Networks - Generalisation - Decision Tree Learning- Representation - Inductive Bias- Issues** (9)

KERNEL AND GRAPHICAL METHODS : **Constructing Kernels - Radial Basis Function Networks – Gaussian Processes - Maximum Margin Classifiers - SVM - Bayes Theorem - Naive Bayes - Bayesian Networks** (9)

Syllabus

UNSUPERVISED AND REINFORCEMENT LEARNING : Measures of Similarity and Dissimilarity - Clustering - Partitioning methods - KMeans - Hierarchical Methods - Outliers - Reinforcement Learning - Reinforcement Learning Tasks - **Q-learning** (9)

Text Books and Reference Books

TEXT BOOKS:

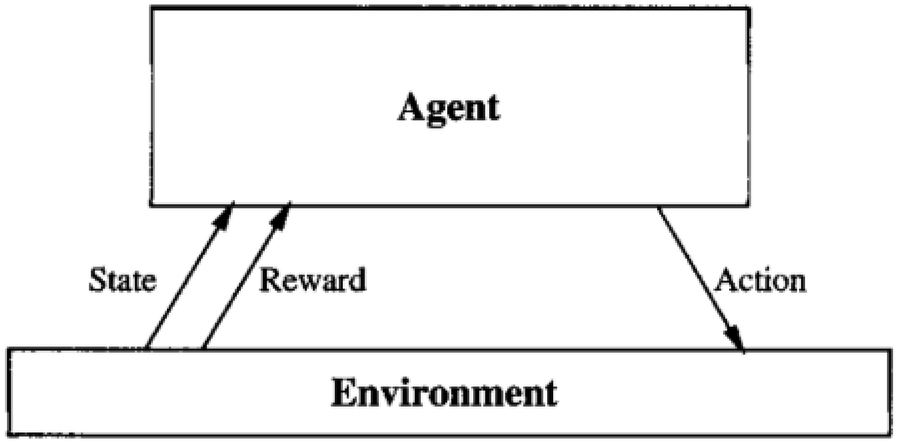
1. **Tom Mitchell , "Machine Learning", McGraw Hill, 2017.**
2. **Christopher M Bishop , "Pattern Recognition and Machine Learning Learning", Springer, 2011.**

REFERENCES:

1. Ethem Alpaydin , "Introduction to Machine Learning", 3rd Edition, PHI Learning, 2015.
2. Trevor Hastie, Robert Tibshirani, Jerome friedman , "The Elements of Statistical learning", 2nd Edition, Springer, 2017.
3. Kevin Murphy , "Machine Learning - A Probabilistic Perspective", MIT Press, 2012.
4. Yaser S. Abu-Mostafa , "Learning from Data", AML, 2017.

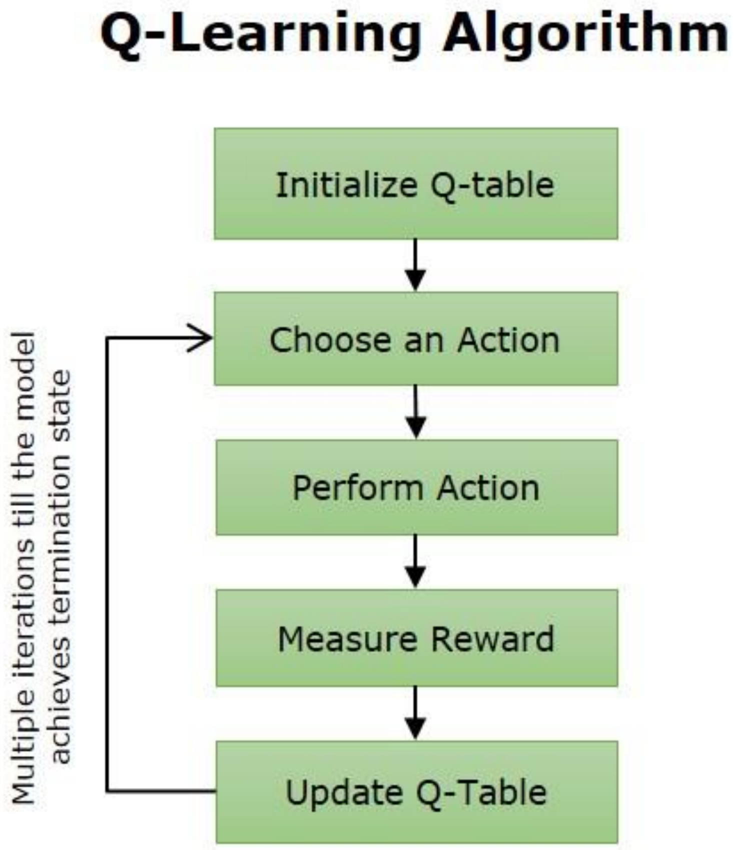
Reinforcement Learning

- Reinforcement learning addresses the question of **how an autonomous agent that senses and acts in its environment can learn to choose optimal actions to achieve its goals.**



- **An agent interacting with its environment.**
- **The agent exists in an environment described by some set of possible states S.**
- **It can perform any of a set of possible actions A.**
- **Each time it performs an action a, in some state st the agent receives a real-valued reward r, that indicates the immediate value of this state-action transition.**
- **This produces a sequence of states s_i, actions a_i, and immediate rewards r_i as shown in the figure.**
- **The agent's task is to learn a control policy, π: S + A, that maximizes the expected**
- **sum of these rewards, with future rewards discounted exponentially by their delay.**

Q Learning



$$Q(s,a) = r(s,a) + \alpha \max_a Q(s',a)$$

Where,

Q(s,a) represents the expected reward for an action 'a' in state 's'.

R (s,a) represents the reward earned when action a is carried out in state 's'.

α is the discount factor, which denotes the significance of future rewards.

$\max_a$Q(s',a) represents the maximum Q-value for the next state s' and every possible action.