19Z601- Machine Learning

Presented by

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CSE

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

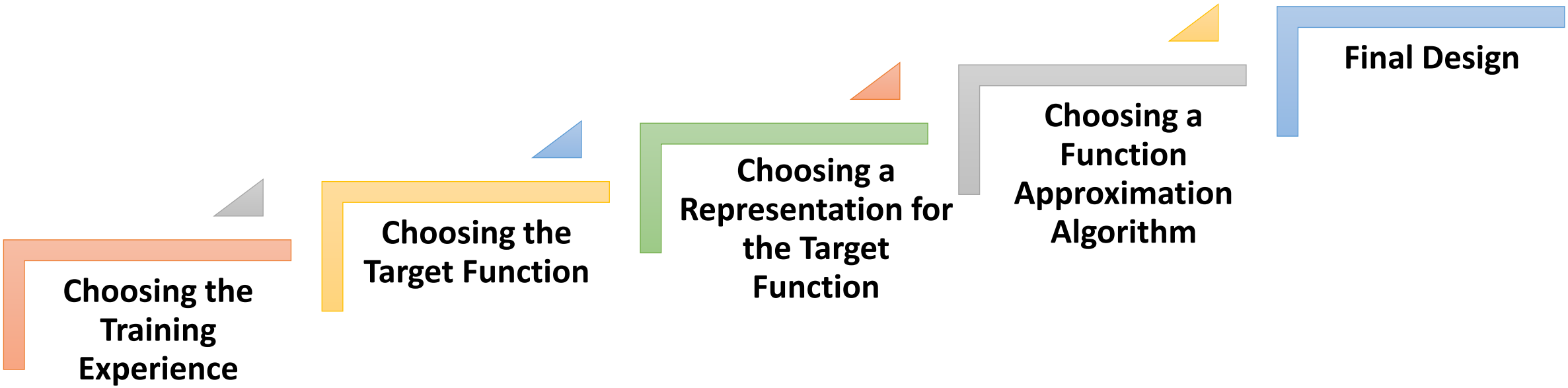
TEXT BOOKS:

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.

Designing Learning System



Choosing the Training Experience

- **Feedback**
  - Direct Feedback
  - Indirect Feedback
- **Supervisor**
  - Presence of Supervisor
  - Absence of Supervisor

	Sepal length	Sepal width	Petal length	Petal width	Class
1	5.1	3.5	1.4	0.2	setosa
2	4.9	3.0	1.4	0.2	setosa
3	4.7	3.2	1.3	0.2	setosa
⋮	⋮	⋮	⋮	⋮	⋮
150	5.9	3.0	5.1	1.8	virginica

Labeled by which supervisor ?
R.A.Fisher

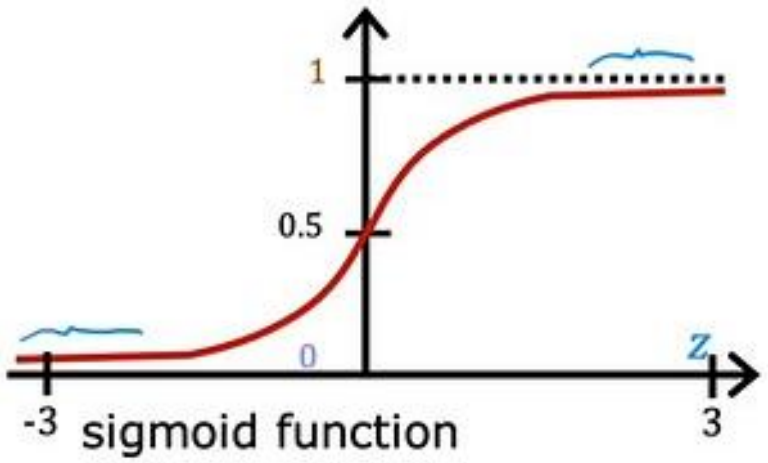
https://archive.ics.uci.edu/dataset/53/iris

Choosing the Target Function

- Type of Knowledge that needs to be learnt is determined.
- Example : Iris dataset, the knowledge to be gained is differentiation between Iris varieties based on width and length of sepal and petal.

  - Target Function : Function of Logistic Regression

    - Y (X) = g (mx + c)
    - g(X) = 1 / 1 + e^{-x}



Choosing a Representation for the Target Function

$$V = w_0 + w_1x_1 + w_2x_2 + w_3x_3$$

Regression task equation for checkers game.

x_1 , x_2 , x_3 represent different **board features**

w_1 , w_2 , w_3 represent **weights**

$$Y(X) = g(mx + c)$$
$$g(X) = 1 / 1 + e^{-x}$$

Classification task based equation for IRIS flower classification (IRIS dataset)

Choosing a Function Approximation Algorithm

- **Focus :** Choose weights and fit the given training samples effectively
- **Aim :** To **reduce error** given as :

$$E \equiv \sum_{Training\ Samples} [V_{train}(b) - \hat{v}\ (b)]^2$$

$\hat{v}\ (b)$ **is the predicted hypothesis**

- **Weight updation**

$$w_i = w_i + \mu * error\ (b) * x_i$$

Final Design

- **Performance System :** To allow the game to play against itself
- **Critic System :** To generate the samples
- **Generalizer System :** To generate a hypothesis based on samples
- **Experimenter System :** To generate a new system based on the currently learnt function.