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ML Assignment 3

1) What is AdaBoost in machine learning ?

Ans.1) AdaBoost is a Boosting based Ensemble learning algorithm.

2) This also uses Decision tree like Random Forest but the concept is very much different than Random Forest.

3) Here boosting basically means that a weak learner turns into a strong learner in an iterative process.

4) Firstly, the algorithm starts as a weak learner which basically trains on the dataset and builds a baseline Decision tree model.

5) The improvement process continues as after the first decision tree model, it looks at which data points during training have been misclassified.

6) The focus is turned towards the misclassification and the tree nodes and decisions are adjusted according to it which basically means the adjusting of weights or cost which are assigned to the nodes while building the tree.

7) The iterative process continues till the final Decision tree model has not been created which provides perfect classification. This is basically the working of AdaBoost algorithm.

8) AdaBoost can be implemented using Scikit using the following statements:

```
from sklearn.ensemble import AdaBoostClassifier
clf = AdaBoostClassifier(n_estimates = 100, random_state = 0)
```

9) Diagramatic representation of AdaBoost is :

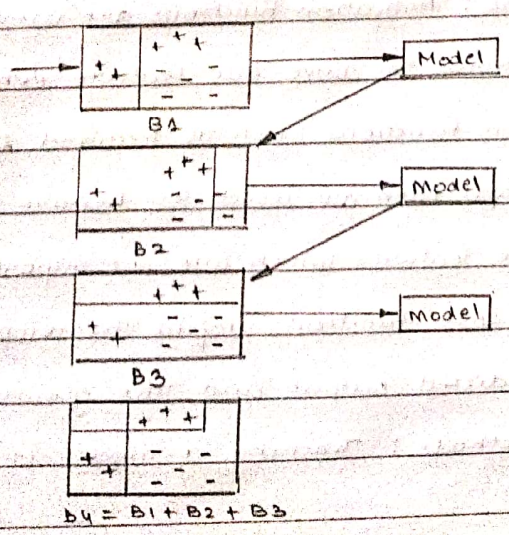

Fig : AdaBoost

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16) AdaBoost algorithm advantages:

i) Very good use of weak classifiers for cascading.

ii) Different classification algorithms can be used as weak classifiers.

iii) AdaBoost has a high degree of precision.

iv) Relative to the bagging algorithm and Random Forest Algorithm, AdaBoost fully considers the weight of each classifier.

2) Define Deep Learning. Explain common architectural principles of deep networks.

Ans:- Deep learning is a subfield of machine learning concerned with algorithms inspired by the structure and function of brain called artificial neural networks.

- They are a set of algorithms built to simulate the activity of the brain - specifically, pattern recognition and the passage of input through various layers of simulated neural connections.
- Deep network consists of input layer, output layer and multiple hidden layers which represent feature hierarchy.

Architecture principles of deep networks.

1) Parameters - Parameters in neural network relate directly to the weights on the connections in the network.

2) Layers - Layers define the stack of neurons in one dense function of neural networks. The customization of layers can be done with change in the type of activation functions.

3) Activation Functions : Activation functions are used in specific architectures to drive out feature extraction. Multiple activation functions such as Rectified Linear Unit (ReLU), tanh, hard tanh are used for feature learning and eliminate features which are not important.

4) Loss Function : Loss functions define the comparison between the predicted output and the ground truth.

5) Optimization methods : Training a model in ML involves

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Finding the best set of values for the parameters vector of the model.

ML is an optimization problem in which we minimize the loss function with respect to the parameters of our prediction function.

6) Hyper-parameters: Hyper parameter is any configuration setting that is free to be chosen by the user that might affect performance. Hyper-parameter falls into several types:

(i) Layer size

(ii) momentum, learning rate

(iii) Activation functions

(iv) weight initialization

(v) Loss functions.

(vi) Number of epochs.

(vii) Sample used per epoch in training and validation set.

(viii) Normalization scheme

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