Machine learning – Assignment - 2

1. Define Perceptron with representation and write the Gradient Descent algorithm for training a Linear Unit.
2. Differentiate:
   (i) Standard Gradient Descent and Stochastic Gradient Descent.
   (ii) Perceptron training rule and Delta Rule.

3. Apply the perceptron training rule on the following training set.
   Desired output : t1= -1, t2 = -1, t3 = 1
   Learning rate: $\eta = 0.1$

$$\text{Initial weights are : } w = \begin{pmatrix} 1 \\ -1 \\ 0 \\ 0.5 \end{pmatrix}$$

$$X1 = \begin{pmatrix} 1 \\ -2 \\ 0 \\ -1 \end{pmatrix} \quad X2 = \begin{pmatrix} 0 \\ 1.5 \\ -0.5 \\ -1 \end{pmatrix} \quad X3 = \begin{pmatrix} -1 \\ 1 \\ 0.5 \\ -1 \end{pmatrix}$$

4. List about the characteristics of the problems for which ANN is best suitable
5. Derive the weight vector with respect to Perceptron Training Rule and Delta Rule.
6. Apply the Back propagation algorithm on the multilayer feed-forward neural network and update the weights. Assume that the learning rate η is 0.9 and the first training example, X = (1, 0, 1) whose class label is 1
   Initial input and weight values are :

x_1	x_2	x_3	w_{14}	w_{15}	w_{24}	w_{25}	w_{34}	w_{35}	w_{46}	w_{56}	w_{04}	w_{05}	w_{06}
1	0	1	0.2	-0.3	0.4	0.1	-0.5	0.2	-0.3	-0.2	-0.4	0.2	0.1

7. Define MAP (Maximum A Posteriori) and ML (Maximum Likelihood) Hypothesis. Derive the relation h_{MAP} and h_{ML} using Bayesian theorem
8. Explain the Naïve Bayes Text classification algorithm
9. Write and apply the Bayes theorem on the following data set:

Chills	Runny nose	Headache	Fever	Flu?
Y	N	Mild	Y	N
Y	Y	No	N	Y
Y	N	Strong	Y	Y
N	Y	Mild	Y	Y
N	N	No	N	N
N	Y	Strong	Y	Y
N	Y	Strong	N	N
Y	Y	Mild	Y	Y

   Test set: find the class label for flu?

Chills	Runny nose	Headache	Fever	**Flu**
Y	N	Mild	N	**?**

10. Write the features of Bayesian learning method.
11. Explain BRUTE-FORCE MAP Learning Algorithm
12. Explain Bayes theorem with equation
13. A patient takes a cancer test and the result came back positive. The test returns a correct positive results in only 98% of the cases in which disease is actually present and a correct negative result is only 97% of cases in which disease is not present. Furthermore 0.008 of the entire population have this cancer.
    (i) What is the probability that patient has cancer?
    (ii) What is MAP Hypothesis?