Graded Questions (Support Vector Machines):

1. SVM – Maximum Marginal Classifier

**Graded Questions**

**Comprehension:** **Maximal Margin Classifier**

Consider a data set with two independent variables, say X1 and X2**,** and one dependent binary variable,Y, with two class labels denoted by +1 and -1. The data set is plotted, along with a separating hyperplane (h) in the figure below.

A picture containing photo, table, man, people

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**Fig 1: Plot of the data set**

Let's say that the class label of the i-th data point is denoted by li (it can take the values -1 and 1). The weights are denoted by w0,w1,w2 and the vector of the i-th data point is denoted by Yi.

As discussed in the lectures, the following two constraints determine the equation of the maximal margin classifier:

* ∑ni=0(W2i)=1

* (liX(Wi.Yi))⩾M

The first constraint simply normalises the coefficients (weights) of the hyperplane so that their sum of their squares is one. For e.g. the line x+y+1=0 originally has weights (w0,w1,w2)=(1,1,1) which in the normalised form become (w0,w1,w2)=(1√3,1√3,1√3). In other words, the equation of the line x+y+1=0 can be written as x√3+y√3+1√3=0 in the normalised form.

The second constraint ensures that all data points are at least M distance away from the hyperplane, i.e. the margin is M. The absolute value of the dot product Wi.Yi is the distance of the point i from the hyperplane. The dot product is positive if the point i lies below the hyperplane (blue), else negative.

With the above information, please answer the questions below.

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1. SVM – Soft Margin Classifier

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1. Kernels:

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