Sessional-2 AML5102 Applied Machine Learning Pattern question

Q0: [CO 2, BT 2] 10 marks 8 questions

Consider the Linear Regression equation $Xw = \hat{y}$ where the dataset is m records and n features m ¿¿ n

1. (1 mark) What should be the dimension of X to fit into the above equation without the need for a separate intercept term?

2. (1 mark) What is the dimension of w to fit into the above equation by taking into account the intercept term?

3. (1 mark) Linear combination of all feature vectors in X with the weight coefficients is mathematically represented as _____

4. (1.5 marks) Linear combination of all feature vectors in X with the weight coefficients is located in ambient dimension of _____ but really located on a hyperplane of _____ dimension within that ambient space

5. (1.5 marks) What is the equation for the vector corresponding to dotted line in the following diagram? Hint: Dotted line vector is orthogonal to Xw
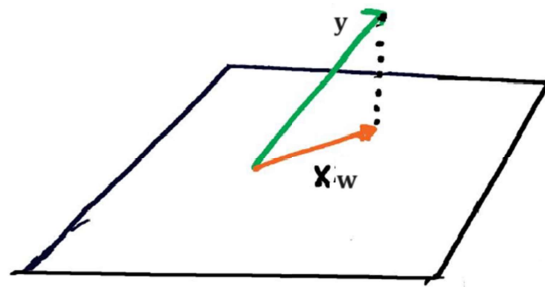

Figure 1: Linear Regression representation

6. (1 mark) Every vector of X located in the hyperplane is orthogonal to the dotted line vector. How will you mathematically represent this ? Hint: Use the relation between orthogonality and dot product

7. (1.5 marks) Arrive at the normal equation for linear regression from the answer you wrote for 6.

8. (1.5 marks) Arrive at the objective function for linear regression in vector format by exploiting the idea that the objective function is nothing but minimization of the L2 norm of the dotted line