**Theory:**

**Question 3**

Write your answers for the following question in the report.

1. What is Naive Bayes’ assumption? How does it help? Explain with an example.
2. For a Gaussian Bayes classiﬁer, which one of these structural assumptions is the one that most affects the trade-off between underﬁtting and overﬁtting:
   1. Whether we learn the class centers by Maximum Likelihood or Gradient Descent
   2. Whether we assume full class covariance matrices or diagonal class covariance matrices.
   3. Whether we have equal class priors or priors estimated from the data.
   4. Whether we allow classes to have different mean vectors or we force them to share the same mean vector
3. Consider a two-class one-feature classiﬁcation problem with the following Gaussian class-conditional densities. p(x|w1) = N(0, 1) and p(x|w2) = N(1, 2).

Assume equal prior probabilities and 0-1 loss function. Solve the following two questions and show your work.

* 1. What is the Bayes decision boundary?
  2. Suppose the prior probabilities are changed as follows: P(w1) = 0.6 and P(w2) = 0.4. How will the decision boundary change?

1. Consider the multivariate normal density for which σij = 0 and σii = σi 2 , i.e., Σ = diag(σ1 2 , σ2 2 , ..., σd 2 ).
   1. Show that the evidence is



* 1. Plot and describe the contours of constant density.

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