TDA 231 Machine Learning: Homework 0

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Theoretical Problems

Problem 1.1

Bayes' rule: $P(Pos|Pos_{Res}) = \frac{P(Pos_{Res}|Pos)P(Pos)}{P(Pos_{Res})}$ That is, the probability of being positive given a positive result is equal to the probability of getting a positive result given that you are positive multiplied by the probability of being positive, divided by the probability of getting a positive result.

$$P(Pos_{Res}|Pos) = 0.99, P(Pos_{Res}) = (0.99)(0.0001) + (0.01)(0.9999) \approx 0.01$$

$$P(Pos) = 0.0001$$

$$P(Pos|Pos_{Res}) = \frac{(0.99)(0.0001)}{0.01} = 0.0099$$

Problem 1.2

$$cov(X, Y) = E[XY] - E[X]E[Y]$$

$$E[X] = \mu_X = 0$$

$$cov(X, Y) = E[XY] = E[X.X^2] = 0$$

Practical Problems

Problem 2.2

In figure 3, we see the correlation and covariance matrices for X and Y, with low ad high values represented in blue and yellow respectively. It is evident that scaling the features in X to [0,1] has a significant on the covariance but none whatsoever on the correlation between features. This follows from correlation being dimensionless, equal to covariance normalised by the product of the standard deviations of each feature. Thus changing the scale of features has an effect on the covariance but not on the correlation.

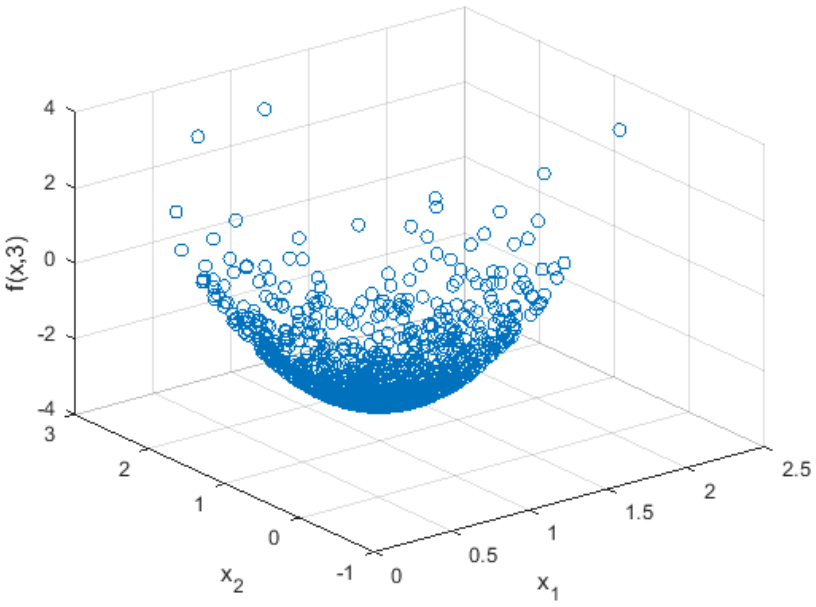

Figure 1: Problem 2.1

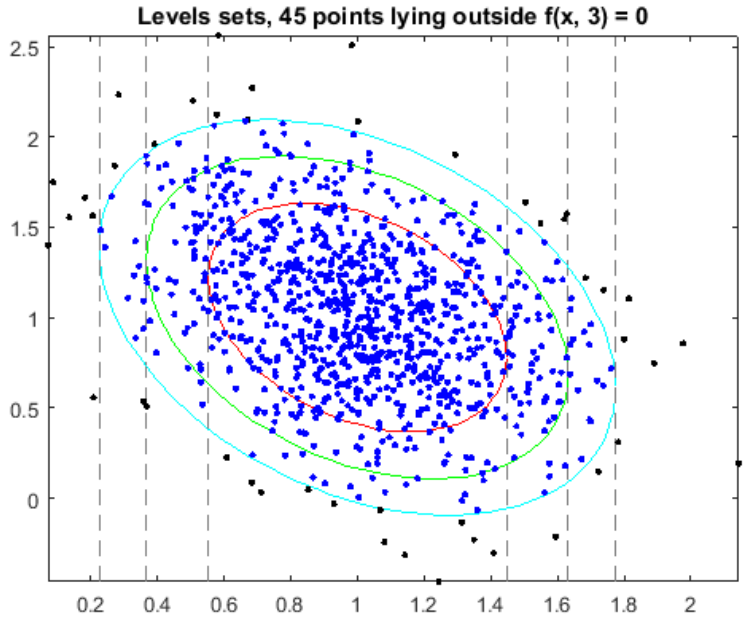

Figure 2: Problem 2.1

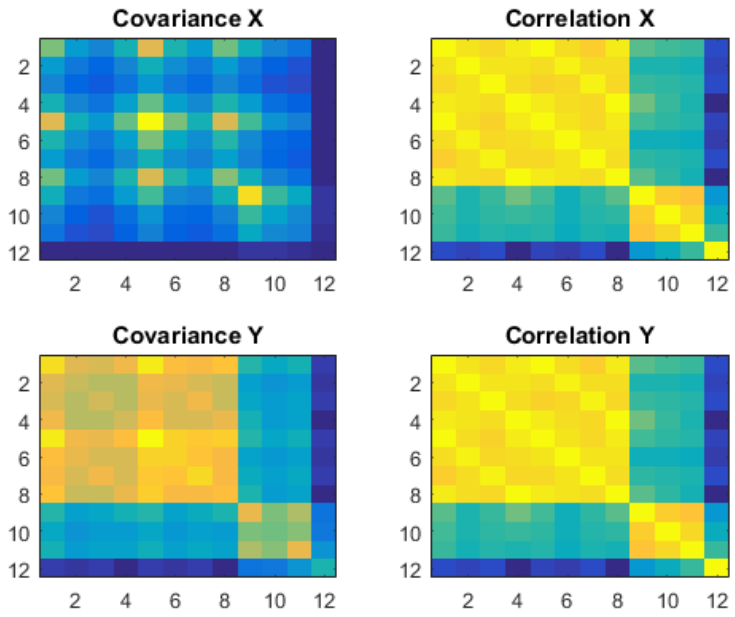

Figure 3: Problem 2.2

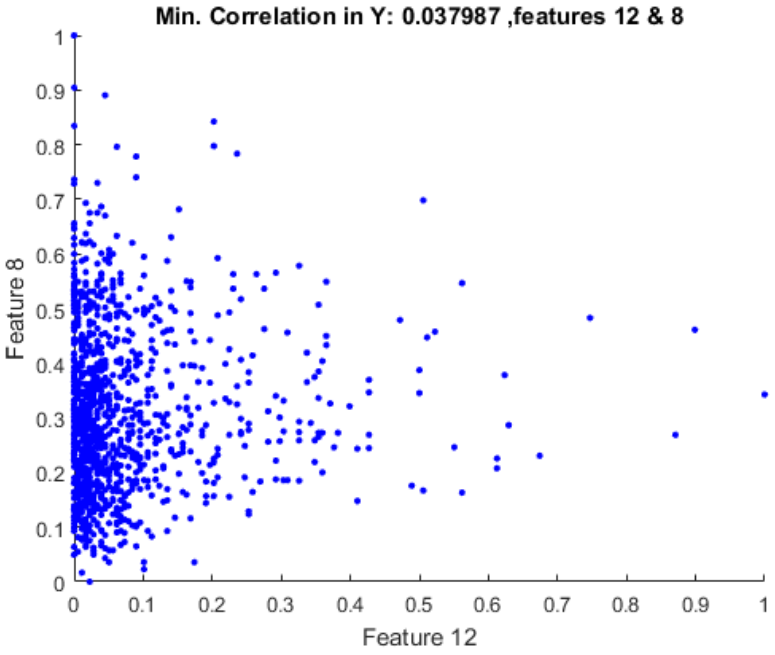

Figure 4: Problem 2.2