

# Learning Coursework: Task 1 report

April 9, 2020

## 1.2 - Correlation matrix interpretation

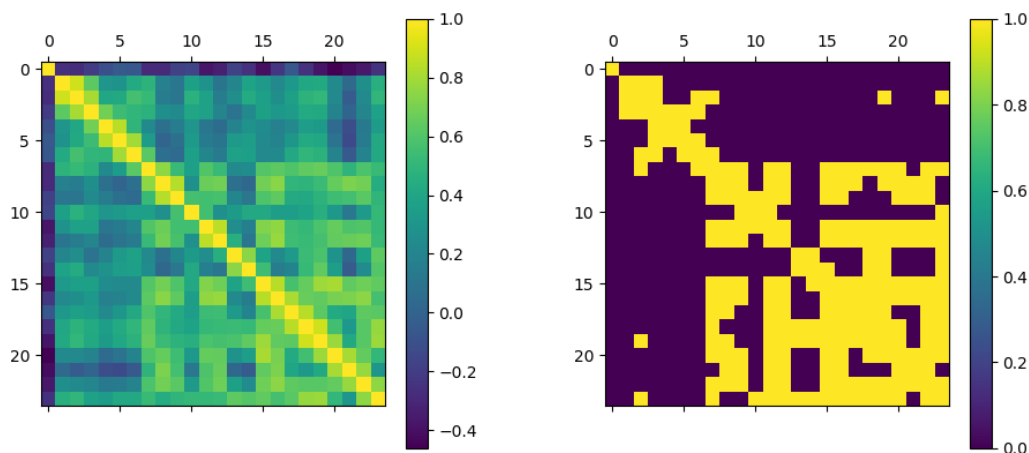


Figure 1: Covariance matrix heatmaps - the full one and one with an applied step function (1 if  $> 0.5$ ,  $-1$  if  $< 0.5$ , 0 otherwise)

### Negative correlations

As we can see on Figure 1, the only feature that is negatively correlated with others is the feature with index 0 (dark blue bars on the upper and left edges of the matrix). These are weak negative correlations, as they are bounded below by about  $-0.4$ .

### Positive correlations

As we can see in the second plot on Figure 1, there are many features with high positive correlations ( $> 0.5$ , seen in yellow). We can observe two clusters of features that are mostly correlated with each other - features  $[1, 6]$  and features  $[7, 23]$  (the rectangles that contain all the pairs of features within these intervals are mostly yellow).

### 1.3

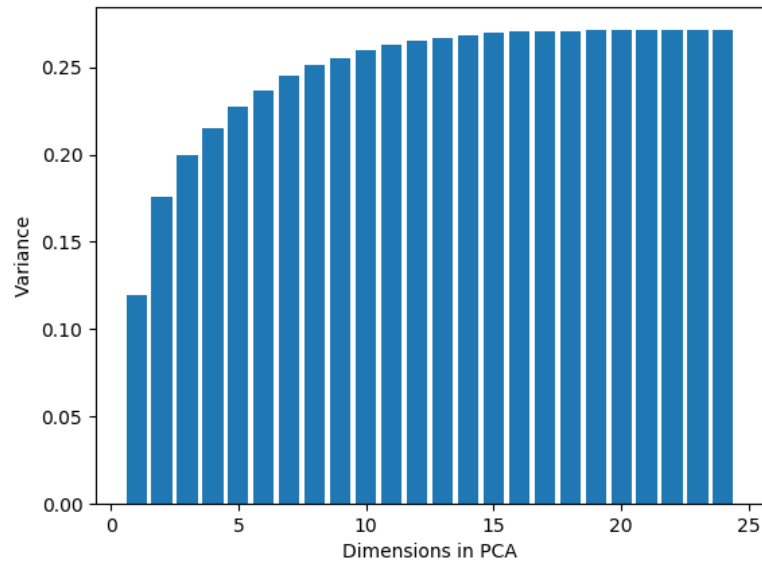


Figure 2: **Task 1.3b - Cumulative variance graph**; it can be seen that the marginal gain is decreasing with each new dimension

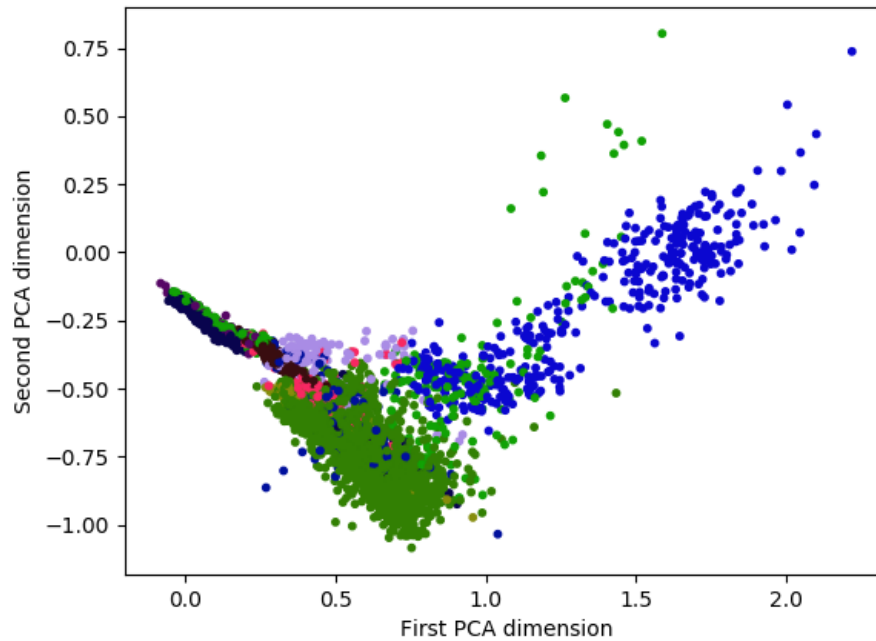


Figure 3: **Task 1.3c - 2D-PCA plane**; labels have unique colours assigned

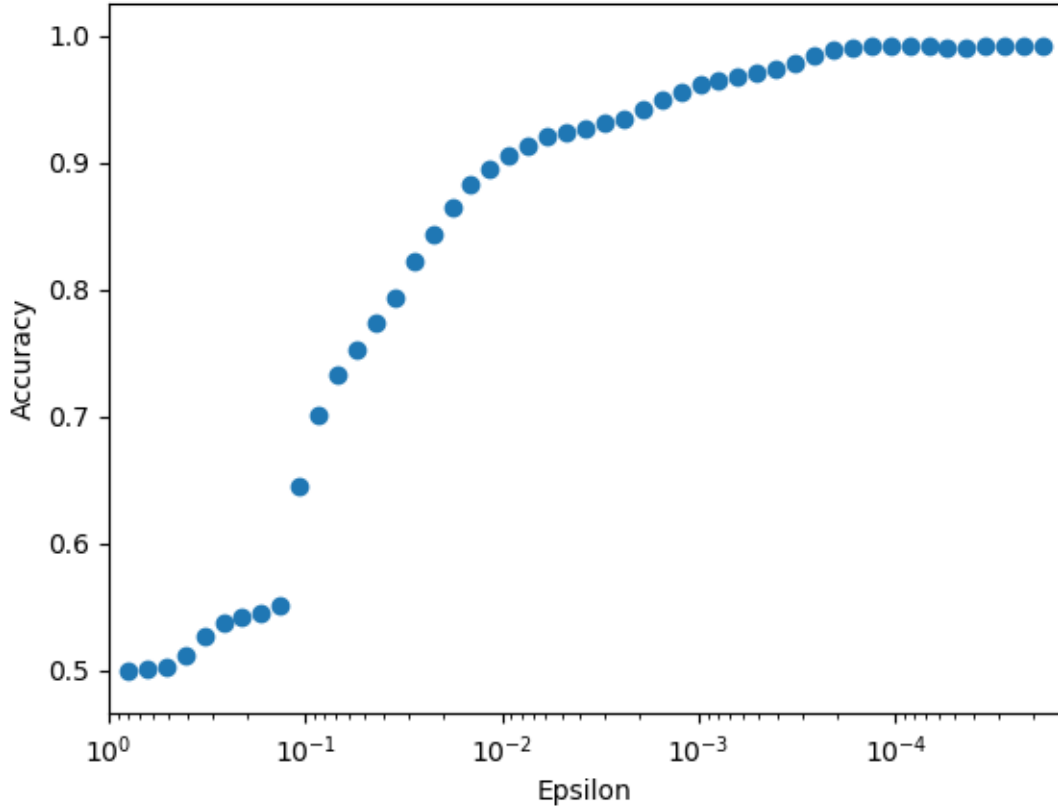


Figure 4: 1.5 - Impact of the epsilon on accuracy; logarithmically scaled x-axis

#### 1.4b - Accuracy vs Covariance Matrix Type

CovKind	<i>Full</i>	<i>Diagonal</i>	<i>Shared</i>
Accuracy	90.101%	83.028%	88.271 %

#### 1.5 - Regularisation parameter analysis

Intuitively, we would expect the accuracy to drop when taking bigger epsilons, as this makes the approximation of the covariance matrix worse. Figure 4 confirms that; the accuracy increases when we take smaller epsilons. What is more, the plot becomes nearly flat for  $x < 10^{-4}$ , so there is no benefit from taking smaller epsilons than that.