Cazzola Michele s323270

# MACHINE LEARNING AND PATTERN RECOGNITION

Project task

## Laboratory 2 – Loading and visualization

1. For each feature, both classes exhibit a unimodal distribution with Normal shape, and they overlap in the central part of their domain:
   * the mean values are the same (approximately 0) for both features and their respective classes.
   * the variances are different:
     + approximately 0.6 for the fake class of feature 1 and the genuine class of feature 2.
     + approximately 1.4 for the genuine class of feature 1 and the fake class of feature 2.

We observe that, for each feature, the class with the lower variance exhibits the highest modal frequency (peak value).

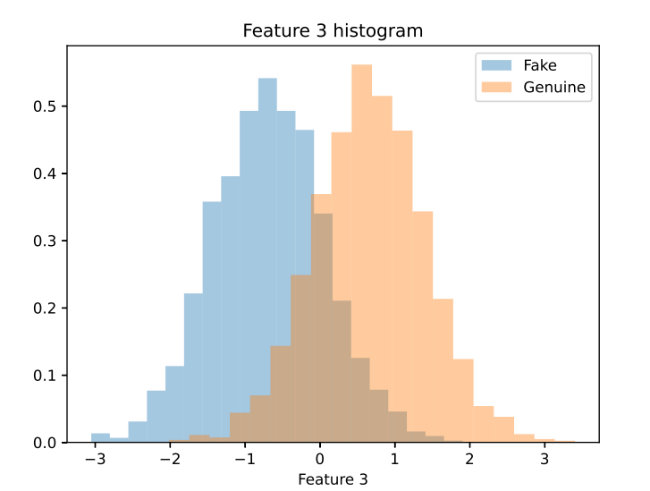
Immagine che contiene diagramma, schermata, testo, Diagramma

Descrizione generata automaticamenteImmagine che contiene diagramma, schermata

Descrizione generata automaticamente

1. For each feature, both classes demonstrate a unimodal distribution with Normal shape, and they overlap on their respective sides; for each pair of classes within each feature:
   * the mean values are opposite but nearly equal in magnitude (between 0.6 and 0.7).
   * the variances are nearly equal (between 0.5 and 0.6).

We observe that, for each feature, the classes display the similar modal frequencies.

Immagine che contiene diagramma, testo, schermata, Diagramma

Descrizione generata automaticamente

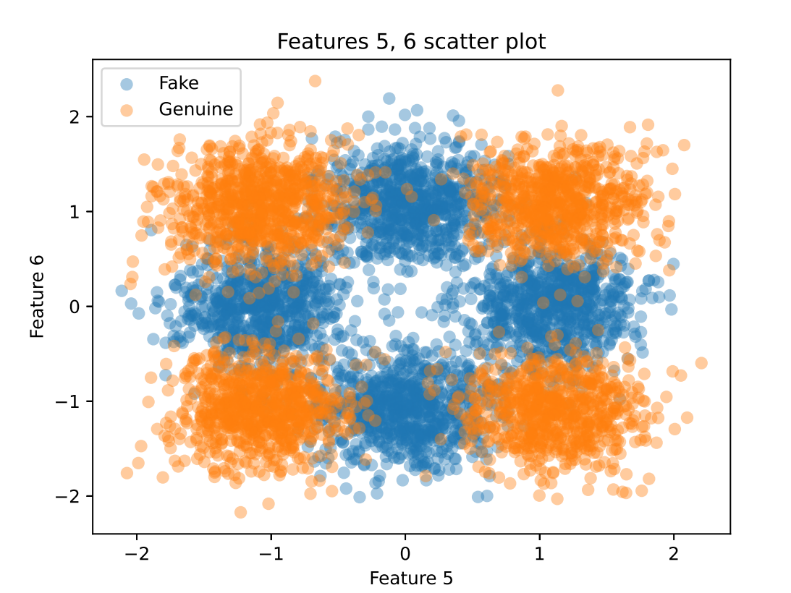
1. For each feature, the fake class displays a unimodal distribution, while the genuine class exhibits a bimodal distribution:
   * for the fake class, the modal values are opposite.
   * for the genuine class, the modal value is approximately 0.

We observe that they overlap around the modal values of the fake class distribution, while the overlapping is minimal in the central part of the domain.

Immagine che contiene testo, diagramma, schermata, Diagramma

Descrizione generata automaticamenteImmagine che contiene testo, diagramma, schermata, Diagramma

Descrizione generata automaticamenteFurthermore, the scatter plots highlight the presence of four clusters for each class.



## Laboratory 3 – Dimensionality reduction

1. By applying PCA, we get these histograms of the six different projected features, in descending order of explained variance:Immagine che contiene testo, schermata, diagramma, Diagramma

   Descrizione generata automaticamenteImmagine che contiene testo, diagramma, schermata, Diagramma

   Descrizione generata automaticamenteImmagine che contiene testo, diagramma, schermata, mappa

   Descrizione generata automaticamenteImmagine che contiene testo, schermata, diagramma, Diagramma

   Descrizione generata automaticamenteImmagine che contiene schermata, diagramma, testo, Diagramma

   Descrizione generata automaticamenteImmagine che contiene schermata, diagramma, Diagramma, testo

   Descrizione generata automaticamente