Biometric Person Authentication – Seminar
Summer Semester 2024
Quality and Usability Lab, TU Berlin

Assignment 1 – Due on 27 May 2024 at 23:59 CEST

2 questions with total marks of 8

Question 1 - Bivariate Statistics (5 marks)

The file DavisData.xlsx contains a table of the body mass in kg and body height in cm of 200 students at the University of California Davis. Consider each student sample as a two-dimensional vector (mass, height) and note that each sample is tagged as female or male. Assuming that each gender has a *bivariate normal distribution* of body mass and body height:

a) Determine the mean vectors μ_F and μ_M for the female and the male students **(1 mark)**
b) Determine the covariance matrices Σ_F and Σ_M for the female and the male students **(1 mark)**
c) Determine the mass and height standard deviations and mass-height correlation coefficients for the female and the male students **(1 mark)**
d) Explain in plain English what your statistical analysis in a) to c) tells you about this population of 200 students **(2 marks)**

Question 2 - Pattern recognition (3x1 = 3 marks)

Given the data of Question 1 and three test samples (60, 169), (71, 174) and (70, 173), use the function `mvnpdf(x,mu,Sigma)` to calculate the likelihoods of each sample x_i being male (against μ_M and Σ_M) and being female (against μ_F and Σ_F).

a) Classify the test samples with equal prior probabilities and equal misclassification costs.
b) Classify the test samples with prior probabilities of P(F)=0.8 and P(M)=0.2, and equal misclassification costs.
c) Classify the test samples with the prior probabilities of b) and misclassification costs of $\lambda_{MF} = 0.5$ [classify a real female as male] and $\lambda_{FM} = 2.0$ [classify a real male as female].

End of main part of the assignment.