**Computational Social Intelligence COMPSCI4080  
Assessed Exercise Part-II Report**

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**Introduction - Facial expression analysis**

Facial expression analysis can be a difficult task, as it is hard to describe facial behaviour as

interpreted by human observation in a way that can be used in the context of machine

learning.

A way to solve this issue is to employ the facial movement measurement techniques created

by Ekman and Friesen, grouped under the name of the “Facial Action Code”. This method

maps visible facial movements made by specific muscular actions to “Action Units”, with a

value representing the degree to which that AU is being used in the current expression. This

allows us to record facial expressions as feature vectors, where the features are values

corresponding to each of the AUs.

**Gaussian Discriminant Functions**

In this task, a classifier was designed based on the concepts of Gaussian Discriminant

Functions.

This method utilises the following formula derived from Bayes rule for calculating the

likelihood of observing a particular value of a feature x i when it’s class is C k using the mean

and standard deviation, across all values of of that feature for that class μ*ik* σ*ik* in the training

set.

We are able to use this formula by assuming that all of our features

**Methodology**

* A description of the experimental setup (training and test set, etc.);

**Problem Statement:**

* The data (files “training-part-2.csv” and “test-part-2.csv”) includes 52 feature vectors extracted from 52 face images, split into training and test set. Half of the vectors (26) have been extracted from smiling faces, while the other half (26) have been extracted from faces of people displaying frown.
* Every record of the csv files includes one feature vector and its respective class:
* • The feature vectors include 17 components that account for the activation level of 17 Action Units (AU01, AU02, AU04, AU05, AU06, AU07, AU09, AU10, AU12, AU14, AU15, AU17, AU20, AU23, AU25, AU26, AU45).
* • The class is either “smile” or “frown”.
* The minimum value of the features is zero (meaning that the muscles underlying an Action Unit are not active) and larger values correspond to higher activation.
* **3.The Assessed Exercise**
* The goal of the second part of the exercise is to develop a classifier capable to automatically map every vector into its class:
* • The classification approach must be based on Gaussian Discriminant Functions (see Lecture 13 and associated texts);
* • The approach should make the assumption that the features are statistically independent given the class (see Lecture 13 and associated texts);
* • The Gaussian Discriminant Functions must be trained over the training set and tested over the test set;
* • The results have to be reported in terms of error rate, the percentage of times your approach maps a vector into the wrong class (see Lecture 14 and associated texts).
* But you must implement the Gaussian Discriminant Functions (the code must be attached to the report). The use of packages implementing the Gaussian Discriminant functions is not allowed.

**Results**

**Appendix**

**References**

1. F.Camastra and A.Vinciarelli, “Machine Learning for Audio, Image and Video Processing”, Springer Verlag, F.Camastra and A.Vinciarelli, “Machine Learning for Audio, Image and Video Processing”, Springer Verlag, 2008
2. [P.Ekman and W.E.Friesen, "Measuring Facial Actions", Environmental Psychology and Nonverbal Behavior, 1976](https://moodle.gla.ac.uk/mod/resource/view.php?id=2576082)
3. Baltrušaitis, Robinson, and Morency, “Openface: an open-source facial behavior analysis toolkit”, IEEE Winter Conference on Applications of Computer Vision, 2016