MIDDLE EAST TECHNICAL UNIVERSITY, NORTHERN CYPRUS CAMPUS
CNG483 Introduction to Computer Vision – Assignment 1

Date handed out: **22 April 2022**
Date submission due: **06 May 2022 23:55**

Content Based Image Classification

Objectives: The purpose of this project is to familiarize you with the fundamental content-based image classification (CBIC) pipeline. The project is expected to make you gain insight about the computer vision research and evaluation methods.

Description: In this project you are required to implement a CBIC system based on features and to evaluate it with the provided dataset using KNN classifier. All evaluations should be reported in a 3-4 pages long paper prepared in the format of given template. The text continues with detailed explanations of the methods and requirements.

Content Based Image Classification (CBIC): The main purpose of the CBIC systems is to classify a query (test) image into one of the categories given in a large database. The classification should be done by comparing semantic contents of the images in the database and the query. However, as we all know, images are represented as a collection of numbers (i.e. pixels) in the lowest level. Hence, there is a difficulty in matching images, which is called the "semantic gap". In order to overcome this difficulty, images should be described as semantically meaningful feature vectors which are (semantically) higher level representations than collection of numbers. You are going to implement some of these higher-level representations in scope of this assignment, but let us first take a glance of the general structure of the CBIC system. The CBIC system pipeline starts with feature extraction of the query image and all other images in the database as seen in the Figure 1. After obtaining all the features, a similarity test is applied between the features of each image in the database and the query image. Finally, based on the result of classification, the most similar images are identified and assigned to appropriate class label.

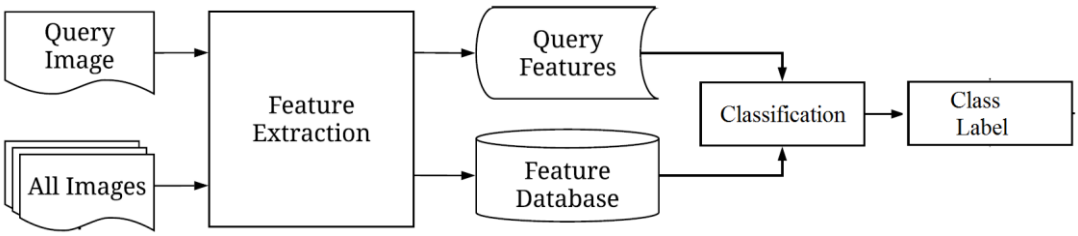

Figure 1: CBIC system pipeline

Requirements: You are required to implement the aforementioned CBIC system using feature extraction technique (will be your decision, you only cannot used grid and histogram-based feature extraction), using Euclidean distance and KNN classifier with 5 different values of K (1, 3, 5, 7 and 9).

After implementation, you should evaluate your CBIC system with different configurations using the provided validation queries and the database.

Finally, you will display the classification results as a plot and display the most successful configuration based on your plotted results.

An important hint about the implementation is saving results of intermediate steps. Since feature extraction for the whole database is a time-consuming process, saving the results for reuse is strongly recommended. Also, you may want to visualize intermediate steps, so you can monitor if you are going well or not.

Database: Database contains 10 Classes. The training set consists of 787 images. The validation set includes 105 images. A query is simply the name of an image whose content will be used for classification. For these queries, the ground truth results (class labels) are the names of the folders. This allows you to evaluate your implementation and do experiments. The report will be based on the observations in the experiments for these validation queries.

Programming Requirements:

In this assignment, you can use MATLAB or Python for the implementation. Your file name should be your name_surname_id. You can use built-in functions. You must use comments and explain what your code is doing step by step.

Submission Requirements:

- You can only submit one file with all functions defined inside it.
- I will put your code inside the "Database" folder which is given to you and run the code. Hence, you must implement your code to work properly accordingly.
- Uncompiling codes will be graded as zero.
- Using grid and histogram-based feature extraction will be graded as zero.
- Late submissions will not be accepted.

Grading Policy:

Grading Item	Mark (out of 100)
Acquisition (reading data from database)	10
Feature Extraction	30
Classification K=1	26
Classification with K=3,5,7,9	14
Displaying plot of results	10
Displaying best configuration	5
Submission requirements followed	5