

Assignment #3

Image Based Biometry
Faculty of Computer and Information Science
University of Ljubljana

Face Recognition Pipeline

I. INTRODUCTION

You need to implement a face recognition pipeline and evaluate it through three stages:

- face detection,
- recognition of whole images,
- recognition of detected faces (this is face recognition pipeline evaluation).

Dataset: You will use a subset of CelebA-HQ. The dataset includes provided identities, face bounding boxes (as shown on Fig. 1, and train/test splits available in `CelebA-HQ-small.csv`, as shown in Fig. 2.

II. INSTALLATION AND PREPARATION

Since it is up to you which approaches you will use, you have to install libraries as needed. For Viola-Jones you need to install `cv2`.

INSTALLATION

- (I) Install OpenCV: `pip install opencv-python`
- (II) Install other libraries that you may need.
- (III) Download the CelebA-HQ small subset with annotations from here: <https://tinyurl.com/celebahqsmall>.
- (IV) Copy the Overleaf project from here: <https://www.overleaf.com/read/ppbyvnbqfyt>

III. TASKS

You are required to implement a face recognition pipeline and evaluate it through the following steps:

1) Face Detection:

- Use the Viola-Jones algorithm for face detection.
- Optimize its parameters for the best performance on the training part of the dataset.
- Report detection metrics using Intersection over Union (IoU).

2) Feature Extraction:

- Select and implement at least three feature extraction methods for face recognition. You may



Fig. 1. Example of face detection during November.

use implementations available in popular libraries (e.g., Scikit-learn, OpenCV).

- Probably the easiest to use methods:
 - Local Binary Patterns (LBP),
 - Histogram of Oriented Gradients (HOG),
 - Dense SIFT (using a fixed grid instead of keypoint detectors).
- 3) **Evaluation through three experiments:**
 - (I) Evaluate detection performance separately and report IoU metrics.
 - Evaluate recognition performance. Plot Cumulative Match Characteristic (CMC) curves and report Rank-1 and Rank-5 recognition accuracies:
 - (II) Whole images using each feature extractor,
 - (III) The full pipeline (Viola-Jones for detection followed by each feature extractor).

4) Report:

- Prepare a detailed report summarizing your methodology, results, and observations with the strict limit of **2 (two) pages**.
- Include all plots (e.g., CMC curves) and tabulated performance metrics (IoU, Rank-1, and Rank-5).

IV. GRADING

Your submission will be evaluated as follows:

- **3pts:** The quality and ingenuity of your solution.
- **2pts:** Quality and clarity of the submitted report.

idx	identity	x_1	y_1	width	height	split
112	114	243	196	548	779	train
123	138	271	215	540	712	test
145	114	315	195	528	748	train
181	85	221	165	556	763	train
209	27	274	216	500	690	train
212	27	279	228	513	670	train
285	138	242	199	516	735	test
290	113	266	203	524	685	train

Fig. 2. Annotations, containing image name, identity, bounding box coordinates in four columns and train/test split.

V. SUBMISSION

Submit the following on Eučilnica by the deadline:

- your scripts,
- a PDF report summarizing your approach, results, and key observations.

Oral defenses will follow. Have fun (we mean it) and experiment!