DL- class project

October 20 2021

0.1 SIFT(Scale-invariant feature transform)

0.1.1 Introduction

As the name suggests SIFT is scale invariant which means that it enables us to detect similar landmarks even if their scale is different. Here, the scale of an image landmark is defined as its rough diameter in the image which is measured in pixels). It involves the following steps

1. Feature point (also called keypoint detection)
2. Feature point Localization
3. Orientation Assignment

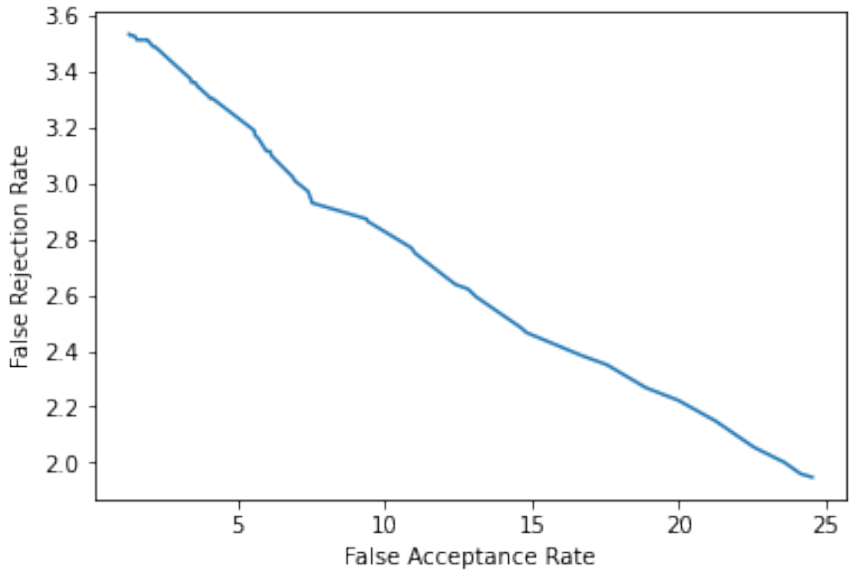

Figure 1: Receiver Operating Characteristic (ROC) Curve

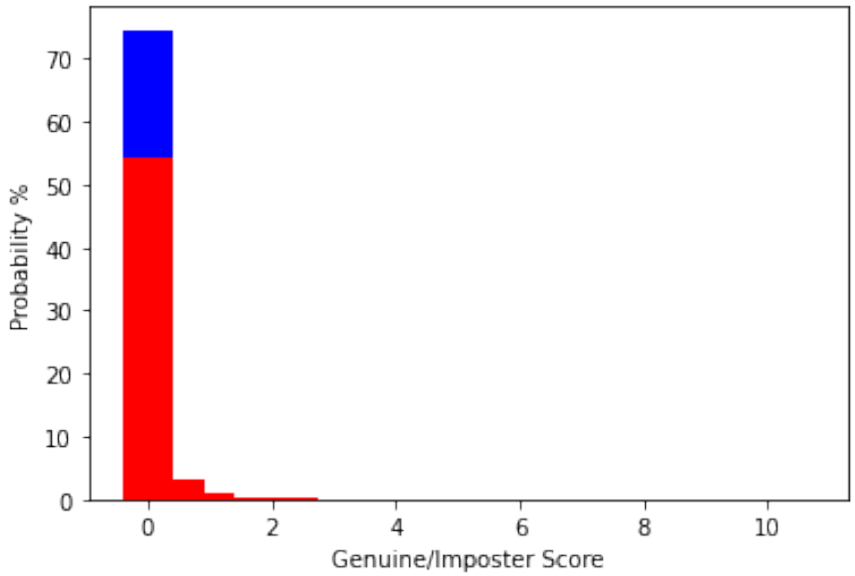

Figure 2: Genuine /Imposter Histogram

0.2 SURF(Speeded Up Robust Features)

0.2.1 Introduction

SURF is composed of two steps:

1. Feature Extraction:In order to detect interest points, SURF uses an integer approximation of the determinant of Hessian blob detector, which can be computed with 3 integer operations using a precomputed integral image.

2. Feature Description: Its feature descriptor depends on the amount of the Haar wavelet reaction around the focal point. These can likewise be processed with the guide of the fundamental picture integral image.

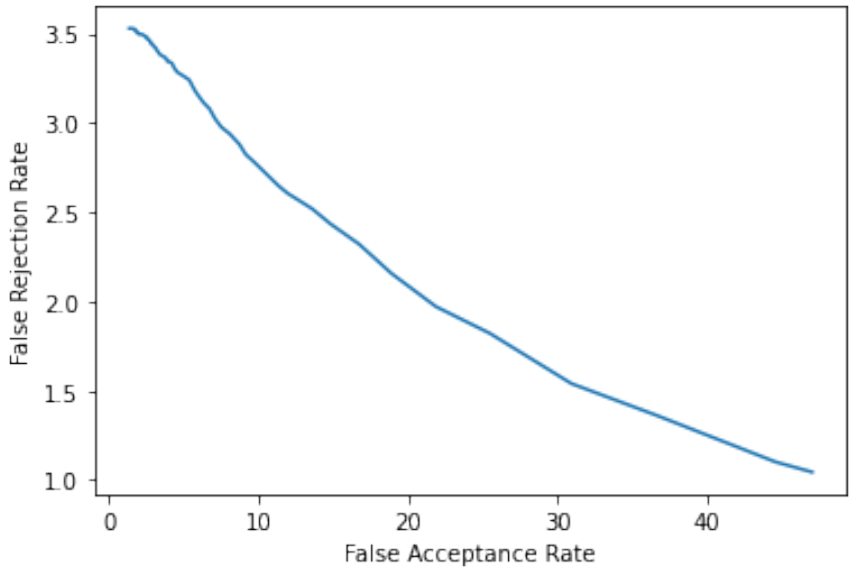

Figure 3: Receiver Operating Characteristic (ROC) Curve

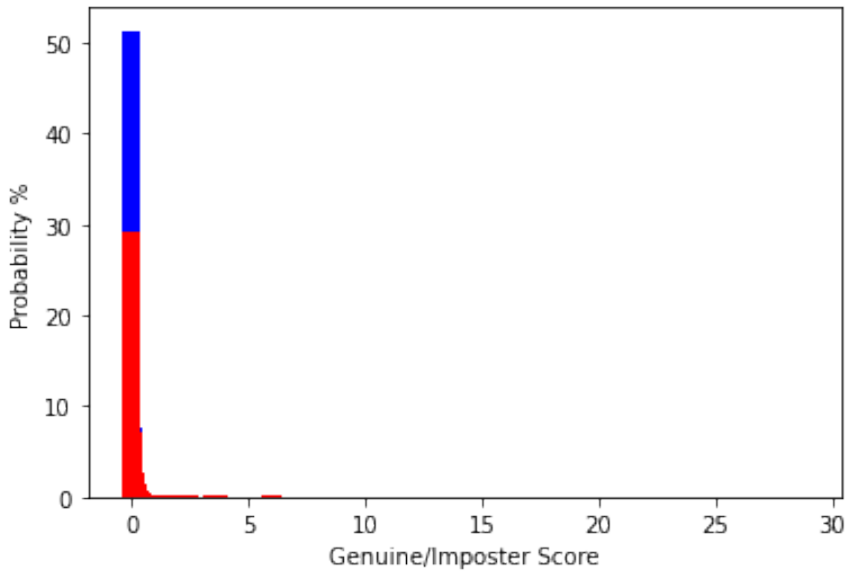

Figure 4: Genuine /Imposter Histogram

0.3 ORB (Oriented FAST and Rotated BRIEF)

0.3.1 Introduction

ORB is built on the FAST(features from accelerated segment test) keypoint detector and the BRIEF descriptor, both of which exhibit good performance and have low cost. The ORB image matching algorithm consists of three steps:

1. Feature point extraction: FAST algorithm is used here. The essential thought is that assuming a pixel is fundamentally not quite the same as the local pixels, it is bound to be a corner point
2. Generation of feature point descriptors:After extracting the feature points using FAST, for each point the descriptors are computed using BRIEF algorithm.
3. Feature point matching

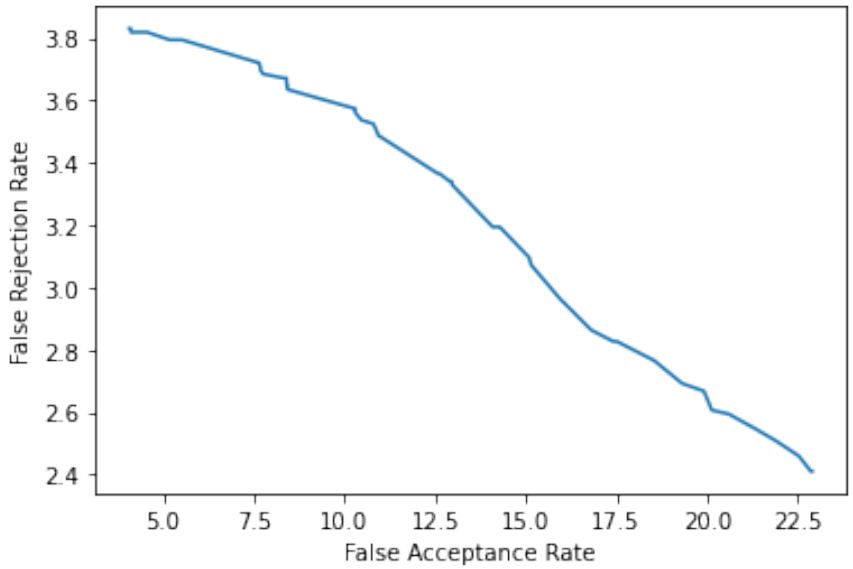

Figure 5: Receiver Operating Characteristic (ROC) Curve

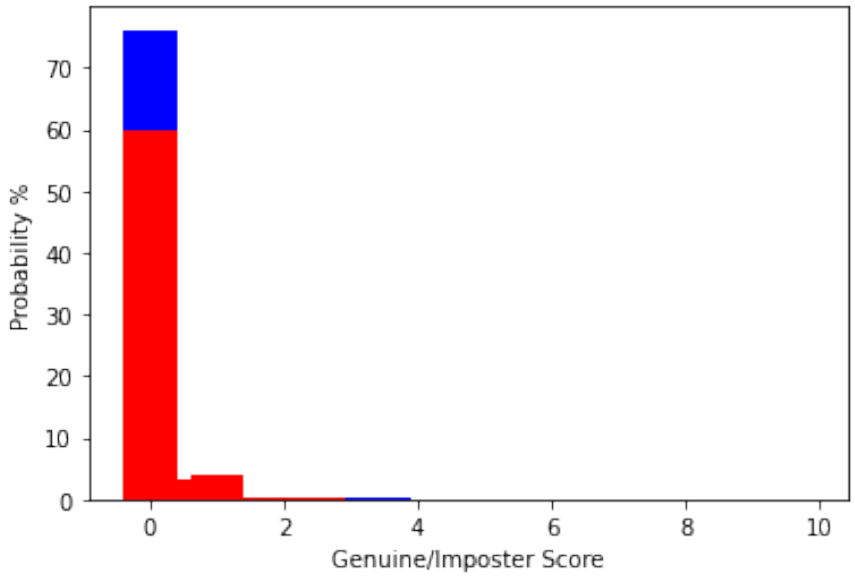

Figure 6: Genuine /Imposter Histogram

0.4 How scores are obtained?

First for every keypoint in image 1 two best matching keypoints in image 2 have been computed. It has been assumed that a keypoint can have only one equivalent keypoint on the other image. So, out of the two matches computed one is good and the other is considered as noise. The score has been obtained using Lowe's ratio test. An array 'good' has been created where all the good matches will be stored. All those keypoint matches where there is no significant difference between the good and noise match, are discarded and others are appended to the 'good' array.
Now for comparing the good and noise match, Rather than basing the comparison on the absolute difference between the distances of the two matches, it has been based on how small the good match is than the noise one. This has been done because the absolute difference would be too dependent on descriptors variables and the distance measurement used. So, the noise match is multiplied by a constant between 0 and 1 and then compared with the good match, if the good match is still smaller than that it is appended to the 'good' array.
Finally the score is calculated by dividing the number of good keypoint matches by the total number of keypoints.

0.5 Results

	SIFT	SURF	ORB
CRR	93.24018902814876	93.25990875392073	92.10526315789474
FRR	3.373741524553113	3.38608497291132	3.83108935128519
FAR	3.3860694472981305	3.3540062731679496	4.063647490820074
EER	0.012327922745017705	0.03207869974337019	0.23255813953488413
Accuracy	96.62009451407438	96.62995437696037	96.05263157894737
Threshold	0.49	0.34	0.99