“Computer Vision”

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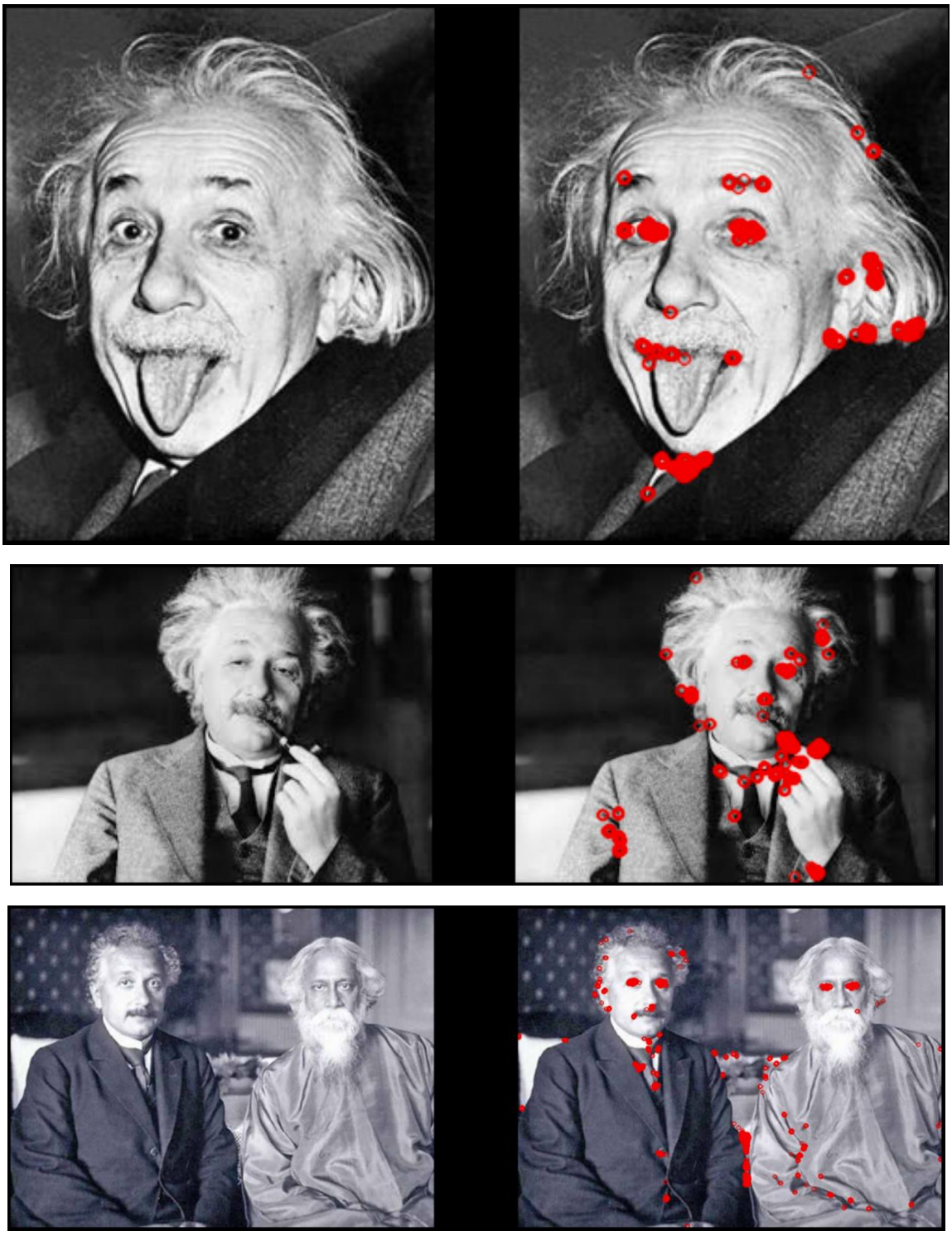
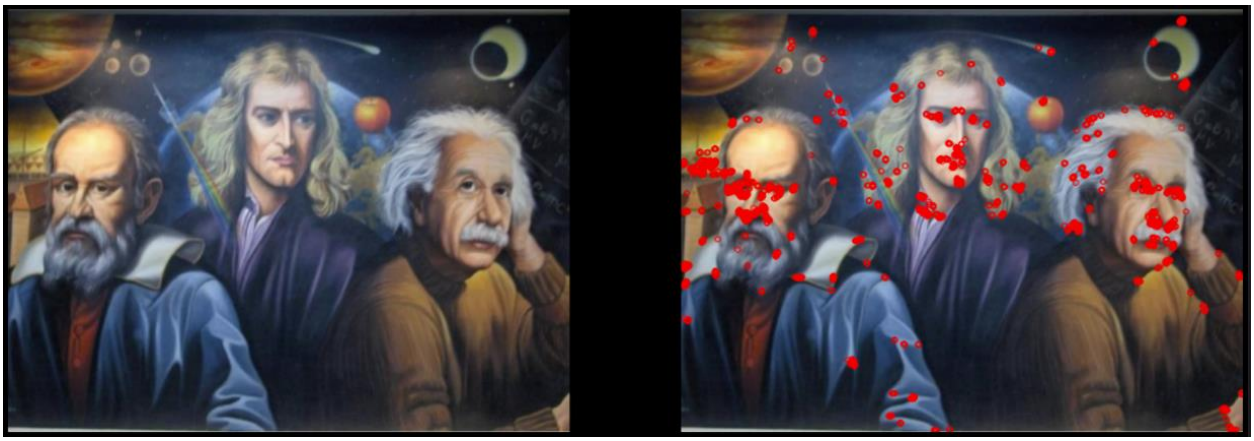
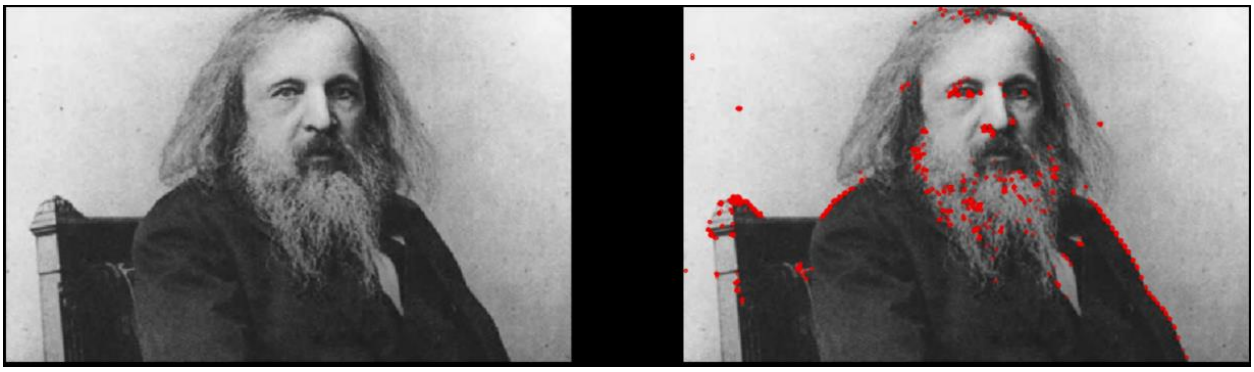
Homework 4

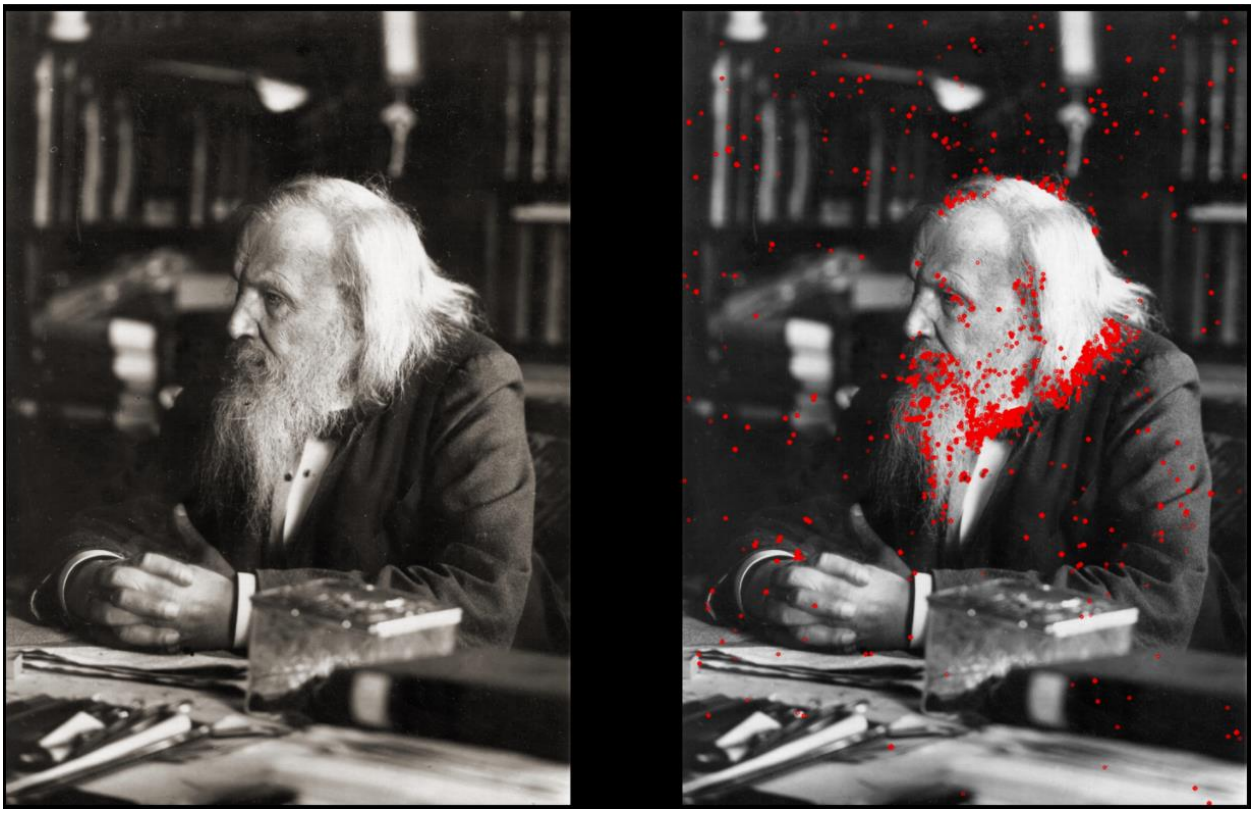
1.

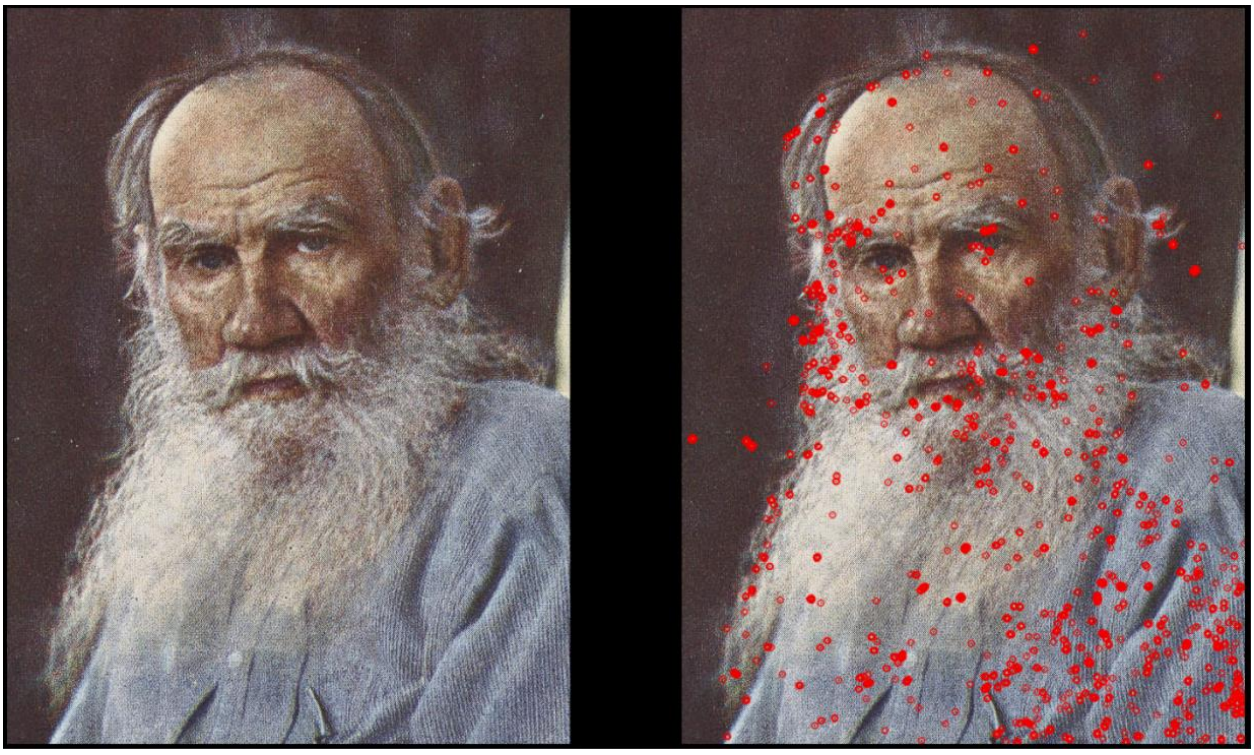
“Harris method”

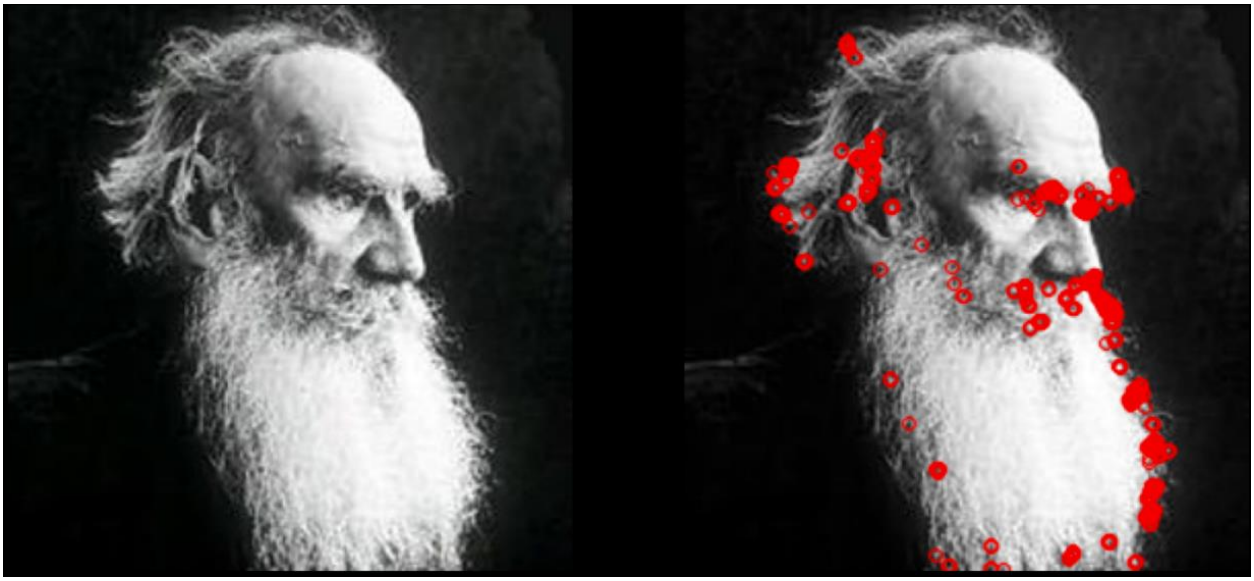


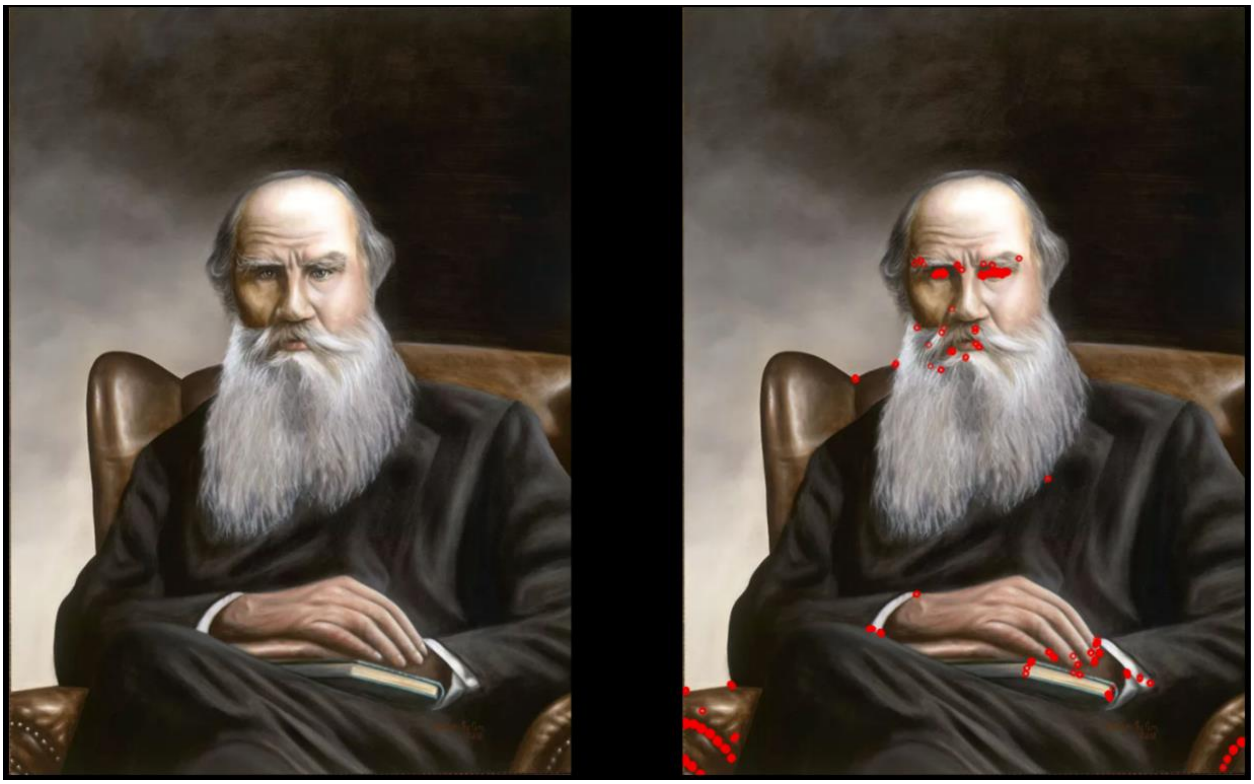


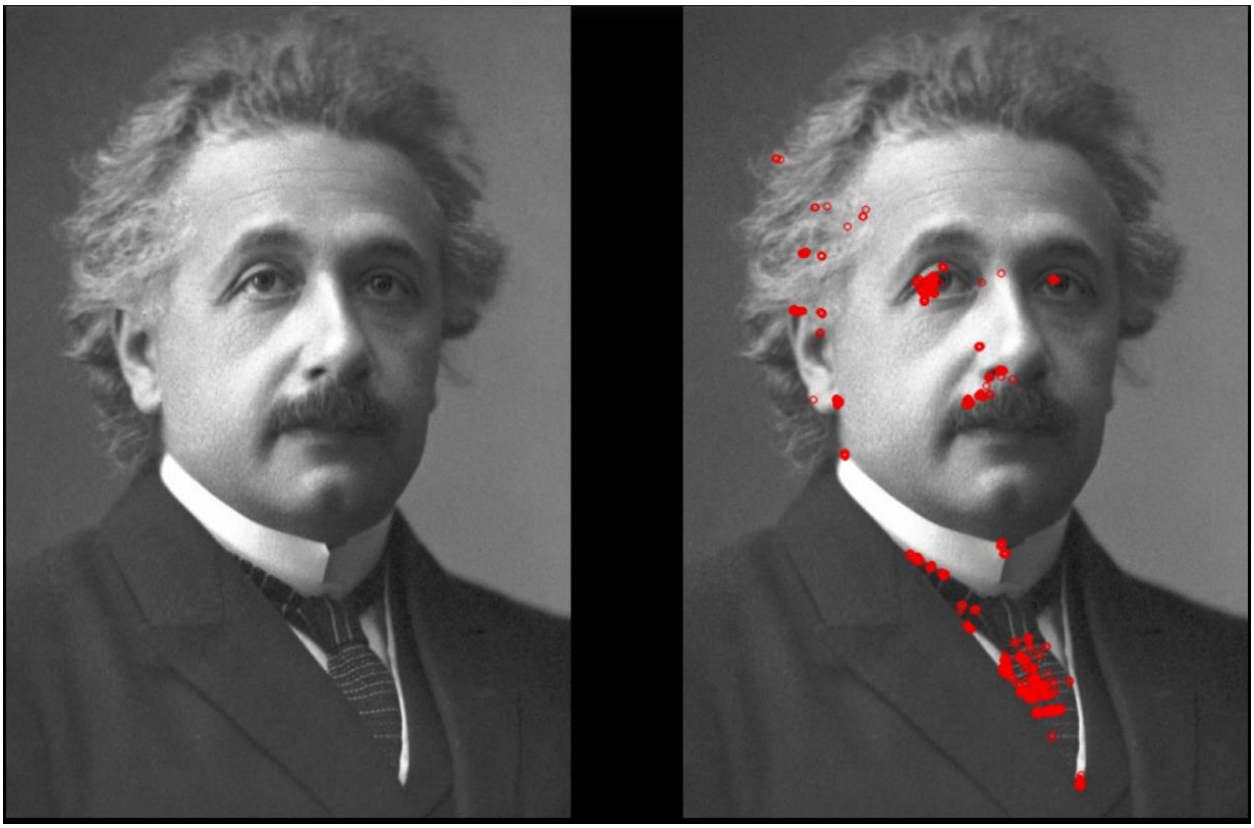




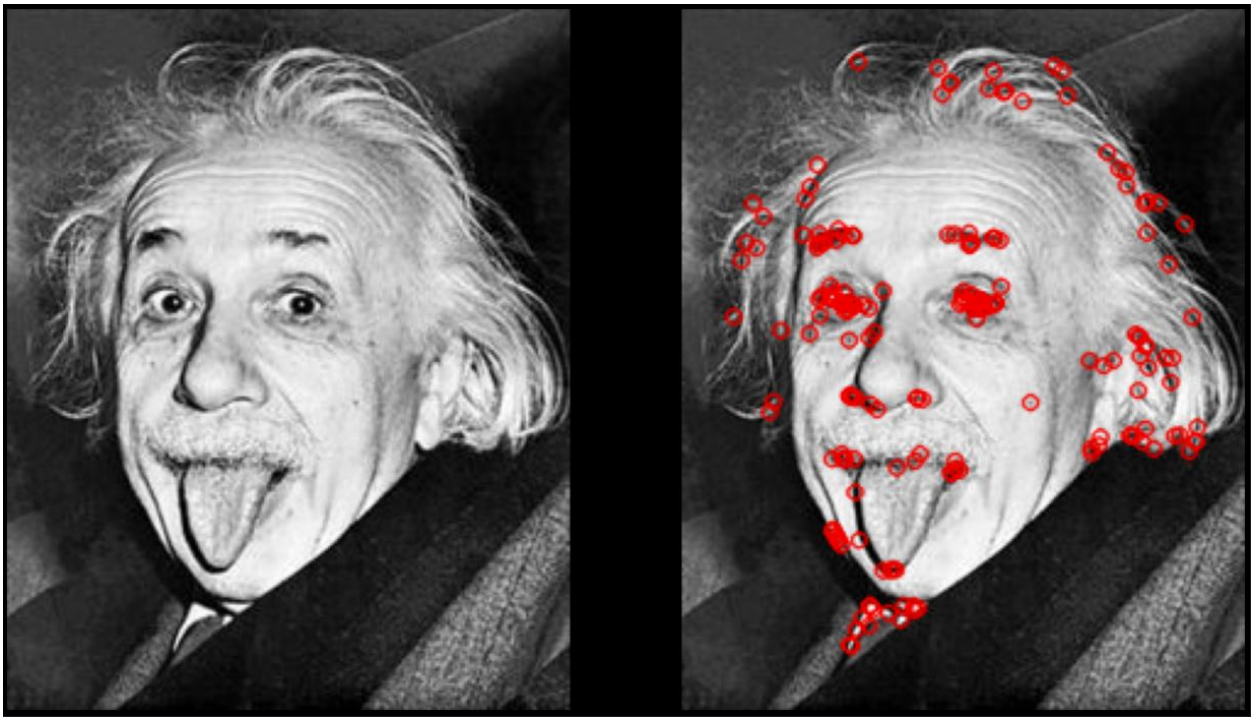


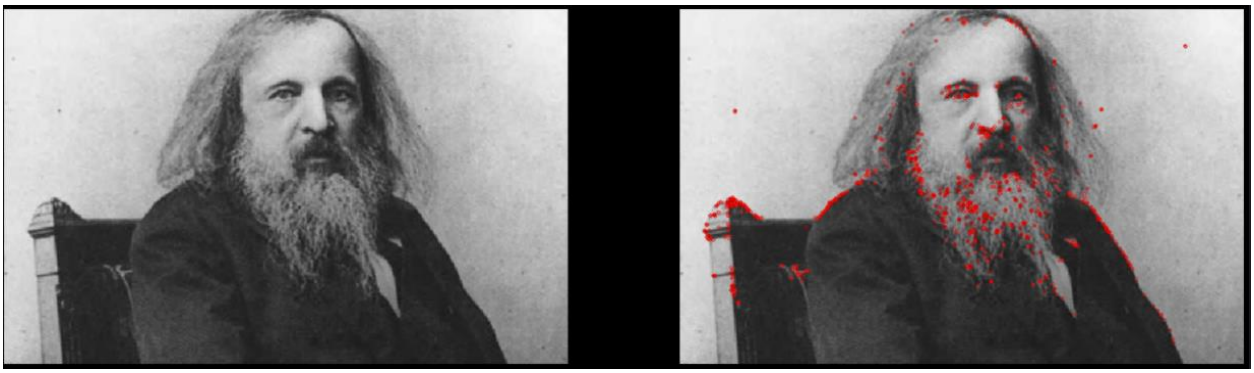


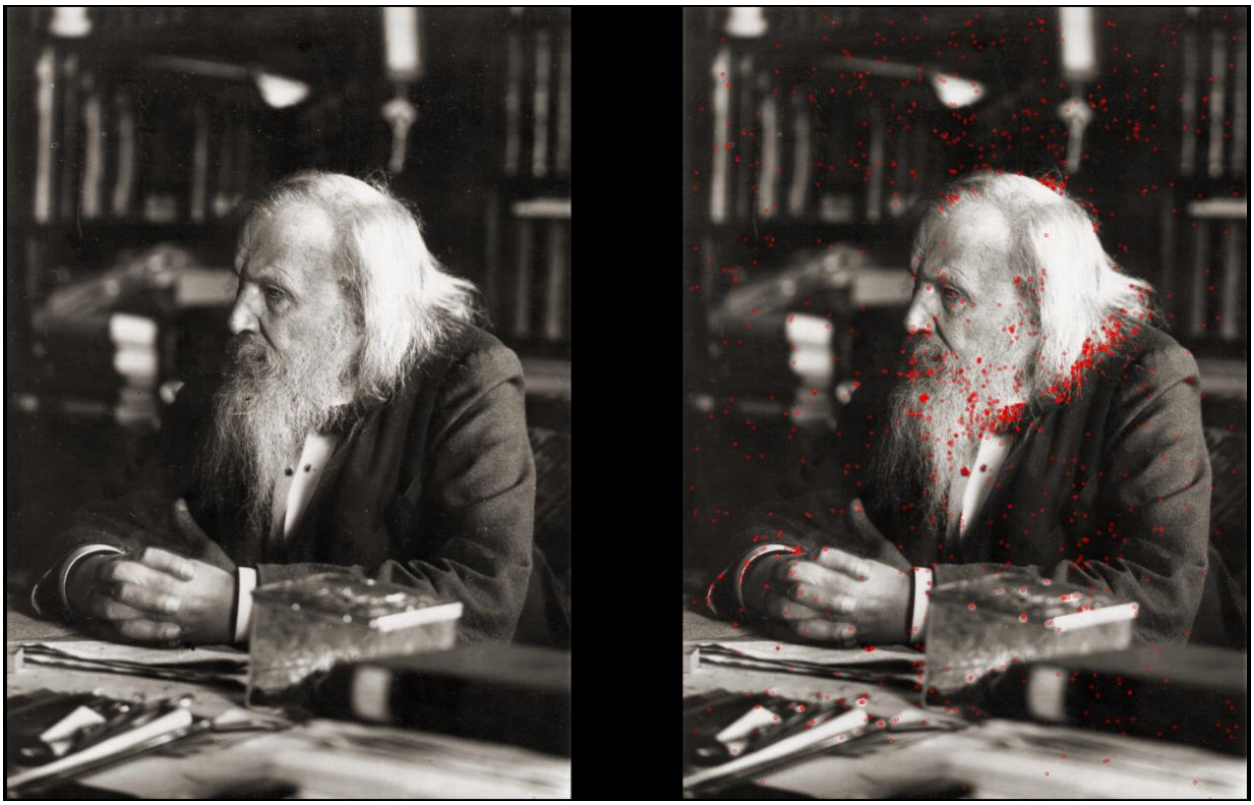


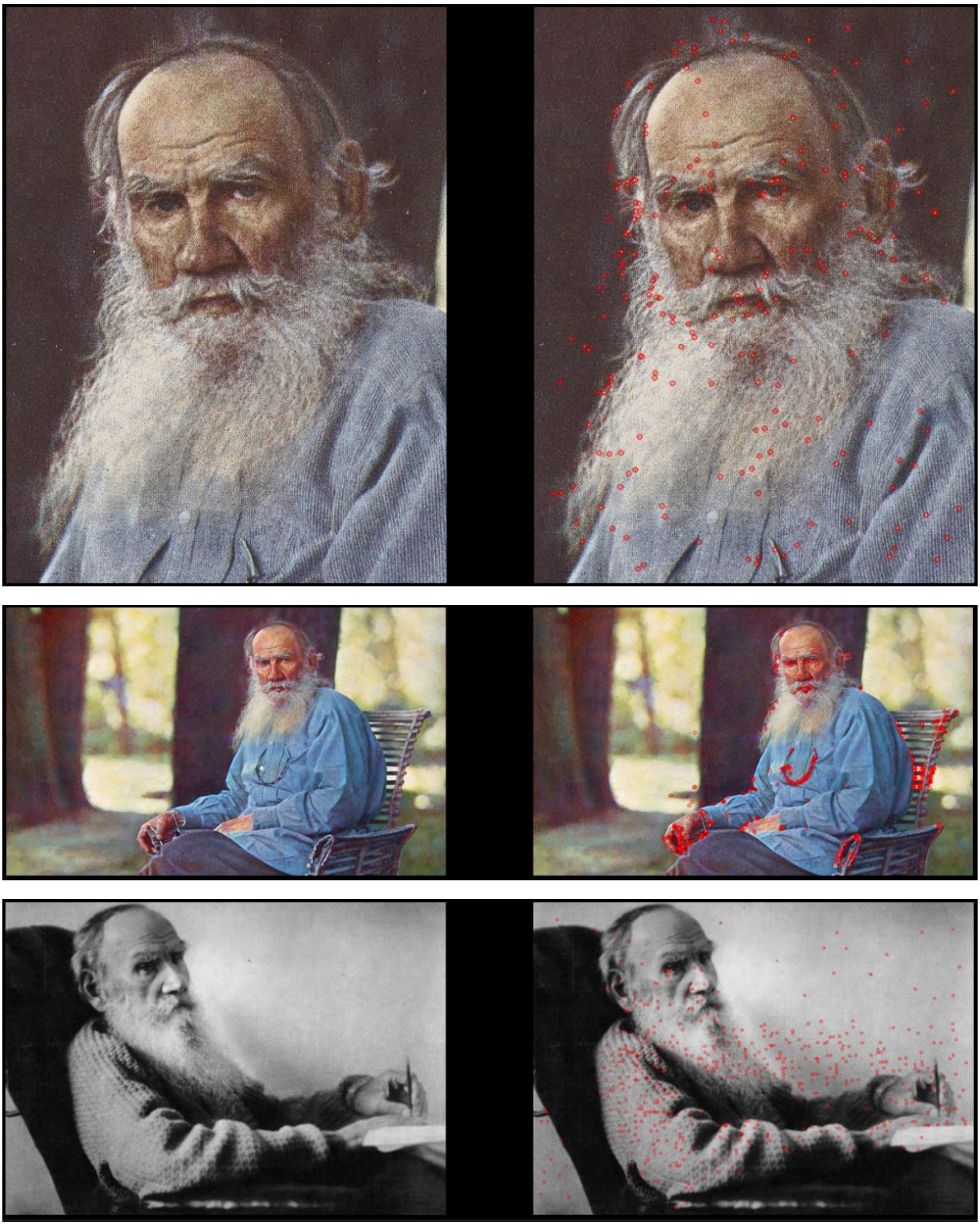


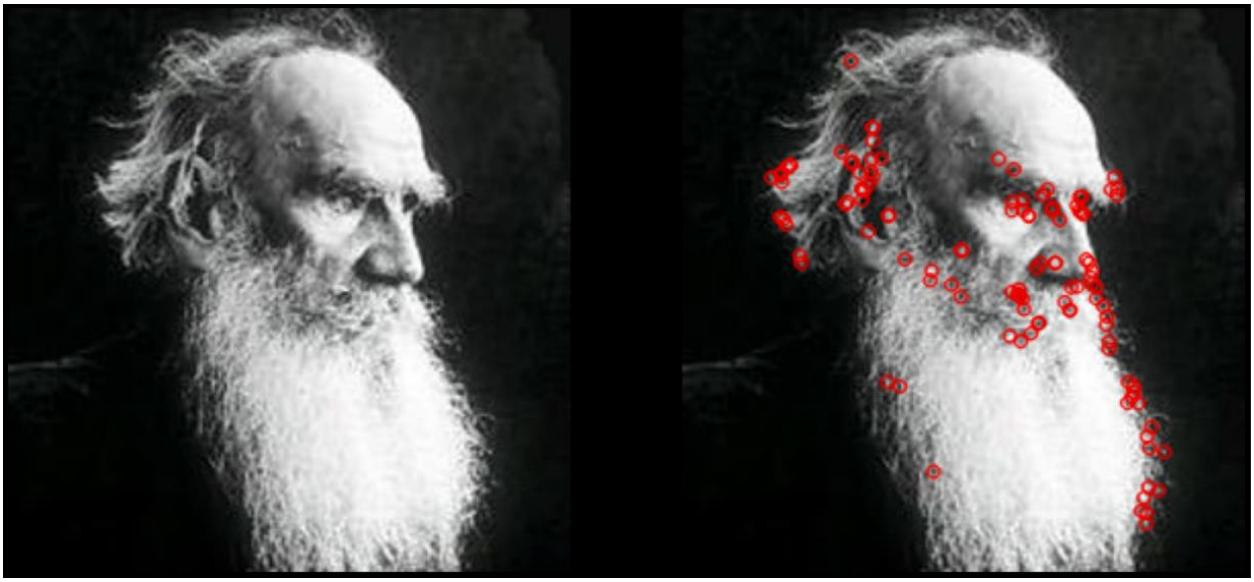
“BRISK method”

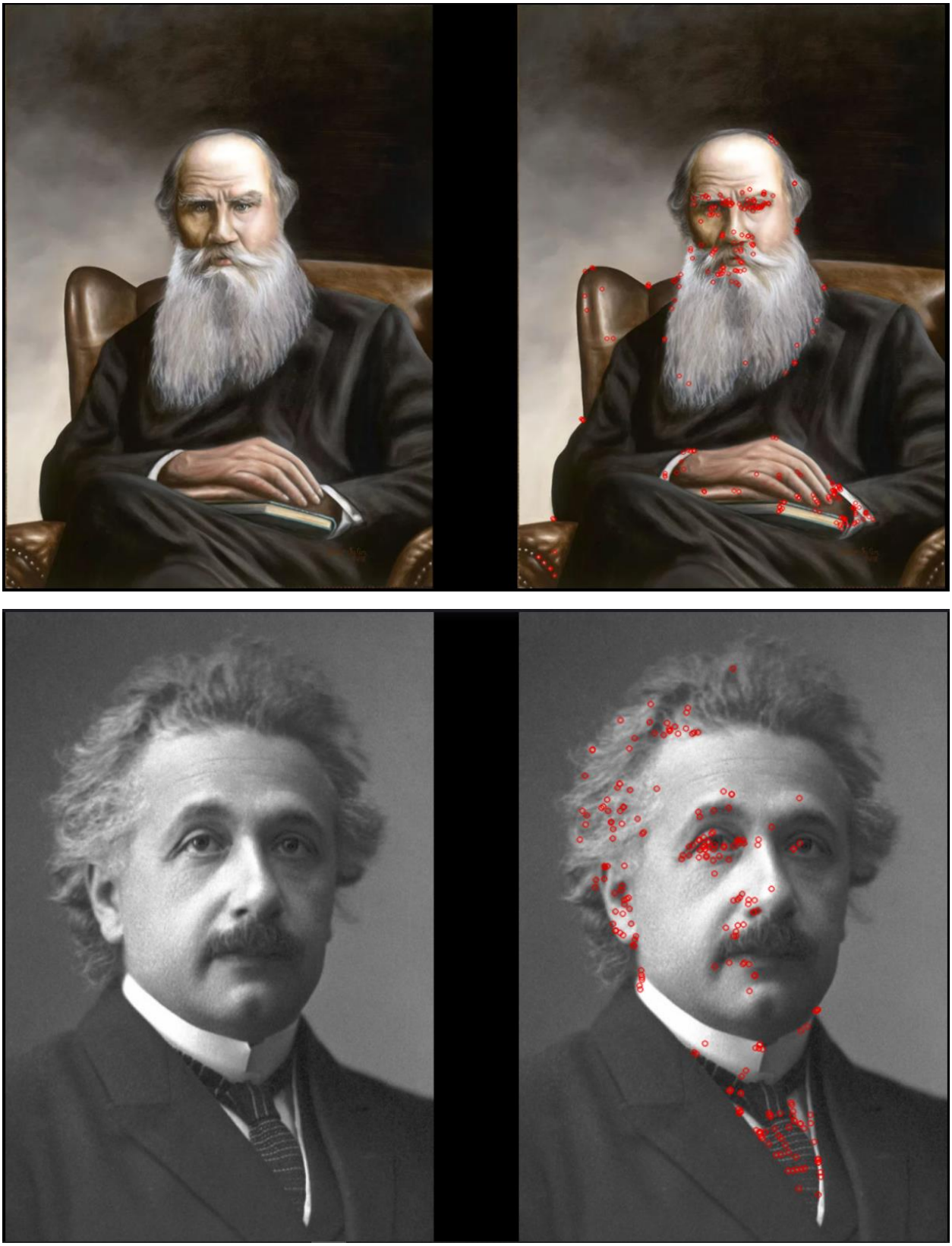












It seems that BRISK algorithm probably operates more efficiently in the domain of face recognition as it detects more diverse and more desired key-points of each facial components and less inefficient key-points from unimportant regions such as clothes or the background and has more focus on faces compared to Harris.

2 & 3.

For this part two different methods of "BFMatcher" module (I.e. KNN match and cross check match) were separately experimented on the dataset which resulted in the following outputs:

(NOTE: images labeled with "TRUE" key-word are the ones classified as including Einstein.)

"Cross-Check match"

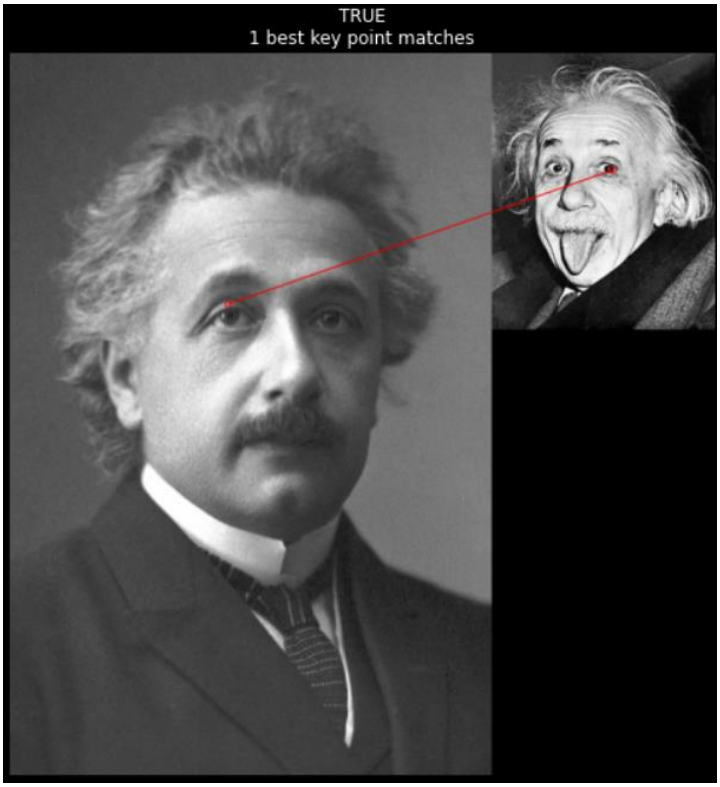
(For the Cross-Check match the following explanation was considered as the metric for classification.)

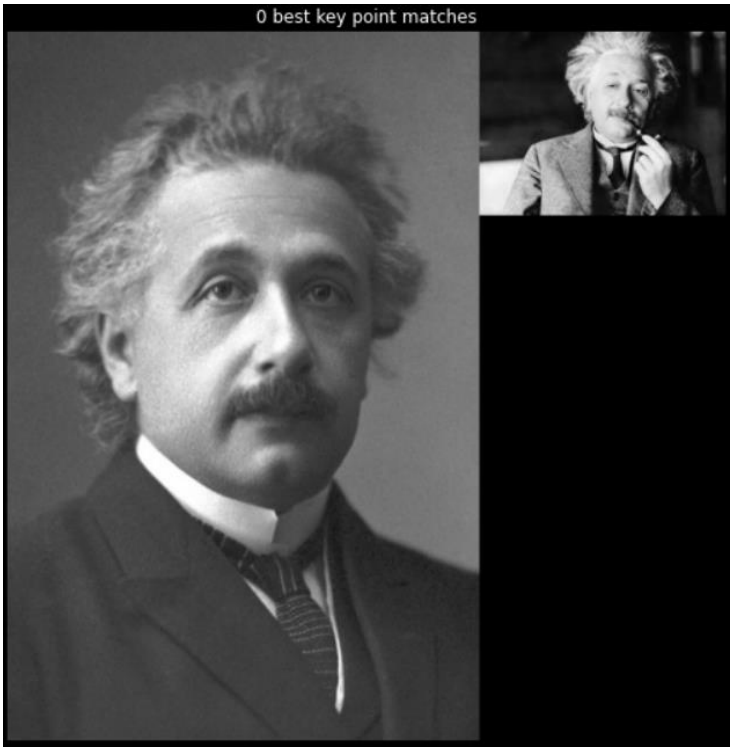
Since most of the determined criteria for classifying images performed poorly, a strict criterion was considered which resulted in better classification. In other words, less False True outputs.

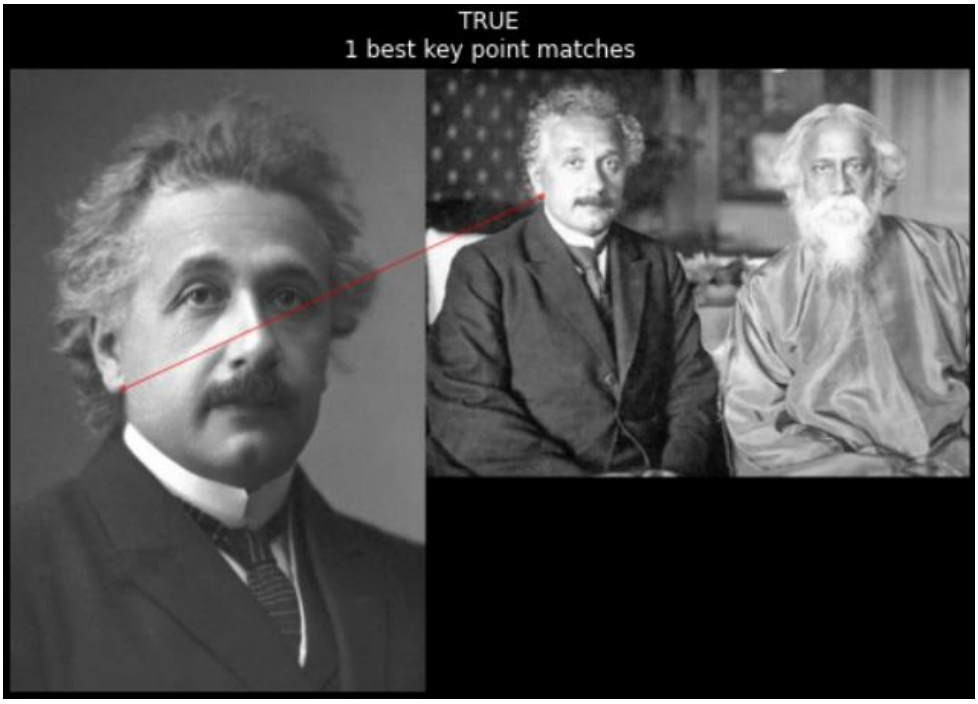
The criterion was as follow:

First, unique threshold was considered for each image for non-minimum suppression step. Second, matched key-point descriptions with more than 70 distance were removed from matched points for each comparison. Lastly, comparisons with more than zero matched points were classified as TRUE.

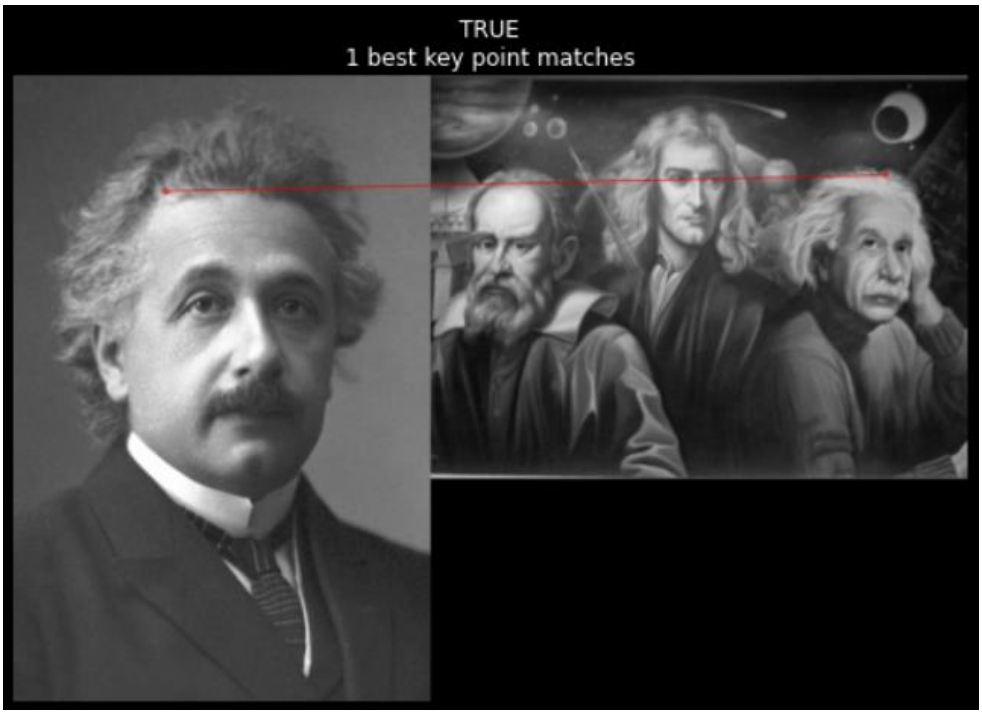
Obtained results are as follows:


TRUE
1 best key point matches


0 best key point matches

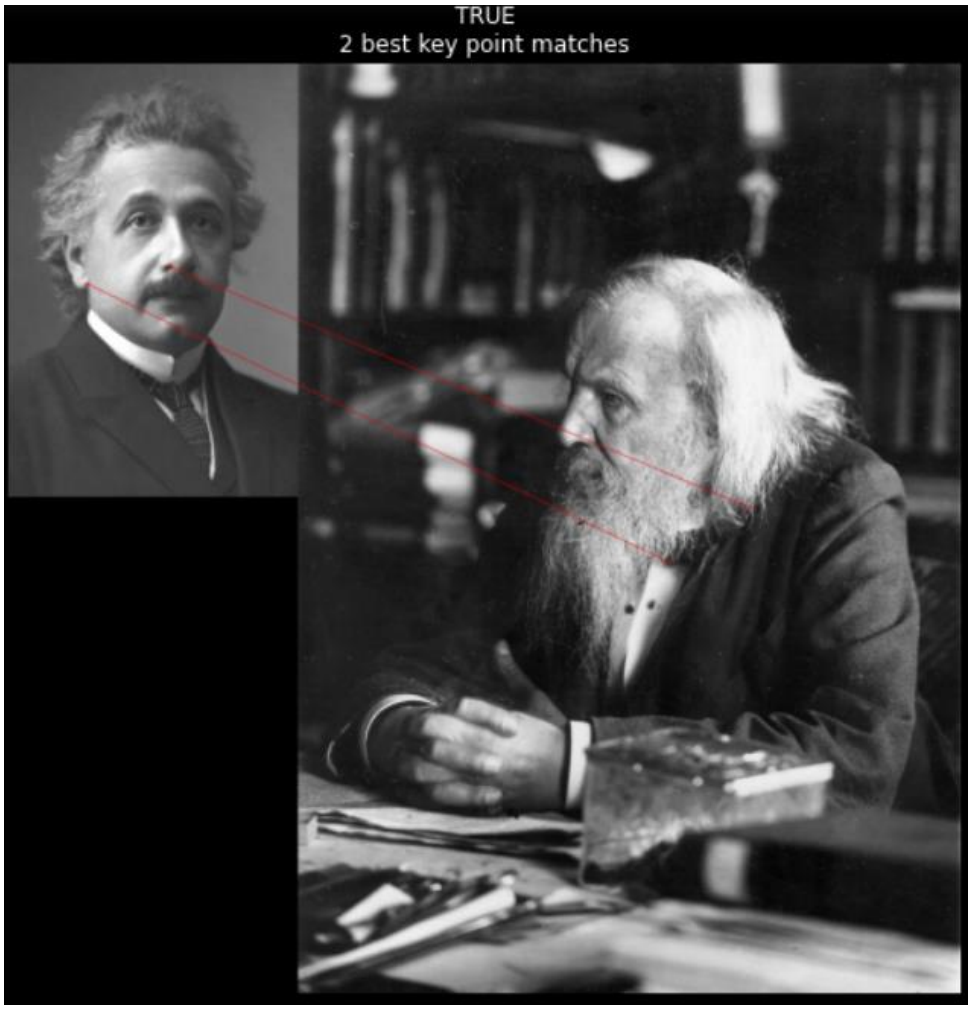

TRUE
1 best key point matches

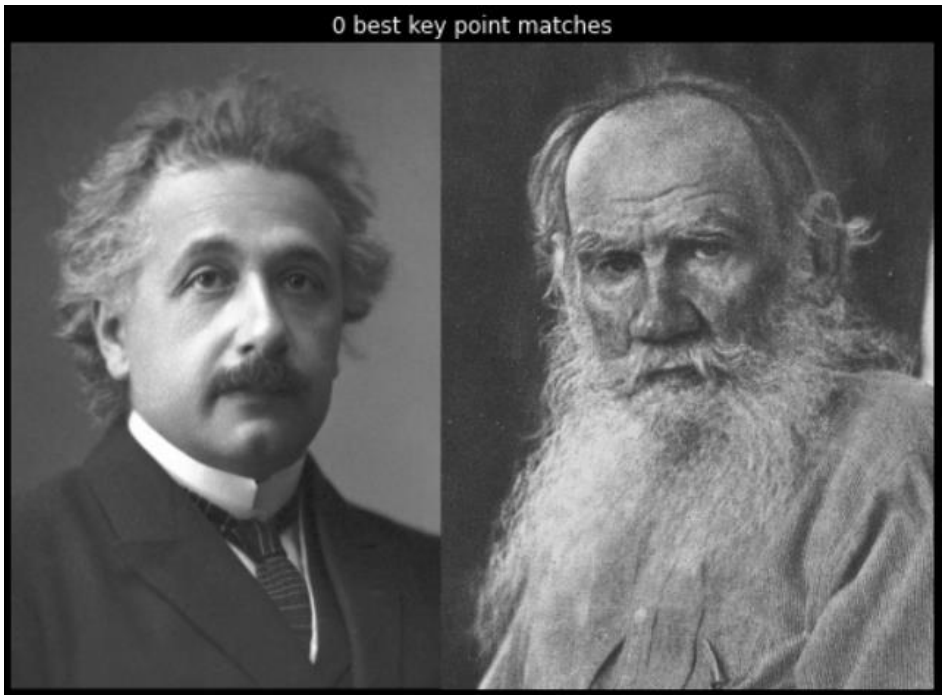

0 best key point matches

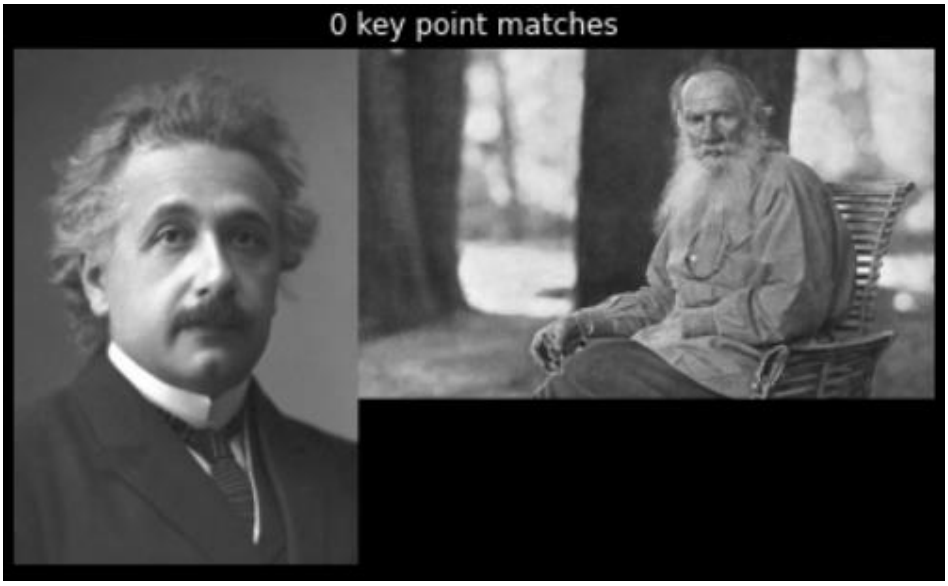

TRUE
1 best key point matches


0 best key point matches

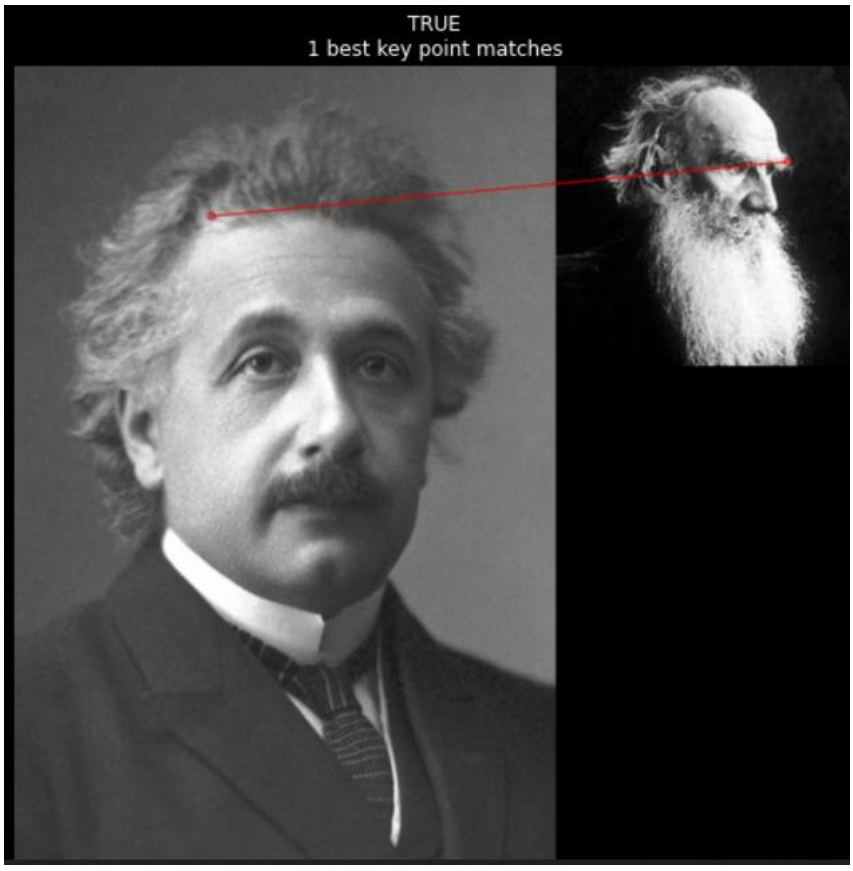

0 best key point matches

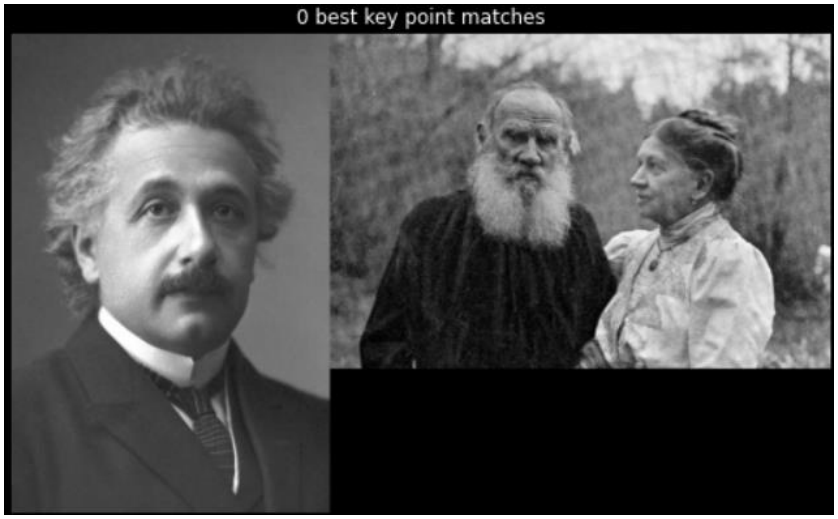

TRUE
2 best key point matches

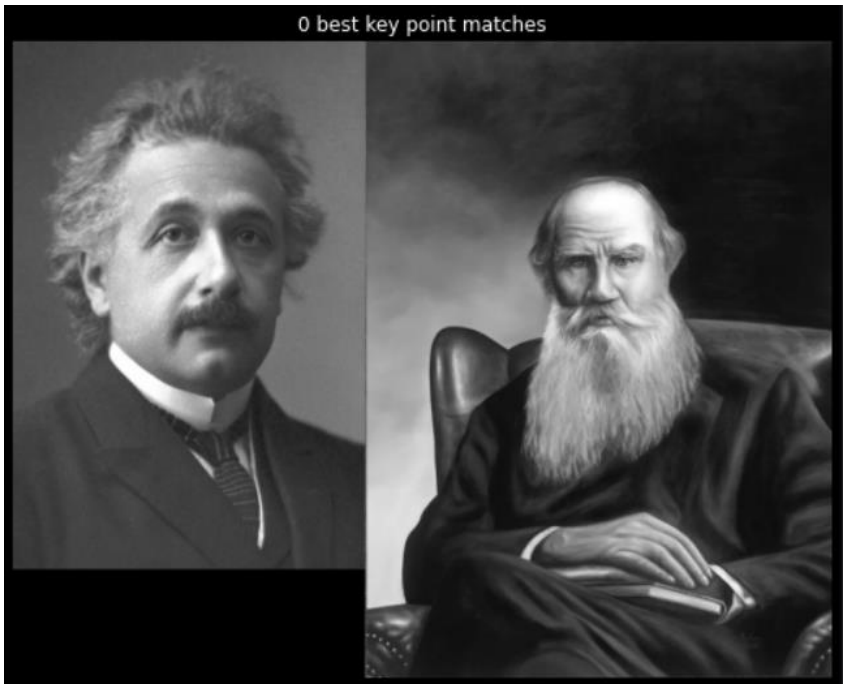

0 best key point matches

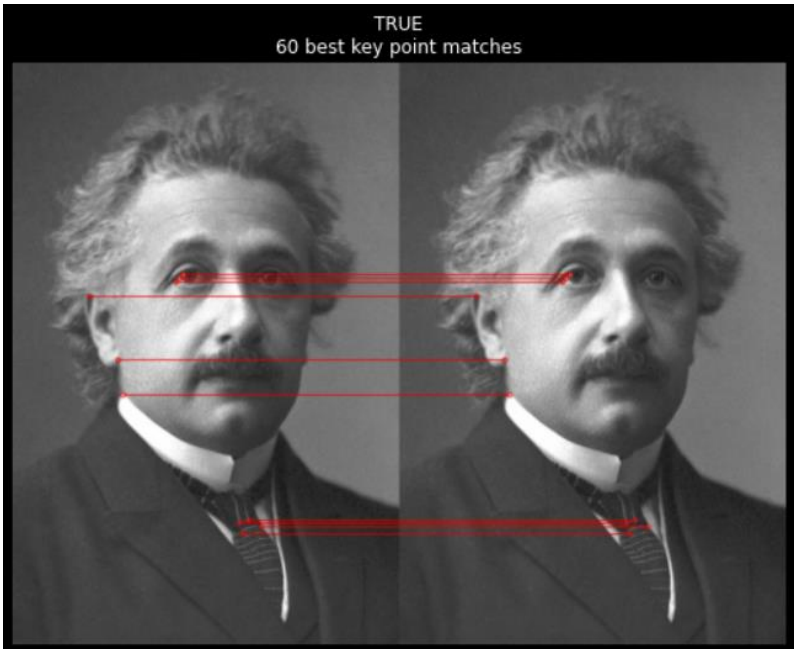

0 key point matches


0 best key point matches


TRUE
1 best key point matches


0 best key point matches

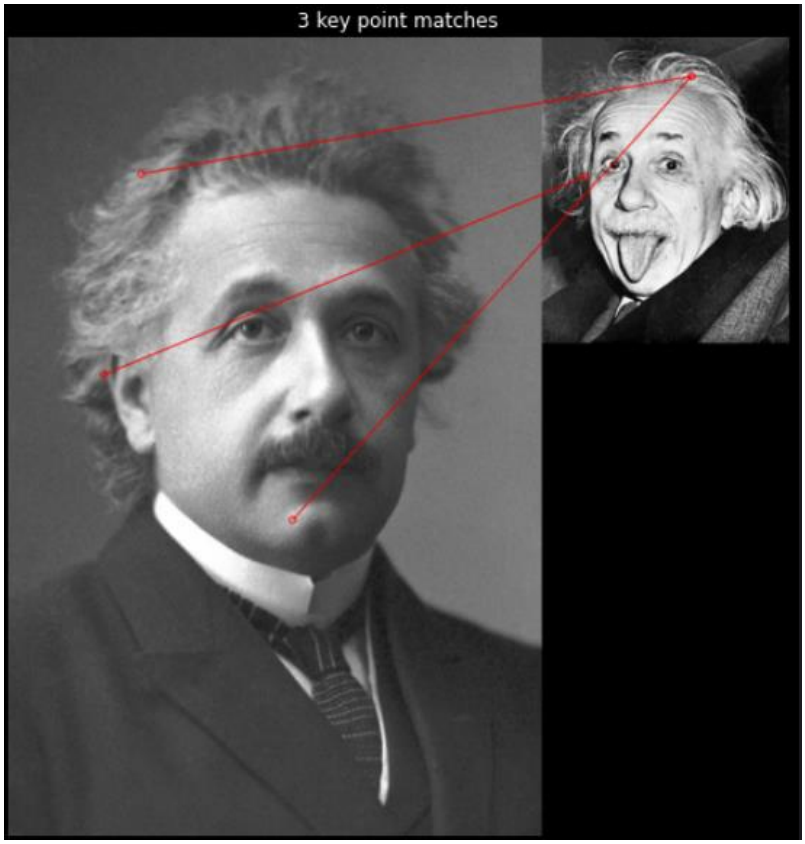

0 best key point matches

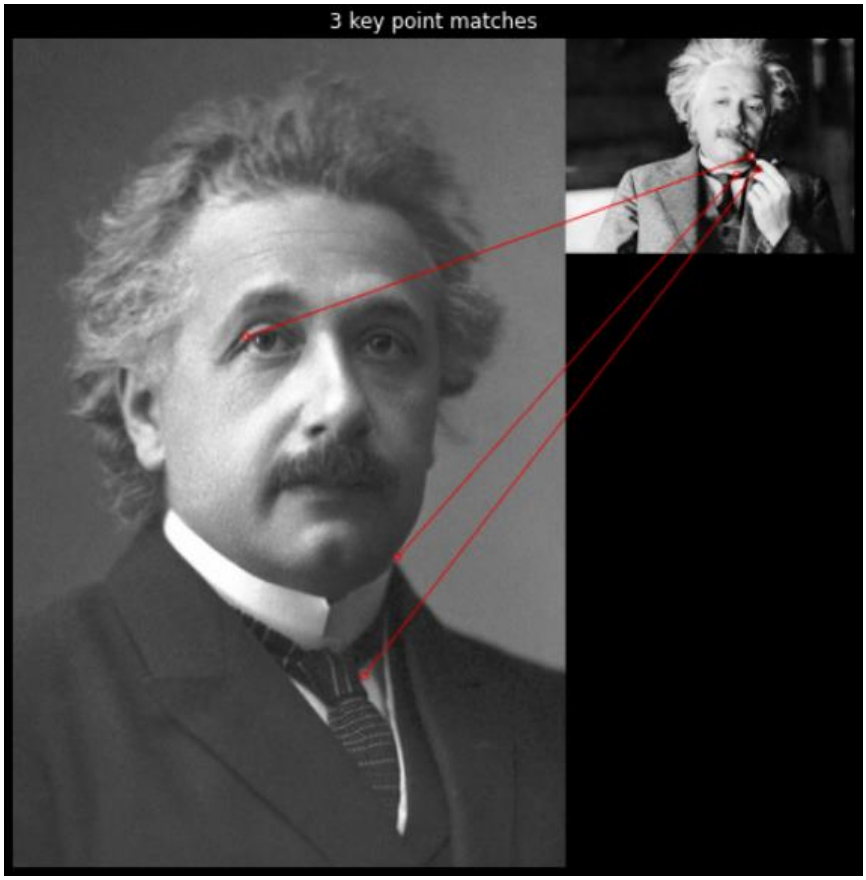


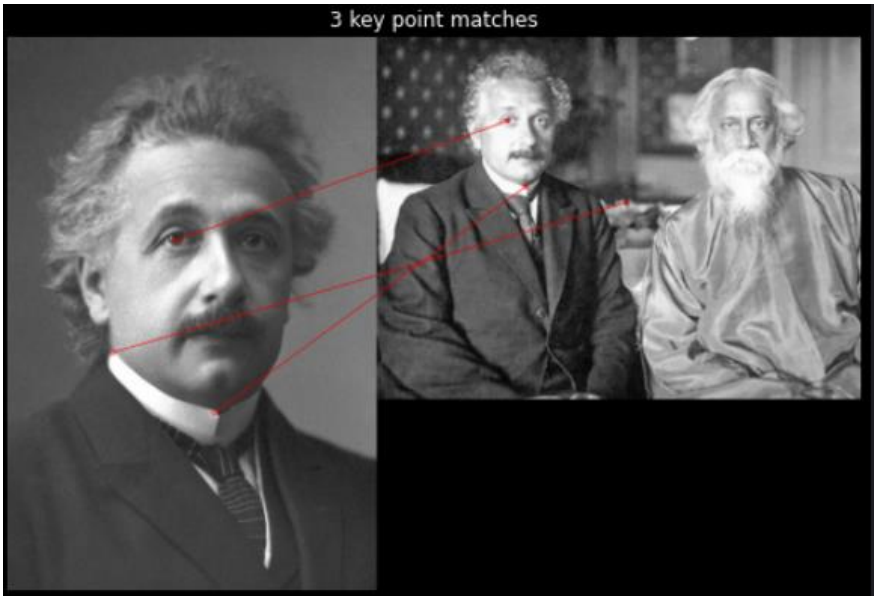
“KNN match”

As the KNN match performed poorly for all experimented criteria, only the outputs are shown (algorithm is shown below):

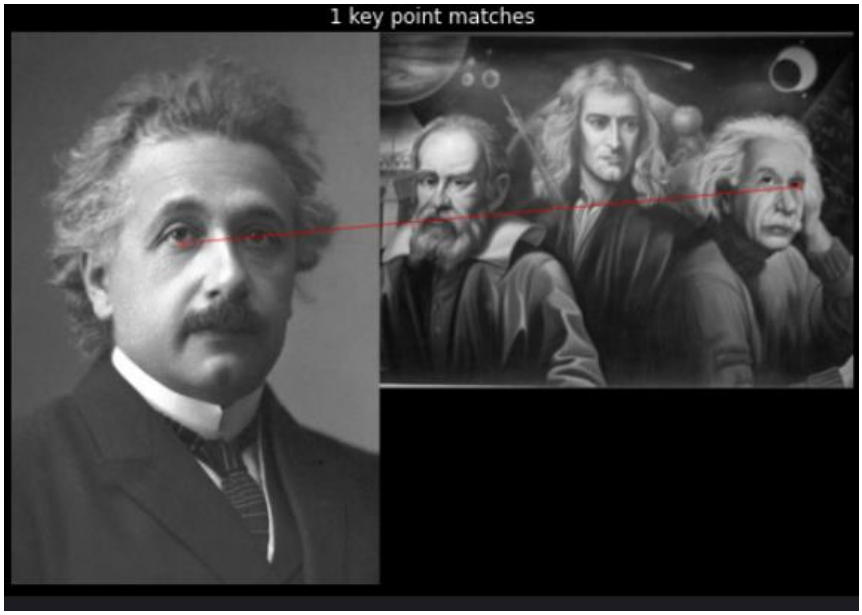
```
for i in range(len(imgs)):

    bf = cv2.BFMatcher(cv2.NORM_HAMMING)
    matches = bf.knnMatch(des[14],des[i], k=2)
    # matches = bf.match(des[14],des[i])

    # Apply ratio test
    good = []
    for m,n in matches:
        if m.distance<200 and m.distance < 0.7*n.distance:
            good.append([m])
```

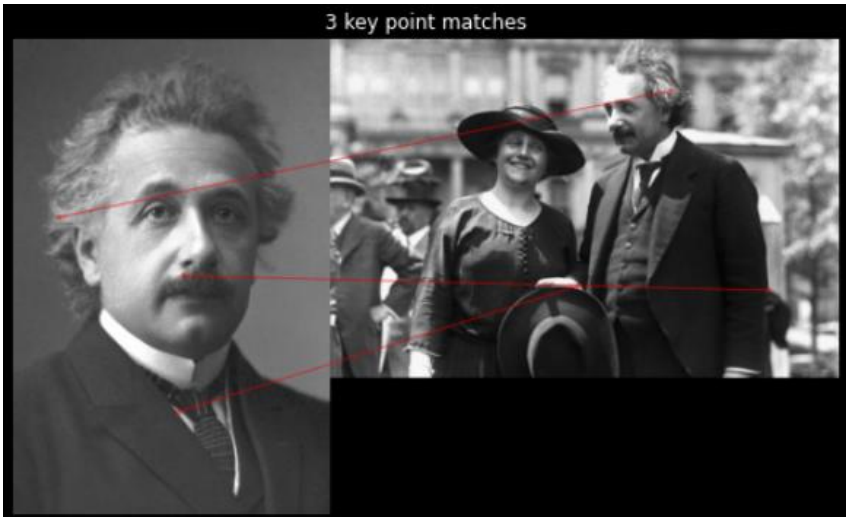

3 key point matches

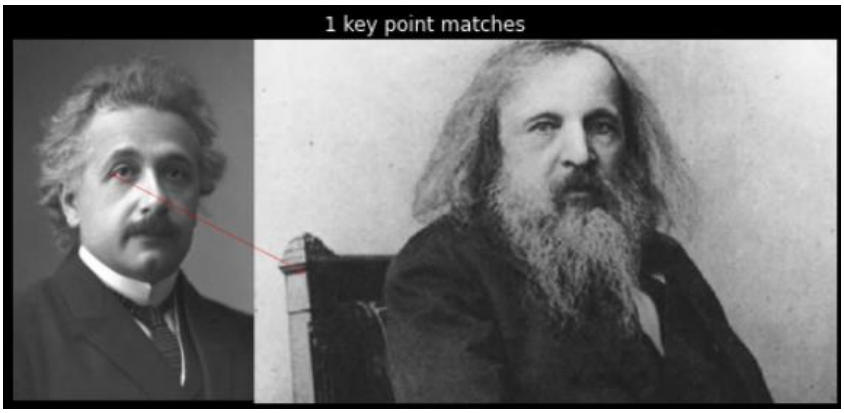

3 key point matches

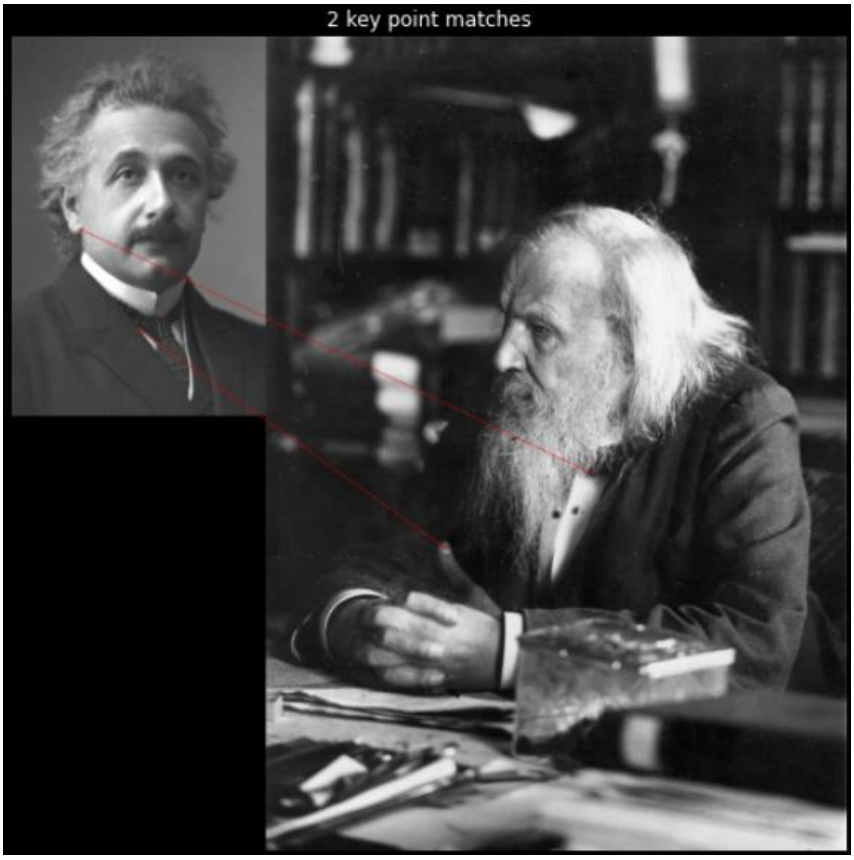

3 key point matches

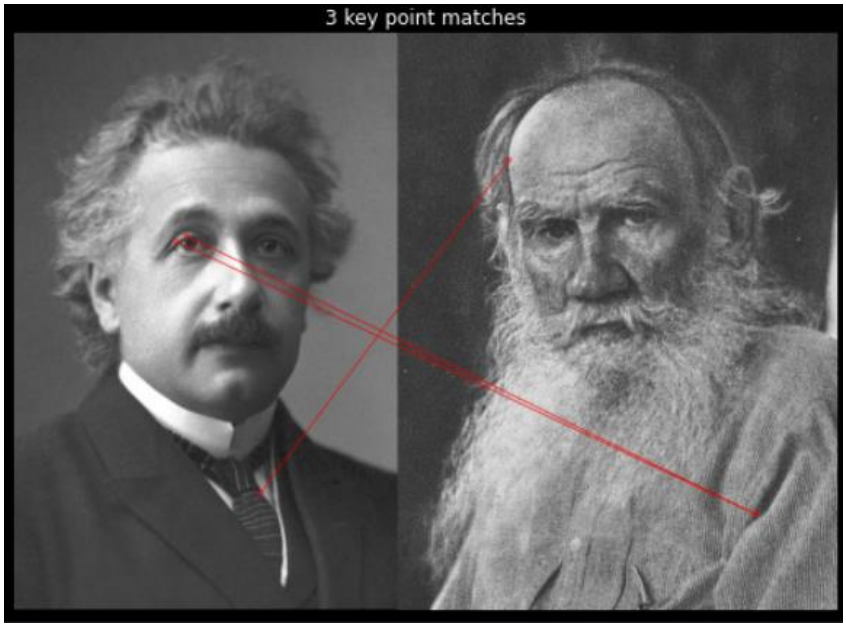

1 key point matches

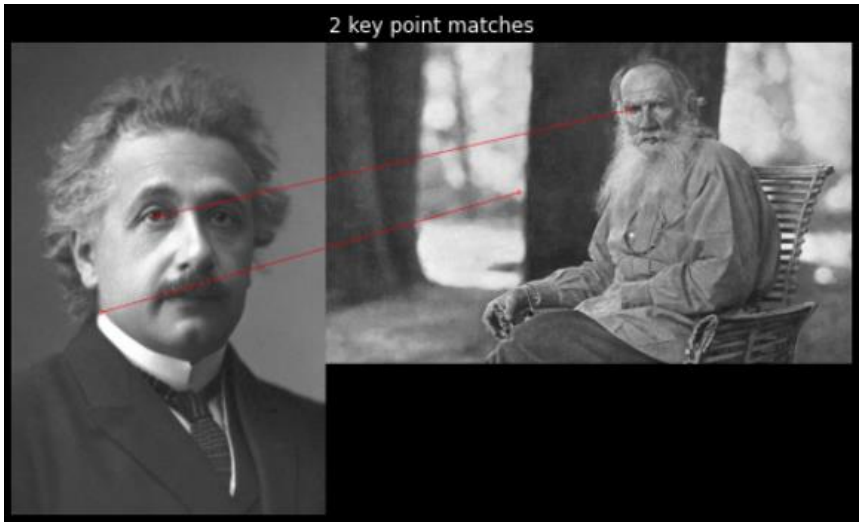

1 key point matches

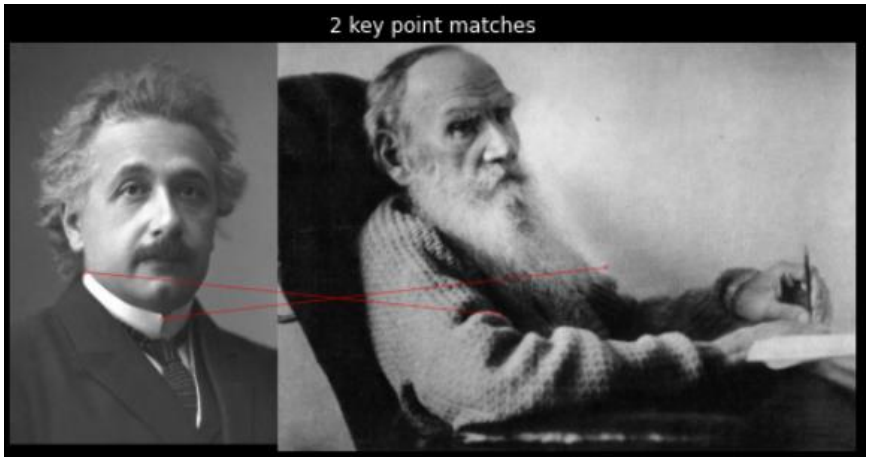

3 key point matches

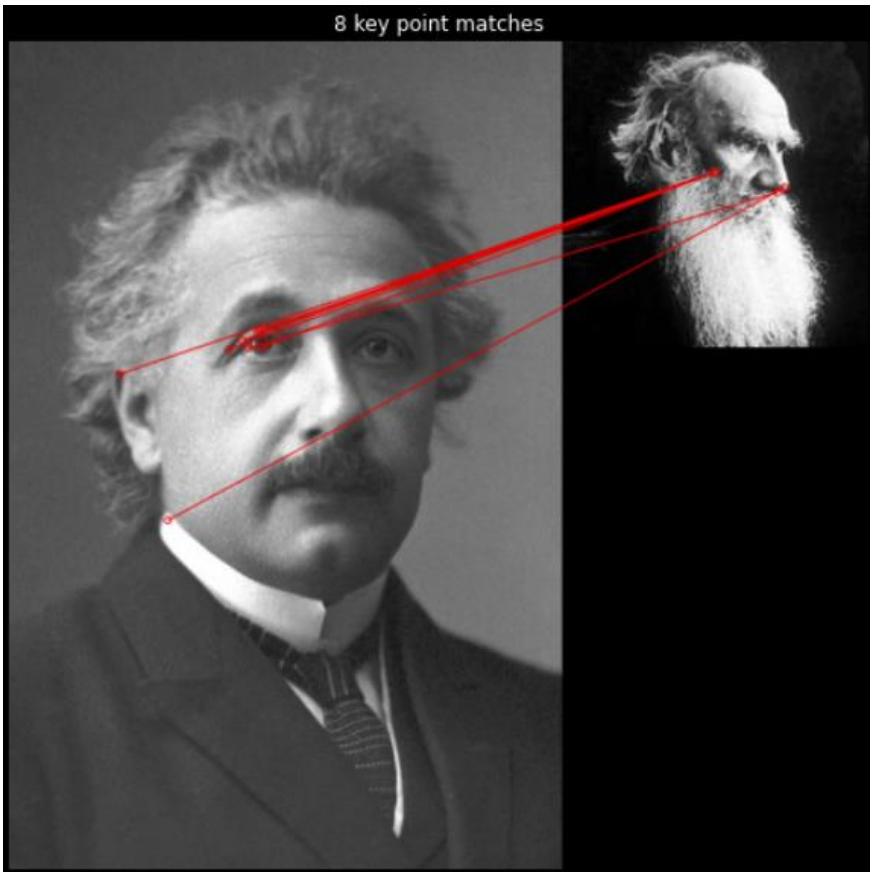

1 key point matches

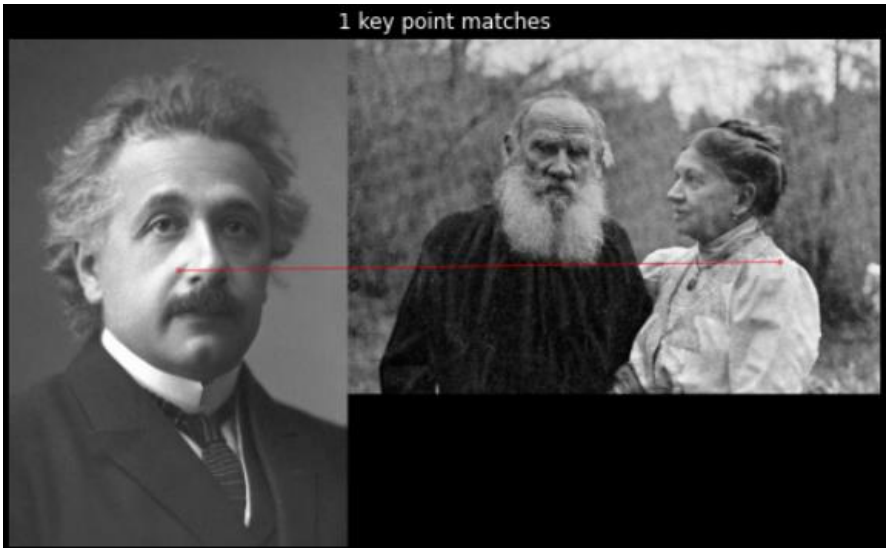

2 key point matches

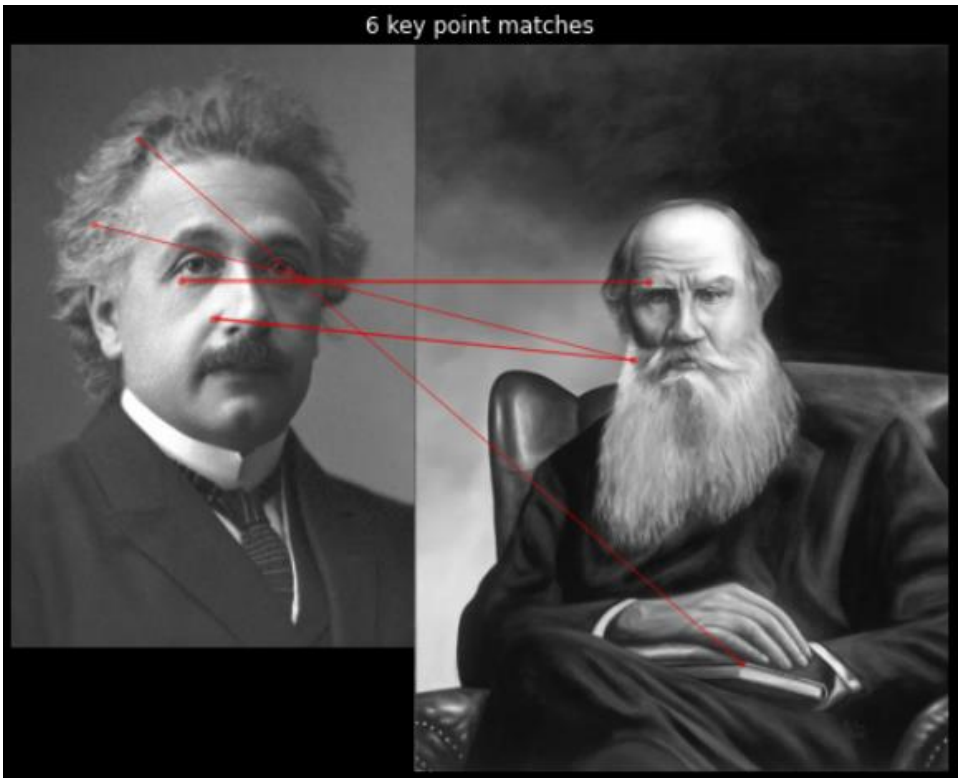

3 key point matches


2 key point matches


2 key point matches


8 key point matches


1 key point matches



4.

Although the algorithm has performed well in extracting key-points of facial components, it poorly performed on classifying images. One of the main problems with the algorithm may be rooted in the fact that we have detected and descripted key-points by two different methods (I.e. BRISK and FREAK) and maybe these two methods are not compatible with each other and lastly performs poorly together. Another possible weakness may be the fact that in different images, Einstein face is from different directions. Another important thing which has contributed in the weakness of the algorithm may be the existence of beard! As we can see in all images, all characters have bulky beards which had resulted in the main portion of detected key-points. Moreover, one of the most important points we can reach is that as we can see in TRUE POSITIVE results above (e.g. the few first images containing

Einstein in both methods), matched key-points are mostly within Einstein's clothes (like his collar) or within his facial components; these matched key-points are rather accurate. In contrast, in False positive images (images which do not contain Einstein) most of the matched key-points are mistakenly matched from Einstein face in reference image to a key-point of the test image which is not within any faces. This incidence, maybe reveals the fact that before taking any steps in face recognition algorithm, initially, a face detection step should be taken in order to focus the face recognition algorithm on only the regions around the detected faces (for example specifying faces in bounding boxes).