Face Recognition – white paper

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saiwa

simple artificial intelligence web application

Face recognition refers to algorithms that identify and verify individuals according to their facial biometrics. Face recognition is a challenging problem in the field of machine vision due to different poses and scales of faces. Particularly in 2D, where angle and distance information are absent, real-world face verification to identify fake photos from real 3D faces poses a complex challenge. Recent advances in AI research have provided reliable and robust solutions to facial recognition [1]. These solutions are often case-specific and show high accuracy when applied in similar environments. At saiwa© we provide a simple, generic and fast face recognition algorithm to represent the potential of this application. However, if you have a special problem to identify individuals in certain conditions you may require a more complex and advanced solution[1].

1 For request a case specific solution, please fill “Request for customization” form that you may find at the bottom of each service page.

saiwa© face recognition service is based on our face detection algorithms. The recognition method is the same but with two face detectors, you can try two approaches: 1) recognition using Dlib face detector and 2) recognition using MTCNN face detector.

In the first approach, after detecting faces and facial landmarks using HOG SVM face detector [2 and 3], the faces are rotated, scaled and sheared in a way that facial landmarks are close to the frontal model.

After face detection and frontalization, the next step is face encoding. All reference images of known reference faces and input unknown faces must be similarly encoded. Here, as in [3], 128 measurements from pre-trained OpenFace network [4] are extracted according to Figure 1.

type	output size	#1×1	#3×3 reduce	#3×3	#5×5 reduce	#5×5	pool proj
conv1 $(7 \times 7 \times 3, 2)$	$48 \times 48 \times 64$						
max pool + norm	$24 \times 24 \times 64$						m $3 \times 3, 2$
inception (2)	$24 \times 24 \times 192$		64	192			
norm + max pool	$12 \times 12 \times 192$						m $3 \times 3, 2$
inception (3a)	$12 \times 12 \times 256$	64	96	128	16	32	m, 32p
inception (3b)	$12 \times 12 \times 320$	64	96	128	32	64	ℓ_2, 64p
inception (3c)	$6 \times 6 \times 640$		128	256,2	32	64,2	m $3 \times 3, 2$
inception (4a)	$6 \times 6 \times 640$	256	96	192	32	64	ℓ_2, 128p
inception (4e)	$3 \times 3 \times 1024$		160	256,2	64	128,2	m $3 \times 3, 2$
inception (5a)	$3 \times 3 \times 736$	256	96	384			ℓ_2, 96p
inception (5b)	$3 \times 3 \times 736$	256	96	384			m, 96p
avg pool	736						
linear	128						
ℓ_2 normalization	128						

Figure 1. OpenFace CNN structure (printed from [4])

Finally, to find the reference face corresponding to that of the unknown input, a linear SVM classifier, which is already trained over all reference faces, is employed.

Figure 2 shows a few results from saiwa face recognition service while the classifier is trained with the 2 reference pictures of Steve Jobs and Bill Gates.

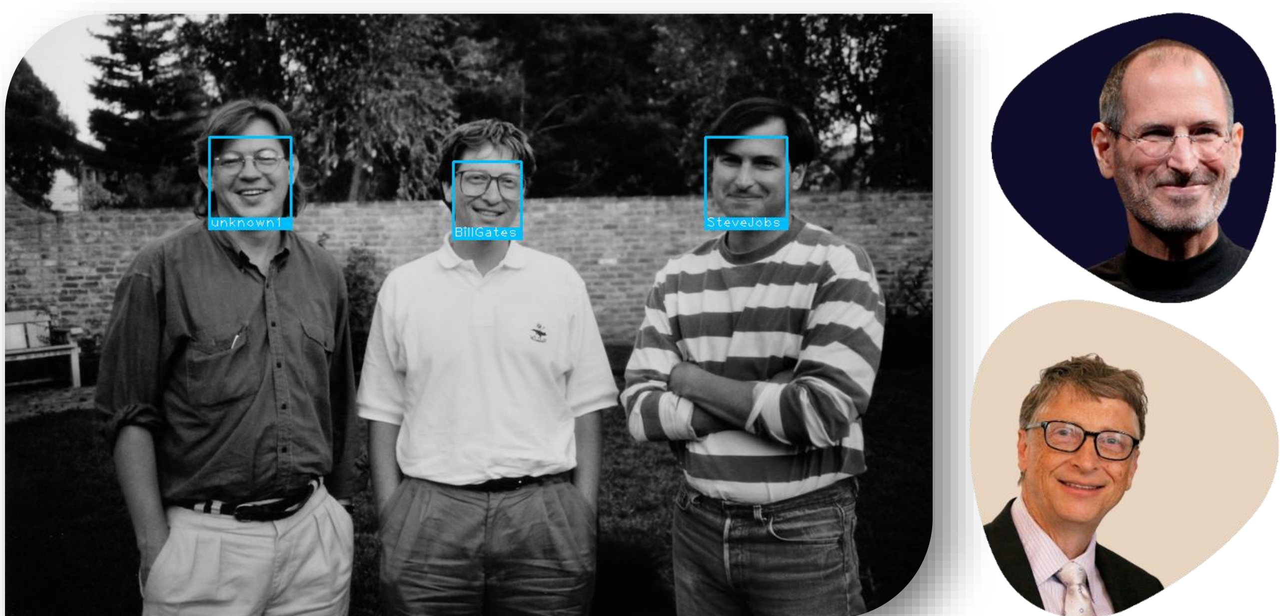

Figure 2. Face detection result using saiwa online interface and Dlib face detector with the two reference images of Steve Jobs and Bill Gates (front view).

Our next recognition method, uses a deep network for face detection, i.e. multitask cascaded convolutional networks (MTCNN) [5]. This method is more accurate in detecting faces but the recognition stage is similar to the first approach. For a comparison study between the two face detection methods, please refer to the corresponding white paper in saiwa face detection service. Figure 3 compares the recognition results of the two methods that are provided in saiwa online demo. Note that MTCNN-based recognition could recognize more athletes especially those with faces far from frontal.

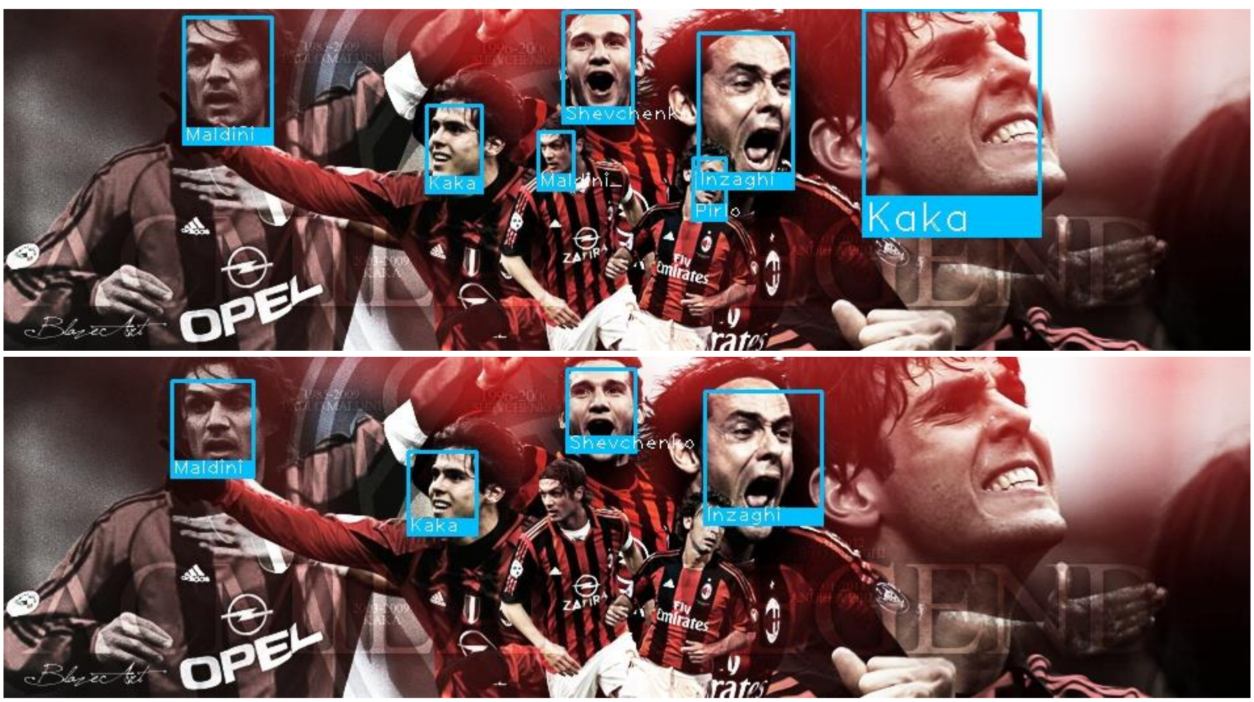

Figure 3. Recognition comparison between the two approaches based on MTCNN face detector (top) and Dlib face detector (bottom)

References:

[1] Wang, Mei, and Weihong Deng. "Deep face recognition: A survey." Neurocomputing 429: 215-244, 2021.

[2] http://www.dlib.net

[3] https://github.com/ageitgey/face_recognition

[4] B. Amos, B. Ludwiczuk, M. Satyanarayanan, "Openface: A general-purpose face recognition library with mobile applications," CMU-CS-16-118, CMU School of

[5] Zhang, Kaipeng, et al. "Joint face detection and alignment using multitask cascaded convolutional networks." IEEE Signal Processing Letters 23.10 (2016): 1499-1503. Computer Science, Tech. Rep., 2016.

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