Contrast Experiment and Performance Analysis Based on Face Recognition Algorithm

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Abstract

Firstly, a brief review of the development process of face recognition technology is made. Then two face recognition algorithms are selected for practical comparison. The advantages and disadvantages of the algorithm are described by analyzing and comparing the algorithm. The data set is established, the model is trained through the neural network, the face database and the recognition system are built, and a recognition experiment is performed on the system fitted under the two algorithms, and the results are analyzed in combination with the experimental results.

Keywords

Face recognition; dataset; neural network.

1. Introduction

As early as the 1960s, people began to study face recognition. After the 1980s, with the development of computer and optical imaging technology, it entered the primary application stage in the 1990s, and began to learn with machine learning [4] and deep learning [7] in the 21st century. In the rapid development of the image field, the face detection [1] [2] was first realized, and then the recognition of the face was developed. Now the face recognition algorithm is changing with each passing day. The key to the success of face recognition lies in the cutting-edge core algorithm, and makes the recognition result have a practical recognition rate and recognition speed. In recent years, people have used neural networks to deeply train the model [6], which has broken the previous recognition records on the face dataset again and again, and its recognition accuracy is comparable to that of humans. In this paper, the Facenet [11] [12] and Insight Face [14] algorithms are selected for comparison, and the face database is established. The above two algorithms are used to fit two different face recognition systems [9] [13], use their own database to test their recognition accuracy.

2. Algorithm Comparison

Facenet was proposed by Google and refreshed the face verification record on the LFW dataset. Facenet did not use the traditional softmax [8] method for classification learning, but directly end-to-end learning an image to Euclidean distance space. 128-dimensional face feature vector [12], and proposed Triplet loss [10] as shown in Figure 1, directly learn embedding feature [13] through the loss function, and optimize the feature distribution. The FacceNet model learns and outputs the feature representation of the face. The facial features of different people are different. The distance between the two facial features is calculated to achieve the purpose of different face classification.

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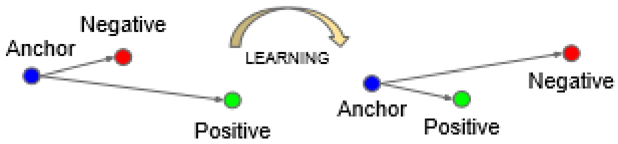

Figure 1. Triplet loss

Insight Face uses the traditional softmax method for classification learning, which is gradually optimized using the most extensive classification loss function Softmax Loss [8] function:

$$L_1 = -\frac{1}{N}\sum_{i=1}^{N} \log \frac{e^{W_{y_i}^T x_i} + b_{y_i}}{\sum_{j=1}^{n} e^{W_{y_i}^T x_i} + b_{y_i}}$$

Where $x_i \in R^d$ represents the deep feature of the i sample and belongs to the y_i class; the embedding feature dimension d is set to 512, and $W_j \in R^d$ represents the j column of the weight $\in R^{d*n}$, $b_j \in R^n$ is the offset term, and the batch size and category number are divided into N and n. The softmax Loss function does not explicitly optimize feature embedding to enhance the similarity of samples within the class and the diversity of samples between classes, which leads to changes in appearance within larger classes (such as changes in posture and age) and larger scale tests. Scenes, there are differences in the performance of deep face recognition. For the sake of simplicity, we have corrected the deviation $b_j = 0$ and converted the logical expression to $W_{y_i}^T x_i = \|W_j\| \|x_i\| \cos\theta_j$, where θ_j is the angle between the weight W_j and the feature x_i ; Correct the single weight $\|W_j\| = 1$ by L2 normalization; fix the embedded feature $\|x_i\|$ by L2 normalization and rescale it to s. The normalization step of features and weights makes the prediction only depend on the angle between features and weights.

$$L_2 = -\frac{1}{N}\sum_{i=1}^{N} log \frac{e^{s\cos\theta_{y_i}}}{e^{s\cos\theta_{y_i} + \sum_{j=1, j\neq y_i}^{n} e^{s\cos\theta_{y_i}}}}$$

Since the embedded features are distributed around the center of each feature on the hypersphere, we add an additional angular margin penalty m [14] between x_i and W_{yi}, which increases the intra-class tightness and inter-class differences. As shown in Figure 2.

$$L_3 = -\frac{1}{N}\sum_{i=1}^{N} log \frac{e^{s\,(\cos(\theta_{y_i}+m))}}{e^{s\,(cos(\theta_{y_i}+m)) + \sum_{j=1, j\neq y_i}^{n} e^{s\cos\theta_{y_i}}}}$$

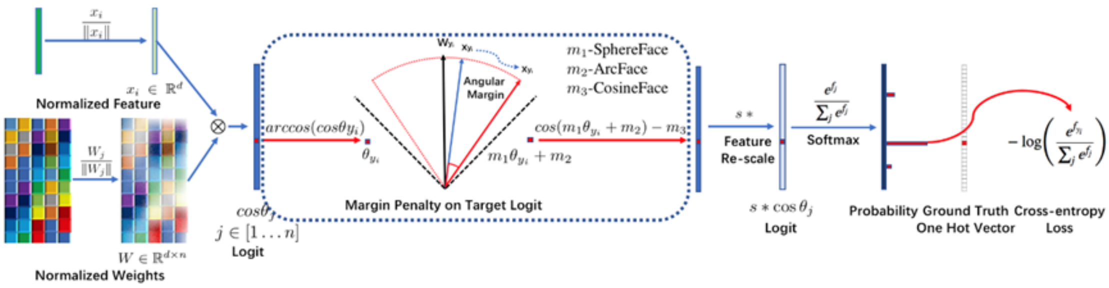

Figure 2. Schematic

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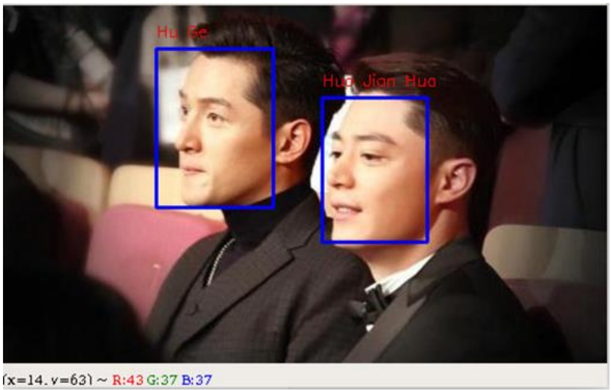
3. Establish A Face Recognition System

Build your own face database, build your own data set, on the one hand use web crawler to collect image data as training data, as much as possible, including different angles, lighting, expressions and other different images, artificial screening of images that do not meet the conditions Ensure that the data set is clean; on the other hand, collect the test image data for the face image that needs to be identified.

The data required to train the model is very large, so I downloaded the CASIA-Webface dataset[14] and trained it with the data I collected. In order to accelerate the convergence speed of the model, it is necessary to load the pre-training model.

FaceNet finally outputs facial features, so it uses a dataset with SVM to train a face recognition system. Insight Face uses softmax for face feature extraction and classification to obtain another face recognition system. The experimental results are shown in Table 1:

Table 1. Comparison of two identification systems

	Facenet	Insight Face
Model verification accuracy on LFW	0.9834	0.9946
The same photo recognition rate comparison screenshot	Recognized: Huo Jian Hua: <0.821> Recognized: Hu Ge: <0.592>	Recognized: Huo Jian Hua <98.11> Recognized: Hu Ge <99.93>
recognize the result		

4. Summary

Using the model obtained from the training to verify on the LFW dataset, we can see that the accuracy difference between Facenet and Insight Face is very small, and the two algorithms perform well on simple face matching effects; face photo recognition test the result is very different.

The distance optimized by the Triplet loss in Facenet is different. The characteristics extracted by different people are different. The same person extraction features will be different because of angle, light, expression, etc., so the space where the same data is located is very divergent, so the performance of face recognition not very stable. The classification effect in space is shown in Figure 4-1. Divergent on the left, compact on the right.

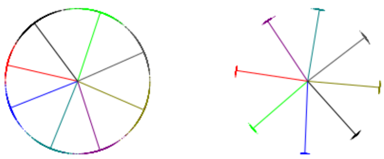


Figure 3. The classification effect in space

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Insight Face adds an additional angle penalty m, which increases both intra-class tightness and inter-class differences, so the recognition rate is high.

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