

Compare Study of traditional machine learning and deep learning algorithm in Face Recognition

Lujie Ma
School of Computer Science
University of Adelaide
a1810558@adelaide.edu.au

Abstract

Identifying objects in the image is now popular in our daily life. Image recognition refers to the task of inputting an image into a neural network and having it output label for that image. A subset of image classification is object detection, where specific instances of objects are identified as belonging to a certain class like animals, cars, or people. This paper will focus on face recognition.

1. Introduction

Face recognition is very common in our daily life, identification is relying on face recognition. Such as tracking student or worker attendance; unlock the phone; law enforcement; airports and border control; finding missing persons and so on. Under the influence of the new crown epidemic (COVID-2019), there is no requirement to get in physical contact with the face recognition, which helps in controlling the spread of diseases like viruses. By the way, face recognition does not disturb the privacy of the individual. Over the past decades, extensive research has made great progress in face recognition. Deep learning and traditional machine learning algorithm is widely used in this area (face recognition). We will Discuss the difference between apply the traditional machine learning algorithm and deep learning in face recognition.

2. Steps of Face Recognition

Facial recognition is a technology that can recognise a person only by looking at them. The steps of face recognition is include preparing the dataset, pre-processing, feature extraction and face verification.

2.1. Pre-processing

Face Alignment is also a step of pre-processing the data sets. Faces in the original data sets can not be used directly,



Figure 1. Example of the output of face recognition. Identify the gender of a person through face recognition by using KNN model. [2]

we should do the pre-processing to the data sets. The purpose of using pre-processing steps in face detection system is to speed up the detection process and reducing false positives. We should extract the images which is wrong. e.g. exclude the image which do not have human faces.

There has some methods in the pre-processing part. One of methods is based on linear image transform (LIT) which ignores scanning a number of non-face windows. The second one utilizes regional minima (RM) to reject non-face windows. [1]

2.2. Feature Point Extraction

Feature extraction is important which will greatly affect the accuracy in the final part (face verification). This part entails measuring and extracting numerous characteristics from the faces. We could use machine learning algorithm or deep learning to help us to get a better strategy to extract the features in faces.

2.3. Face Verification

The final step is face verification. This is the most complex step during the face recognition. By extracting the feature points in the previous step, we need to compare against

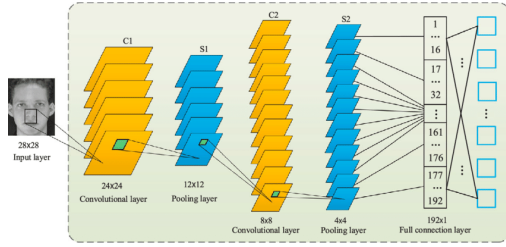


Figure 2. CNN model [4]

the database features. If there is a match, return the face is recognised successfully; if not, return the faces is not included in the database. We can use some match strategy to increase the accuracy in this part. e.g. top-k strategy.

3. Traditional Machine Learning Algorithm

There are many algorithms in traditional machine learning, popular machine learning algorithms include: Linear Regression, Logistic Regression, SVMs, K-Nearest Neighbour, Decision Trees, Random Forests, PCA, K-Means Clustering, and Gradient-boosting trees. Some algorithm's output is interpretable, e.g. logistic regression, decision tree. This is one of benefits of traditional machine learning.

3.1. K-Nearest Neighbour algorithm

There is the formula of K-Nearest Neighbour algorithm in mathematic:

$$d(p, q) = d(q, p) = \sqrt{\sum_{i=1}^n (q_i - p_i)^2} \quad (1)$$

KNN is the most practical / non-parametric approach for facial recognition. [3] based on features such as eyes, nose, eyebrows, mouth, ears within the source image. It achieves its robustness by normalising the size and orientation of face. [5]

The disadvantages of KNN: Time complexity for each prediction is $O(MN \log(k))$ where M is the dimension of the data, N is the size or the number of instances in the training data. Therefore, KNN method not work good in a large datasets.

4. Deep Learning Algorithm

In recent year, deep learning have been recommended to solve the problems in computer vision area. The benefit of deep learning is that deep learning is able to perform automatic feature extraction from the data. Deep learning models can find much higher-level or abstract representations of data, which machine learning can not do this.

4.1. Convolutional Neural Networks

In face recognition, CNN model achieve great success which can get a high accuracy in face recognition. There are many researches around the CNN model. If we want to identify the person, using CNN model accomplishes this by extracting the low-level features such as the edges contained in raw pixels. Then deduce some abstract concepts of the nose or eyes in the face, which is useful to proceeds to recognise the face.

However, Convolutional Neural Networks has some disadvantages. The lack of interpretability and randomness sometimes plagued by researchers.

5. Conclusion

In this paper, we analysis the technology based on some descriptor methods and combine the traditional machine learning algorithm (K-Nearest Neighbour algorithm) and deep learning algorithm (Convolutional Neural Networks). It still have many algorithms which works perfect in face recognition. However, there are still many challenges exists in the face recognition. e.g. identity faces in the low light environment, face recognition with extreme poses.

References

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