Artificial Neural Network in Face Detection

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ABSTRACT
Face detection is one of the challenging problems in the image processing. The basic aim of face detection is determine if there is any face in an image. And then locate position of a face in image. Human face detected in an image can represent the presence of a human in a place. Evidently, face detection is the first step towards creating an automated system, which may involve other face processing. The novel face detection approach relies on neural networks, which can be used to detect faces by using transformation fast Fourier transform (FFT). The neural network is created and trained with training set of faces and non-faces. The network used is a two layer feed-forward network. There are two modifications for the classical use of neural networks in face detection. First, the neural network tests only the face candidate regions for faces, thus the search space is reduced. Second, the window size used by the neural network in scanning the input image is adaptive and depends on the size of the face candidate region. All results are implemented in MATLAB 7.0 environment.

Keywords: Neural Network, face detection, FFT, feed forward Network, MATLAB.

1. INTRODUCTION

1.1. Neural Network

Neural networks have emerged as a field of study within AI and engineering via the collaborative efforts of engineers, physicists, mathematicians, computer scientists, and neuroscientists. Although the strands of research are many, there is a basic underlying focus on pattern recognition and pattern generation, embedded within an overall focus on network architectures.

This section focuses on the pattern of connections between the units and the propagation of data. As for this pattern of connections, the main distinction we can make is between.

1.1.1. Feed-forward neural networks

Where the data flow from input to output units is strictly feed forward is called feed forward neural network. The data processing can extend over multiple (layers of) units, but no feedback connections are present, that is, connections extending from outputs of units to inputs of units in the same layer or previous layers.

1.1.2. Recurrent Neural Networks

Contrary to feed-forward networks, the dynamical properties of the network are important. In some cases, the activation values of the units undergo a relaxation process such that the neural network will evolve to a stable state in which these activations do not change anymore. In other applications, the changes of the activation values of the output neurons are significant, such that the dynamical behavior constitutes the output of the neural network.

2. FACE DETECTION IN IMAGE

Many techniques for face detection in image were classified into four categories.

2.1. Knowledge based method

It is dependence on using the rule about human facial feature. It is easy to come up with simple rules of describe the features of a face and their relationships. For example, a face often appears in an image with two eyes that are symmetric to each other, a nose, and a mouth. , and features relative distance and position represent relationships between feature. After detecting features, verification is done to reduce false detection. This approach is good for frontal image; the difficulty of it is how to translate human knowledge into known rules and to detect faces in different poses [1].

2.2. Image Based method

In this approach, there is a predefined standard face pattern is used to match with the segments in the image to determine whether they are faces or not. It uses training algorithms to classify regions into face or non-face classes. Image-based techniques depends on multi-resolution window scanning to detect faces, so these techniques have high detection rates but slower than the feature-based techniques. Eigen-faces and neural networks are examples of image-based techniques.

2.3. Features Based method

In feature-based approaches researchers have been trying to find invariant features of faces for detection. The underlying assumption is based on the observation that humans can effortlessly detect faces and objects in different poses and lighting conditions and, so, there must exist properties or features (such as eyebrows, eyes, nose, mouth, and skin color) which are invariant over these variability's. Numerous methods have been proposed to first detect facial features and then to infer the presence of a face. Based on the extracted features, a statistical model is built to describe their relationships and to verify the existence of a face. In this paper skin color feature will be discussed and used [5].

2.4. Template matching method

Template matching is a method of comparing an input image with a standard set of images known as templates. Templates are face parts cut from various pictures. Normal correlation between the input image and each template image is calculated. This technique compares two images to decide if the desired shape was being viewed [6]. Template matching methods use the correlation between pattern in the input image and stored standard patterns of a whole face / face features to determine the presence of a face or face features. Predefined templates as well as deformable templates can be used. A template-based face detection method includes: producing an average face image from a face database, wavelet-converting the produced face image and removing a low frequency component of high and low frequency components of the converted image [1].

3. IMPLEMENTATION PHASE

3.1. Architecture methodology

First create the neural network architecture and then trained with training set of faces and non-faces. In neural network architecture some functions are used for train purpose (training function trainscg ()), initialization purpose (Layer Initialization Functions initnw()), for performance purpose (Performance Functions msereg ()) etc. in our face detection algorithms Fast Fourier transform are using with training function trainscg()[8].

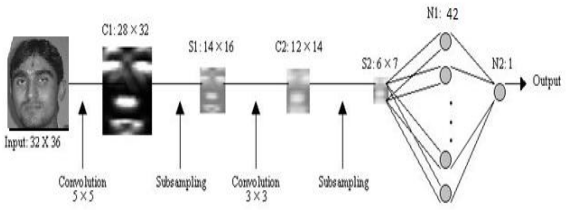

Fig.1: Architecture for Face detection

3.2. Training methodology

Before the training, first stored 50 face image of size 32×36 a 50 non face image of same size and then load the both folder in MATLAB and make a .mat file.MAT file is use as database if change in some image in the folder of face and non face then it will create again. Multi-Layer Perception (MLP) with a back propagation learning algorithms was chosen for the proposed system due to its simplicity and its capability in supervised pattern matching. It has been successfully applied to many pattern classification problems [2]. Our problem has been considered to be suitable with the supervised rule since the pairs of input-output are available. For training the network, basically used the classical back propagation algorithm. An example is picked from the training set, the output is computed. The error is calculated as the difference between the actual and the desired output. It is minimized by back-propagating it and by adjusting the weights. Although back-propagation can be applied to network with any number of layers, it has been shown that one layer of hidden units suffices to approximate any function [4]. Therefore, in most application, a MLP NNs with a single layer of hidden units is used with a sigmoid activation function for the units f (a) $=1/1+e^{-a}$. This function has the interesting property of having an easy to compute derivative f ' (a) = f (a) [1- f (a)][9]. The MLP training is amount to: Repeatedly presented with sample inputs and desired targets, then the output and targets are compared and the error measured. At last, adjusts weights until correct output for every input image [10].

4. RESULT

The test was performed using 6 training images. The results are as followed in Table 1. The face detection algorithm (FFT_trainscg()) shows 92.006 % of right hit rate, 5.714 % of repeat rate, 9.89 % of false hit rate and Average Accuracy is 82.56%. The average run time is 287.4026 seconds.

	Size _of_ image	Num_ Faces	Num _Hit	Num_ Repeat	Num _False	Num_miss	run time [sec]	False_postive(%)	False negative (%)	Accuracy(%)
Dog1.jpg	60X59	1	1	0	0	0	8.674004	00	00	100
Mon2.jpg	128X93	1	1	0	0	0	0.994095	00	00	100
3.jpg	150X150	7	6	0	1	1	58.51247	14.28	14.28	71.27
4.jpg	150X65	7	7	0	0	0	23.413958	00	00	100
5.jpg	130X96	15	14	0	1	1	51.352306	6.66	6.66	86.66
6.jpg	226X108	4	3	1	1	1	16.706838	25	25	50.0

Table1. Face Detection Results using 6 Training Images

Num_ Faces: total number of faces in the picture
Num_ Hit: number of faces successfully detected
Num _ Repeat: number of faces repeatedly detected
Num_ False: number of case where a non-face is reported
Run time: run time of the face detection routine

*run time measure in C2D processor, 2.66 MHz, 2.00 GB RAM.

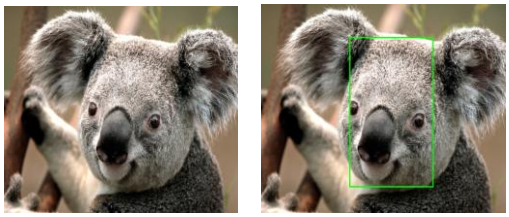

Fig-2(dog1.jpg)

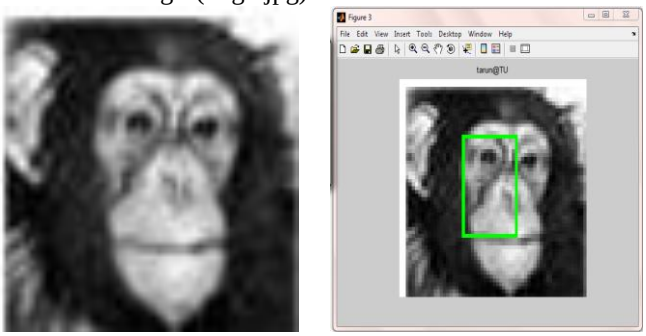

Fig-3(monkey2.jpg)

Fig-4 (6.jpg)

In this algorithm implemented some images of animal faces etc .It is also worked for other species that have two eyes, a noise and a mouth. Some figure using MATLAB tool shown in above fig 2 fig 4 and fig 4. One is without detection the face and second one after implementation in MATLAB. Some interesting results are attached in the table 1, RGB image convert into gray image for face detection[7].

5. CONCLUSION

Our experiments have shown that using MLP neural networks for face detection is a very promising approach. The model's robustness has been obtained with a back propagation learning algorithms and the **tansig(()** activation function[3]. In our approach no preprocessing is needed since the normalization is incorporated directly in the weights of the input network. MATLAB's Neural Network Toolbox has proven to be relatively easy to use to develop, train, and test neural networks. Images can be imported directly into the MATLAB workspace and supporting applications to create training data implemented as MATLAB script.

6. REFERENCE

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