

Using the Cascade Pattern for Sex Determination

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Abstract: One of the very useful tools that today is considered by many researchers and scholars is to use logical patterns to achieve previously planned results. Because of different applications, different models have been proposed for the sex determination and one of these models is the cascade mathematical model that offers the desired result through approximate the data and scaling algorithm. Purpose of this study is to use these networks to detect the sex from the face. Results obtained in experiments revealed that face-based sex determination has been successful to the extent of 90%, indicating its ability to solve the issues of sex determination.

Key words: Cascade algorithm, image processing, sex determination, scale, logical patterns

INTRODUCTION

Sex determination plays a major role in identifying people and display their feelings in the community. The human ability to determine the sex (or gender) is significant. This skill will stand against changes in visual conditions such as facial expression, age as well as changes in glasses, beard or hair style. Face-based sex determination is a major issue in the application such as security systems, credit card control and identify the culprits. For example, the ability to model a specific face and distinguish it from a large number of stored faces models, improve extensively the process of identify the culprits. In order to solve the problems that derive the appropriate procedures to solve it, it is recommended the use of various algorithms in information processing which is called the planned calculation (Athitsos *et al.*, 2005). While it is true that humans are capable of sex but the coding and de-coding methods of faces in human brain is not quite clear. Face detection and sex determination has been studied for over 20 years. The development of a computational model for face detection is quite difficult due to the complexity of faces and multi-dimensional structure of the visual. Therefore, face detection is a high-level activity in computer vision and can encompass many initial vision techniques (Gama and Brazdil, 2000; Blanchet and Charbit, 2006).

In issues where a certain method cannot be presented or our knowledge is too small that an exact

solution is not possible, the use of algorithmic method is proposed which should be based on true, logical and organized matters. The first stage of face detections is to extract evident features of face images. Here a question arises and to what extent it has the ability to measure facial features. Studies in the past few years suggests that human focus on specific features of face for face detection.

Despite the reliable biometric systems such as fingerprint and iris identification, sex determination system creates a more emotional relationship between the machine as the operator and the user and this is done without full contact of body part with detection devices and instill greater confidence among users and the development of advanced digital cameras has been instrumental in developing and increasing the fans of this system (Athitsos *et al.*, 2005; Segal and Weinstein, 1988).

Because of lack of enough understanding, detection of facial features cannot be achieved simply by machine. In this study, we try to provide an algorithm using a cascade pattern and implement a scale pattern to perform a face-based sex determination. First, we try to describe the features of this algorithm and express its structure and then we will explain the test results.

CASCADE ALGORITHM DESCRIPTIONS

In mathematics and particularly in wave theory, the cascade algorithms is a Numerical Method to calculate the

function values using a scale and the discrete and repeatable wave functions. In general, the basis for this sampling algorithm is the values of a sequence and valuing the sampled consecutive points of that sequence. Since, this action is sequentially applied to the output generated this algorithm is called cascade algorithm (Segal and Weinstein, 1988).

By using filter coefficients, iterative algorithm implemented to generate successive approximations for $\psi(t)$ or $\varphi(t)$. If the algorithm converges toward a specific point, then the point formed the amount of wave functions. When the boundary conditions $\varphi^{(0)}(t)$ is set this repeatability for kth approximation is defined as follows:

$$\varphi^{(k+1)}(t) = \sum_{n=0}^{N-1} h[n] \sqrt{2} \varphi^{(k)}(2t-n) \quad (1)$$

The amplitude of wave function approximation based on the scaling is as follows:

$$\Phi^{(k+1)}(\omega) = \frac{1}{\sqrt{2}} H\left(\frac{\omega}{2}\right) \Phi^{(k)}\left(\frac{\omega}{2}\right) \quad (2)$$

Now if an image be given to the above wave function in the form of pixel, the function must tends towards infinite to cover this image completely. So:

$$\Phi^{(\infty)}(\omega) = \prod_{k=1}^{\infty} \frac{1}{\sqrt{2}} H\left(\frac{\omega}{2^k}\right) \Phi^{(0)}(0) \quad (3)$$

By applying the infinite to understand the whole measure, we have:

$$\Phi(\omega) = \prod_{k=1}^{\infty} \frac{1}{\sqrt{2}} H\left(\frac{\omega}{2^k}\right) F^{(0)}(0) \quad (4)$$

Given the above function, we concluded that this limitation is related to the initial form of data and the sex determination is based on this limit. The cascade model converged to $\varphi(t)$ and in particular, the following functions determine as a response that can be detected by applying some certain filters and specific classification of function for the desired gender:

$$\psi(t) = \sum_{n=-\infty}^{\infty} g[n] \sqrt{2} \varphi^{(k)}(2t-n) \quad (5)$$

In Fig. 1, approximation of a diagram has been symbolically determined using the cascade algorithm through several stages.

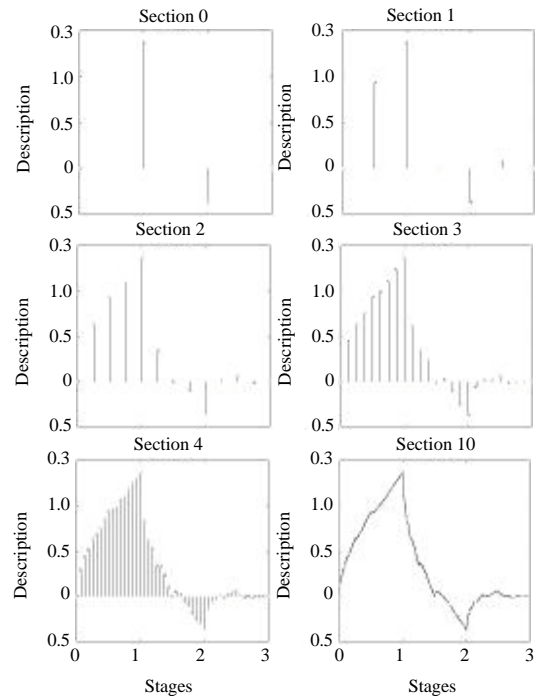


Fig. 1: The symbolic description of cascade algorithm

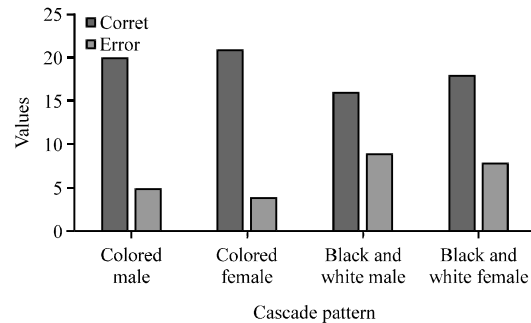


Fig. 2: Evaluate the performance of cascade pattern compared to different images

DESCRIPTION OF THE EXPERIMENT

After the process of coding in C++ language, four categories of different image on the basis of sex and color of the picture was given to the desired code. The results showed that the cascade algorithm works well in sex determination. Pictures of female sex are diagnosed with less error than male sex which stems from the type of facial expression and makeup. About assessment the algorithm toward the color of pictures, color image was relatively better than black and white.

For this purpose, from each category, 25 image were assigned to the desired code and then the operation of



Fig. 3: Examples of images given to the cascade pattern

sex determination was initiated based on the type of images. The results are shown in Fig. 2. As can be seen in Fig. 1, the best performance of cascade pattern was obtained in female color images that 84% of cases were correctly identified. Figure 3 shows several kinds of different images given to the pattern.

CONCLUSION

Sex determination in the different images were evaluated by the cascade algorithms in four different groups that the final result was dependent on the input image and image quality. Regardless of the type image, the results showed that the sex determination carried out through this algorithm was correct in 75% of cases. In issues where a certain method cannot be presented or our knowledge is too small that an exact solution is not possible, the use of algorithmic method is proposed. Nevertheless, we can try to improve the performance of this algorithm through the development of the algorithm and determine the complex and boundary conditions for it such as type of makeup.

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