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AESN: A Database of Human Eyes, Noses, and Mouths for Person Identification or Facial Expression Recognition

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ABSTRACT

In this paper, we have constructed AESN, a database for regions of human faces. AESN is an improved dataset of human eyes, noses, and mouths that are clipped from facial photos. It was constructed to identify people, in addition to recognizing expressions of individuals. This database was collected from several resources, some from the Internet, and others taken by our cameras. We have got it through several types of multimedia, either directly from pictures or by extracting frames from videos. The purpose for needing a dataset for eyes was due to the emergence of the Corona pandemic, which obligated people to wear masks. In our work, we need AESN during developing a monitoring system to increase their ability to discover the identity of people through the eyes area only. It was considered a great challenge due to the loss of a large part of the face. We have accomplished promising results when using AESN images in our studies. In addition to the eyes, the remaining parts of the face (nose and mouth) have many interests due to the diversity of the shape of the nose, which mainly serves medical applications and the gestures that occur in the mouth as a result of emotional reflections that help us clarify the emotional state of the person, as well as helping researchers in finding biometrics features for recognition systems.

1. Introduction

One of the most challenges that researchers face in the process of capturing and dealing with parts of the face is the angle of capturing the image and the accuracy of the captured image. For example, but not limited to, occurs can prevent a person from accessing or using custom resources. The development of monitoring systems based on cloud computing and the analysis of people's images is one of the most important developments in technology due to the principle of security[1][2]. To clarify the mechanisms used in selecting the images to be intersected, it is to define the area of the eyes as indicated in [3], and when the selection is clear, the images are selected, cropped, and stored. Also, one of the conditions

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required to be met is not to wear obstacles that make it difficult to discriminate, that is, to follow the same controls used in registering people's identities in civil records, issuing passports, or entering the airport. It is not permitted to cover the eyes or wear sunglasses, as shown in Fig.1.

Fig. 1. Samples of obstacles in eyes detection

In addition to the above, many applications use images of eyes, including in determining eye color. In our previous study, we extracted eye color as one of the characteristics of humans [4]. Also, eye images are used to identify some diseases such as trachoma, cataracts, etc., as in Fig. 2. that may cause major problems for vision and can be observed from digital images. Eye diseases are considered one of the most common diseases that cause complete disability in humans, as they move them from the world of colors and shapes to nothingness. It causes the person significant effects not only on the level of vision, but also on the psychological level. Therefore, trying to diagnose the diseases that cause blindness early is necessary. Digital image processing played a major role in detecting many diseases, so it is necessary to provide a good database dedicated to eyes only to make it easy for researchers to classify, compare and recognize as well. Any acceleration in the process of discovering the disease makes more speed of determining the necessary treatment for it [4][5].

Fig. 2. Snapshots of infected eyes

As well as images of eyes, noses, or mouths only make it possible to detect the psychological state of a person, such as states of anger, happiness, fear ... etc. Although eyes are the most expressive tool in the face [6], mouths have become a very promising tool in emotion prediction, as depicted in Fig. 3. The recognition of emotional aspects through facial expressions is a common thing, as many research have appeared in the past decades. Its use has increased with the increase in applications based on multimedia and the development of technological imaging devices that have become available in abundance. As a result, the study in this field has increased the mechanism of interaction between man and computer. The researchers dealt with the creation and use of a database of various human expressions (sadness, happiness, anger, wonder, naturalness, annoyance, fairness, and others). Consequently, the higher the accuracy of the captured images, the better results they gave[7][8].In addition to the above, the nose has received wide attention in cosmetic operations, especially for people who have been subjected to accidents that led to fracture or deviation in the nasal bone. And for the shape of the nose to be consistent with the face, the shapes of the noses have been classified from coarse to fine. Determining the outline or shape of the nose is necessary for patients who wish to undergo surgical operations (nasal deviation, sinusitis, plastic surgery) As it is difficult to imagine the shape of the nose before the operation, so the doctor needs to clarify the current shape of the nose and what it will reach after the operation, and what changes will occur, especially if the patient had been involved in an accident that resulted in a shattered or major deformity of his nasal bone.

Fig. 3. Eyes and mouths emotions

Adopting the appropriate shape is not limited to the nose itself but is affected by the rest of the parts of the face, including the eyes, cheeks, mouth, and the shape of the face in general[9][10], as seen in Fig. 4.

Fig. 4. Different shapes of noses

2. Methodology

RGB images were collected and prepared as we take pictures using a camera or video recording. We have taken into account choosing the shots that are frontal and do not contain deviation in the angle of capture. Also, the eye features must be clear, because the main goal is to extract the eye features to adopt them as an identifying feature. And as we indicated previously move away from everything related to covering the eye. Some things directly affect the features of the eye, which as the intensity of lighting, as it negatively affects the change of eye color due to reflections, in addition to changing its size, as the person is forced to close it in the case of strong lighting. After completing the registration process, the eyes and forehead area is determined using the Viola Jeans algorithm (adopted in our research) which is named after two researchers in the field of computer vision (2001), Although this algorithm is not recent, it has proven its strength in distinctively identifying facial features [11][12]. As we referred, the principle of eyes detection depends on the hypothesis that depending on the region of the eyes is darker than the nearest region they are neighbours for it. To find the segments of eye analog search in the input image for small patches that are nearly darker than their neighbourhoods and as larger as eyes. We considered a pair of potential eye regions as eyes if it satisfies some conditions depending on the anthropological characteristics of human eyes. For discarding regions corresponding to eyebrows, the system uses the fact that the centre part of an eye region is darker than other parts. After that, a simple histogram analysis of that region is done to select eye regions since an eyebrow region should exhibit only one peak while an eye region shows two. An end constraint is the alignment of the two major axes, so the two eye regions belong to the same line. According to the above, we add to this region the forehead because we need the upper part of the face being separated, as in Fig. 5.

Fig. 5. The cropped eyes and forehead from the RGB face image

We notice in the pictures that the eyes area has been deducted, in addition to the forehead area, for the purpose of taking advantage of a larger set of features, such as skin colour[3], as these features are included in many classifications for the purpose of finding differences between one person and another. Moreover, the classifications of the nose and mouth have many applied fields and different uses either in computer vision or medical applications. Determining the shape of the nose, whether by colored or thermal images or using X-rays, has greatly contributed to identifying nasal problems and the mechanism of their treatment. On the other hand, emotional states have a great impact on the muscles of the face, especially the mouth, and each expression has several levels of influence and changes, for example, a smile differs from laughter, or anger differs from screaming, and so on.These expressions were reflected in the shape and movement of the mouth due to the tensile and relaxation processes that occur in the facial muscles, especially those surrounding the mouth. We have used the same technique above in determining both nose and mouth. The frame of the face was initially determined, then the mouth and nose are cut as eyes, and stored in our dataset. As in Fig. 6 and Fig. 7, the capture angle was luminal which helps in achieving the process.

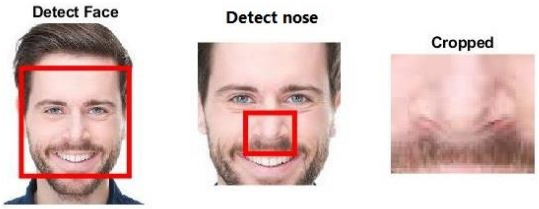

Fig. 6. The cropped face and nose from the RGB face image

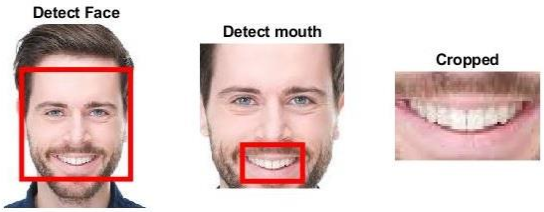

Fig. 7. The cropped face and mouth from the RGB face image

3. Dataset Description

The dataset of face images that are associated with this paper is collected from different resources which are as follows.

- Celeb A Data set found in [13],
- Caltech 101 dataset [14],
- Videos of celebrities on the Internet,
- Photos and videos of our relatives in Egypt and Iraq.

All these images are in RGB, after arranging these images, we resized and labeled them, to be ready for any system eighter for detection, classification, or identification.

4. Conclusion

Many methods can be used to cut parts of the face, especially if the faces have strong angles of deviation, and each of them has its own appropriate treatment method, which may make it more difficult. Therefore, the process of choosing the appropriate database or image capture method is not simple to create a larger dataset and obtain better results. Therefore, supporting the systems with good data helps in giving the correct recognition rates and reducing the size of the resulting error, because any defect in the data that feeds the system leads to a failure in the accuracy of the results.Since recognition systems depend mainly on the accuracy of the images taken for the purpose of giving better results, this also depends on the camera used for capture, the angle of capture, lighting, and the background of the images. All of these factors affect the details and data of the images. [15][16].

5. Dataset Availability

The dataset associated with this Paper is devoted to the public domain, and it is available at https://drive.google.com/drive/folders/1QPJpmX-kkSmVEf3SGdsbHIP3A1CS9n6l
In addition, more information on how the regions were detected and clipped can be found find in our research paper [3].

6. Disclaimer

This paper was funded and managed by authors from Basra University and Ain Shams University, as part of our study.

7. Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

8. Acknowledgment

We must express our thanks and appreciation to everyone who contributed to recording or taking pictures that support our work, given that our system was based on merged data between the pictures announced on the Internet and real pictures from our community.

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AESN قاعدة بيانات للعيون والأنوف والأفواه البشرية لتحديد هوية الأشخاص أو التعرف على تعبيرات الوجه

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الكلمات المفتاحية

تعبيرات الوجه، عيون الإنسان، قاعدة بيانات الصور، تحديد هوية الشخص.

الملخص

في هذا البحث، قمنا ببناء AESN، وهي قاعدة بيانات لمناطق الوجوه البشرية. AESN عبارة عن مجموعة بيانات محسنة للعيون والأنوف والأفواه البشرية التي يتم قصها من صور الوجه. تم إنشاؤه للتعرف على الأشخاص، بالإضافة إلى التعرف على تعبيرات الأفراد. تم جمع قاعدة البيانات هذه من عدة مصادر، بعضها من الإنترنت والبعض الآخر إلتقط بالكاميرات. لقد حصلنا على ذلك من خلال عدة أنواع من الوسائط المتعددة، إما مباشرة من الصور أو عن طريق استخراج الإطارات من مقاطع الفيديو. وكان الغرض من الحاجة إلى مجموعة بيانات للعيون بسبب ظهور جائحة كورونا، مما ألزم الناس بإرتداء الكمامات. نحتاج في عملنا إلى AESN أثناء تطوير نظام المراقبة لزيادة قدرتهم على اكتشاف هوية الأشخاص من خلال منطقة العيون فقط. واعتبر ذلك تحديا كبيرا بسبب فقدان جزء كبير من الوجه. لقد حققنا نتائج واعدة عند استخدام صور AESN في دراساتنا. وبالإضافة إلى العينين، فإن لأجزاء الوجه المتبقية (الأنف والفم) اهتمامات عديدة نظراً لتنوع شكل الأنف الذي يخدم بشكل رئيسي التطبيقات الطبية والإيماءات التي تحدث في الفم نتيجة الإنعكاسات العاطفية، التي تساعدنا على توضيح الحالة العاطفية للشخص، كما تساعد الباحثين في إيجاد ميزات القياسات الحيوية لأنظمة التعرف.

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