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Survey On Face Detection and Recognition Algorithms Using Deep Learning

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Abstract:

A facial recognition system uses a number of algorithms to recognize faces in digital photographs, identify people, and then confirm the authenticity of the acquired images by comparing them to facial images that have been saved in a database. Biometric technology is based on facial features of a person. Face detection and Recognition are major concerns in the area of biometric based systems and purposes. This process must ensure recognition accuracy and minimum processing time. Some cutting-edge techniques allow it to be retrieved more quickly in a single scan of the raw image and lie in a smaller dimensional space while effectively keeping face information. The techniques for face detection and recognition are classified on the bases of their target application. Also, the techniques are classified and analyzed on the bases of their working domain as spatial, frequency, integrated and hardware support. Face detection is a challenging topic in computer vision because the human face is a dynamic object with a great degree of diversity in its appearance. There have been many different ways put forth, from straightforward edge-based algorithms to composite high-level systems leveraging cutting-edge pattern recognition techniques. With the help of biometrics, a facial recognition system can extract facial details from a picture or video. The data faceprint stored via facial traits is compared by the face recognition software using deep learning algorithms.Among them, face detection is a very potent tool for face recognition, image database management, human computer interface, and video surveillance. Face recognition is a rapidly developing technology that has been used extensively in forensics for purposes including criminal identification, airport security, and controlled access.

Keywords **—Face Recognition, Linear Discriminant Analysis, Face Image, Internal Feature, Scatter Matrix, Face Detector.**

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I. INTRODUCTION:

Using a digital image or a video frame from a video source, a person can be recognized using a facial recognition system. Systems for facial recognition can function in a number of ways. The first iteration of facial recognition technology was a computer application program. However, now it is more prevalent in both IOS and Android apps and is also used in other different forms of technology such as robotics. The facial recognition system is more commonly employed as a security mechanism than biometric systems such as fingerprint and eye recognition technology. Biometric software called facial recognition technology maps an individual's facial traits statistically and stores them as data for a face print. With the help of deep learning algorithms. Whenever an individual utilizes the software, the face is verified through the stored images in the system. If it matches the stored image, the individual is granted access. Facial recognition systems run on an algorithm. They map a particular device, photo, ID against a person concerning its facial features. Facial recognition technology employs different methods to capture and store images. These images are stored in the system for future use, and when a user uses the feature the next time, the idea is matched with the ones stored in the system.

Many companies now depend on facial recognition technology to enhance their organization's safety. This research will focus on the algorithms that the system deploys to help understand how images are captured, stored, and recognized by the system to grant access to a user. These algorithms are complex in nature. A comparison will also be drawn with other security measures such as fingerprint and manual password entering systems. This research will provide a detailed analysis of how facial recognition technology has performed compared to other security measures and whether or not it has been successful in terms of security.

A face image detector and a face recognizer are the two functional elements that make up this architecture. The face image detector examines the image for human faces and isolates them from the background. After a face has been identified or located, the face recognizer will perform a recognition process to determine who the people are. They have a feature extractor and a pattern recognizer for face identification and recognition. The field of biometrics technology utilizes detection and recognition methods involving human body parts such as fingerprint, palm, retina (eyes) and face. Biometrics ID method of access is not only authenticating but also verifies the identity of a person, which corresponds to the authorized access. It helps us from many frauds and cheatings etc.

II. LITERATURE REVIEW

In Deep Learning for Face Recognition: A Critical Analysis, Biometrics includes fingerprint, retinal scanning, voice identification and facial recognition. It is now commonplace in applications such as airport security, and has been widely embraced by law enforcement agencies, due to the improving accuracy and deploy ability of systems, and the growing size of face databases [1].

All facial recognition and detection systems require the use of face datasets for training and testing purposes.

This review will alternatively focus on more recently proposed deep learning methods, which were developed in response to the limitations of HoG and Haar wavelet features in capturing salient facial information under unconstrained conditions. Loss function modifications have been very popular as a means of improving accuracy of face recognition systems, thus many variations have been proposed lately. Softmax loss function and its variations are commonly used as they promote separation of features. Improving performance by increasing depth and width has drawbacks such as overfitting, which may lead to bottlenecks and needlessly increases computer resources, e.g., when a lot of weights eventuate with 0 values.

In Face Detection on Low-Quality Images: A Survey Yuqian Zhou, Ding Liu, and Thomas Huang are the authors. Deep object identification networks that were trained on high-quality samples were demonstrated to be unreliable when put to the test on low-quality photos. In this study, we examine the sturdiness of face detection algorithms on low-quality FDDB photos with varying blur, noise, and contrast levels. To make the images less noisy and have lower high-frequency components, gaussian blur is used. By reducing the ranges, we can restrict the original images' pixel values. We discovered that the lack of appropriate blurry features in the intended or learnt filter banks renders both classical and deep learning methods insufficiently resistant to the blurring of testing samples.The test photographs feature several indistinct tiny faces in the background and a larger face in the center. We discovered that additive noises have a significant impact on all models' detection efficiencies, particularly when the variance hits 1, at which point no faces could be detected by any of the models [2].

In a survey of deep face recognition, Face detection performance has significantly increased in terms of both speed and accuracy because to the potent DCNNs. Face detection, at least frontal face detection, is no longer a difficult task. A dataset called CASIA WebFace has over 500K photos of 10K people. The CASIA group automatically gathered it, and it was later manually edited. The Oxford group has proposed a dataset called VGGFace for training deep models. It contains about 2.6 million faces of 2,622 people. The set includes 3.7 million annotated video frames from over 22K recordings of 3,100 subjects, as well as 367,888 face annotations in still photos for 8,277 subjects. Although this loss effectively differentiates training classes, it does not expressly limit the intra-class variation of each subject, which is its fundamental drawback for transfer learning. By splitting the encoder into two sections, one of which creates identity features and the other of which is supervised with non-identity labels, their approach achieves disentanglement [3].

In a Survey of Face recognition with Machine Learning, although face recognition systems in indoor platforms have improved to a certain extent, face recognition in outdoor platforms continues to be a difficult problem due to variations in lighting conditions. By placing a camera in a high position, the faces are seen from a certain angle. Given an image of an unknown person, identify that person using that image using a database of images of well-known people. Finding the positions and dimensions of a known quantity of faces is the goal of face localization (usually one). One lacks this additional information when it comes to facial detection. The Eigenface method is one of the generally used algorithms for face recognition [4].

In a Deep Neural Networks-Based Survey on Face Recognition, The quality of the retrieved features has a significant impact on how well face recognition systems and picture classification algorithms perform. Instead of manually creating feature extractions, deep neural networks give well-informed feature learning. The accuracy of computer vision tasks is increased by unsupervised neural networks' non-linear dimensionality reduction, which is substantially more accurate than statistical approaches. Their approach uses customized window widths created to better collect facial information; face knowledge being included into the neural network architecture. Since Gabor wavelet processing works with pictures in both the spatial and frequency domains and can effectively capture various local orientations and scales, it is employed here to extract information from photos of faces. Consequently, greater feature extraction, better generalization, and enhanced classification performance in the extremely blurred images are enabled. This demonstrates the subtle changes in the highly blurred input photos [5].

In Recent Developments in Deep Learning Face Recognition Method, the human face is an essential component of social connection and communication. Face recognition is also crucial for interactions between humans and computers. These days, access control, security, surveillance systems, and the entertainment sector all make extensive use of it. These tasks are made simpler and quicker thanks to advances in face recognition. There are different categories of face recognition: Face verification, and Face recognition [6].

In Methods & Applications for Face Recognition, the study of image analysis and computer vision has a difficult challenge in face identification. Information security is becoming increasingly important and challenging. Currently, security cameras are prevalent at offices, universities, airports, banks, ATMs, and other places with security systems. A biometric system called face recognition is used to recognize or authenticate a person from a digital image. Security systems use face recognition technology. The approaches for facial recognition are as follows: 1. Integrated matching techniques 2. Methods based on features 3. hybrid approaches [7].

In Automated attendance system implementation study using face recognition technology, In numerous applications, including video monitor systems, human computer interface, door control systems, and network systems, human face recognition is a crucial subfield of biometric verification. This essay explains a mechanism for tracking student attendance. Using Personal Component Analysis for face recognition the system will keep track of the pupils' attendance in class. It will give the instructors the tools they need to access student information [8].

In Convolutional neural networks and edge computing are used in the Deep Unified Model for Face Recognition, Due to its non-contact method, face recognition technology has a modest advantage over other biometric systems like fingerprint, palm print, and iris. Without touching or other interaction with the person, face recognition technology may also identify them from a distance. Face recognition systems also aid in deterring crime because the images they collect can be saved and used in a variety of ways to identify a person. Face recognition software is currently used in places like Facebook, airports, train stations, bus stops, and other public spaces [9].

III. METHODOLOGY

One of the simplest aspects to recognize in a face is its eyes, which is often where algorithms for detecting faces begin their search. The computer might then try to identify the iris, mouth, nose, and nostrils. The algorithm does extra tests to verify that it has actually spotted a face once it determines that it has located a facial region.

Template-matching methods are based on comparing images with standard face patterns or features that have been stored previously and correlating the two to detect a face. Unfortunately, these methods do not address variations in pose, scale and shape. Using motion to find faces is another option. In real-time video, a face is almost always moving, so users of this method must calculate the moving area. One drawback of this method is the risk of confusion with other objects moving in the background. Although the Viola-Jones framework is still popular for recognizing faces in real-time applications, it has limitations. For example, the framework might not work if a face is covered with a mask or scarf, or if a face is not properly oriented, then the algorithm might not be able to find it. Face detection improves surveillance efforts and helps track down criminals and terrorists. Personal security is also enhanced since there is nothing for hackers to steal or change, such as passwords. Face detection and facial recognition technology is easy to integrate, and most solutions are compatible with the majority of security software. In the past, identification was manually performed by a person; this was inefficient and frequently inaccurate. Face detection allows the identification process to be automated, thus saving time and increasing accuracy. Face detection can also be used for facial motion capture, which is the technique of employing cameras or laser scanners to digitally record a person's face motions.

IV. DISCUSSION

Face detection technology provides better security opportunities. It increases the level of protection. For instance, facial detection software helps the enhancement of surveillance strategies and serves as the foundation for the identification of terrorists and criminals. It is also possible to create face recognition technologies like Face ID or faceprint readers. It is fundamental to face recognition because all face recognition technologies intrinsically detect faces at first. Traditional verification involved showing an identification document (ID) to a security guard or seller. This type of verification is not possible online. Additionally, not all biometric identifiers are included in IDs, passports, and driver's licenses. Photos that include the person's face, on the other hand, are included in most IDs. For instance, AI enables today's facial recognition systems to incorporate multifactor authentication, video authorization and other features to create a more capable access control solution. Facial recognition is expanding its use cases and capabilities, making it a technology worth investigating and considering today for the challenges of tomorrow.

V. CONCLUSION:

In the past 20 years, face recognition technology has advanced significantly. Today, automated identification information verification is possible for safe transactions, security and surveillance operations, and building access control, among other applications. Because these applications typically operate in restricted contexts, recognition algorithms can benefit from those limitations and achieve high recognition accuracy. But in smart surroundings, where computers and machines are more like helpful assistants, next-generation face recognition technologies are going to be widely used.

Computers must be capable of accurately identifying surrounding individuals in a way that blends in with the natural rhythm of everyday human contact in order to accomplish this goal. They must be adaptable to human perceptions of when recognition is likely and not necessitate specific interactions. This suggests that future intelligent settings should share many of the same modalities and constraints as people. These objectives currently seem within reach, but a lot of research needs to be done to make human recognition technology perform consistently in a wide range of settings using data from a single or several modalities.

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