FACIAL RECOGNITION TECHNOLOGY

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ABSTRACT

Facial Recognition Technology (FRT) emerged as a solution to address several contemporary needs of identifying and verifying an individual's identity. It fulfills the biometric system requirements, which tries to recognize the status of an individual by using features distinctive from the body and functionalities that are more familiar with the operation of visual surveillance. This report develops an analysis that connects the socio-scientific literature with the technology on FTR and addresses the concerns and challenges attached to the development, evolutional, and the operational usage that are specific, the contexts, and goals. It highlights the problematic, potentials, and the limitations of the technology. The report also identifies the tasks that the FRT seems to be ready to deploy, the areas with specified obstacles, and how to overcome them by the developments of future technology and operating procedures of sound. It also addresses specific issues that appear to interact with technology. It is also concerned with the ethical considerations on the extent of efficacy. The report's findings are further broken down into different categories to understand further the evaluation, performance, operation, policy concerns, and political and moral operations. So far, the technology has been implemented in several fields to enable monitoring and surveillance. In this background, the report also addresses the FRT alterations on the nature of the authoritarian and lines that are oppressive in the United States as the primary focus.

KEYWORDS: Infrared, Smart Cameras, Biometrics, Facial Recognition, Surveillance and Hyperspectral.

INTRODUCTION

The facial recognition system has been implemented mostly in several social places. The technology is associated with promises in strengthening public safety and widening its implementation in several other applications that emerge. The technology is advanced on bank users to verify their identity, and in billboards that advertise in response to the passer-by moods.

The most particular interest is in the implementation of the facial recognition system in the fields occupied by different personnel. There are various applications of facial recognition in detecting the identity, including security systems on campus, roll-calls that are automated, and student emotion and monitoring the attention. In many countries, the FRT technology has prompted the controversy in several ways. They adopt the surveillance camera utilization and tracking and monitoring firms that are technology-based.

Therefore, FRT can be viewed as an extension that is the logic of technology-based trends of surveillance established in several fields. However, this article seems to address the literature review and to problematize specific notions of the FRT system. Drawing the concern on how technology is implemented in various lines, the report emerges the debates

From communication, media, and scholars of surveillance. In shading light on the FRT system, this report addresses the system's algorithm and how surveillance and monitoring techniques are enhanced and implemented to foster identity recognition in ways that are not harmful to the users.

LITERATURE REVIEW

In the Facial recognition spectrum, there is the use of different methods:

HOLISTIC METHODS

In this appearance method, the image of the face is considered entirely and does not support the facial features' processing separately. The technique is unique in recognizing the facial image and helps in facial processing in a more different way than the other methods. Researchers always implement the use of this approach in FR by the use of infrared images. Studies have been done to identify the potentials of the IR imaging for the FR by using shapes that are significant and considered elementary from thermograms. The

pure form of this structure was recognized as the fingerprints (Wright, 2018). The original shape used different approaches to be extracted from the thermograms. There are no technical details for the available method, so there is no work to indicate these methods 'methods' effectiveness.

CLASSICAL METHODS

The earliest research on the appearance of a holistic approach was done only for visual surveillance. Cutler carried out the first research study of the images of IR for FR by implementing a technique that was based on faces proposed by holistic method research. Cutler worked on a database of 288 thermal images by producing the rate of FR at approximately 96%. The database consisted of 12 images for every 24 subjects, and each image in the database represented various facial and pose. Later on, enhanced linear methods were developed by Socolinsky and Selinger such as the linear discrimination analysis (LDA), Eigenfaces, local feature analysis (LFA), and the competent, independent analysis (ICA) for both the visible and thermal database FR (Al-Kawaz et al., 2018). They then conclude that the accuracy produced by the thermal being much higher than the VS since a large number of variables were identified in the images on the database.

CONTEMPORARY METHODS

There is a less complicated comparison between the FR methods in similarities between IR and VS. A technique based on the general Gaussian model mixture was studied in 2011 by Elguabaly and Bouguila. They took the different sample images parametric using the Bayesian approach and achieved the accuracy of 95% of FR on both the thermal and visibility database. Another model for the FR was developed by considering a database of 50, each having ten images of a different pose. It supported some evidence for the support of FR in the IR spectrum. The appearance-based method helped the statistical technique that is complicated rather than including knowledge for specific data (Stark, 2018). This serves as a significant drawback in that the data considered for identity have not included the interpersonal variations due to the difference in the status of emotion, intake of alcohol and exercise, or temperature of the person.

FEATURE-BASED METHODS

The extraction of IR images for the FR has adopted feature-based practices by different researchers. Removal of the features of an IR imaging is done based on the local binary patterns (LBP), transform of wavelet, and transform of curvelet, blood perfusion, and vascular network. Wavelet as a transformation is used in presenting one and two-dimensional signals, which incorporates the appearance of the face in the VS. Curvelet form of transform extends the wavelet transform functioning in which the orientation degree depends directly on the curvelet scale. In 1997, a proposal was made from the extraction of thermal image features. The approach was based on the combination of neural network results-based classifications with the appearance that is locally averaged (Hernandez et al., 2019). The method proposed was executed in a room temperature that ranged from 302K to 285K, and the rate of recognition rated at 92% when the data for training and tasting were obtained at the correspondent room temperature. The method achieved a recognition rate of about 60% when the difference in temperature was kept at 17K among the sample and training data.

MULTIMODAL METHODS:

FR methods of IR imaging face the challenge of the eyeglasses that are opaque and acquired data depending on the person's physical and emotional conditions. The glasses and the variations of psychological states such as the emotions contrast in that they do not produce any FR limitations. Due to the challenging factors, IR and VS can be viewed as contemporary to one another. Different methods that describe IR use the concept of fusion with the IR spectrum. Two techniques can be used in the fusion of images, based on the level of data and the other on the level of decision. In the data level, the construction of features is done by inheriting the information from the two modalities, and then the classification of data is done. In the scale of decision, the matching accuracy of IR and VS is calculated on two individuals. Eigenfaces and the pursuit filters were implemented in matching the images (Otberdout et al., 2018). The comparison was also carried out to identify the isolation performance as well as greyscale projections, and their fusion methods were ranked as the best methods. The error rate was reduced from 10% to 1% by the proposed fusion

method.

RISING OF FACIAL RECOGNITION TECHNOLOGY

The facial recognition system has been increased from parallel advancement in the processing of computer vision. It involves the technique of machines being implemented to recognize and learn the patterns of the streaming of image data. Improvements in the technology of video cameras. For instance, the techniques of facial recognition work by computing the extracted features of the face that is captured by a digital video camera (Rossion & Michael, 2018). The image is then compared with the looks that were previously analyzed and stored on a database. These databases have large numbers of faces that were photographed with the associated name and other identifiable information that are personal.

The face recognition system works by analyzing the shapes of the faces computationally concerning the positioning and the distance that exists between the set of geometrical coordinates. The coordinates include the center of both pupils, the nose bridge, and the eyebrow ends (Amato et al., 2018). Since every person is given a unique face print, when the properties of sets of the geometry of an image that is captured are compared with a database of a pre- existing identifiable image of a person, the system makes a match with the specified individual. The ability to verify a person's identity and the technological forms that are corresponding for detecting the face are developed to analyze and scan facial expressions to identify the individual's moods, emotions, and states that are effective.

A biometric technology relies on the measurements of characteristics of the human body to constitute the developments. The contemporary technology is in a manner that is similar to the recognition of the iris, identification of gait, and fingerprints. The accuracy of imaging the digital facial recognition continues to be hampered by the poor lighting and shadow, hence making the biometric methods less accurate than the technologies of facial recognition, which retains the advantage of not requiring the person to avail themselves for inspection. Therefore, this will enable the monitoring of a large group of people continuously (Cook et al., 2019). Besides, the image quality is becoming enhanced by the cameras in consumer electronics such as smartphones and laptops that have enabled the software that is relatively cheap to be expanded and applications being developed that offer facial recognition that is device-based. Alongside the techniques of personal identification, there exist systems that are based on the principles of detecting faces whereby the faces being scanned do not meet the particular individual. Such technologies are implemented in reading the expressions and tracking the individuals that are de-identified from a camera to all the cameras across a shopping mall to seek the inference of age, gender, and the mood of the shoppers. Seemingly, the applications of the FR technology are beginning to shift from the technology of detection to technology of identification as outlets for commercial services to link the data of the camera with the information of purchasing (Quinn et al., 2018). When the systems for facial recognition become widespread, the applications for detection, such as inferring moods, will be implemented to establish security and marketing.

The technology of facial recognition is becoming dominant and pervasive. This is because it promotes enthusiasm that is considerable and gives clear expectations. In a practical sense, applications for facial recognition promises myriad benefits and convenience, including the aspects of speed and secure transactions, services that are customized, and enhancing safety and security in public (Zafeiriou et al., 2018). On the core, FR transforms the identification process from a target that is active to a passive and general recognition. By default, this means that everyone passing in front of the camera is recognized and identified by the system. The digital camera system for facial recognition can determine a large mass of people since they are developed to do the task which no human can be able to recognize the identity of all the people involved.

THE PROBLEMATIC SITUATION FOR THE RISE OF FACIAL RECOGNITION

Our understanding and experience in monitoring in a private and public range are significantly transformed by the emergence of computer-driven technology of facial recognition. Indeed, there is a little to worry about when presumed. Many countries have implemented extensive human-operated CCTV camera networks. Perhaps, facial morphology features have been an accepted premise as a mood, intentions, and personality indicators which stretches back to the interests of Ancient Greek physiognomy. Many people are

welcoming the proclaimed benefits of deploying FR technology. It caters to efficiency and security in transactions, accountability that is great, public safety and security enhancement, economic productivity improvement, and commercial services, among many others (Banerjee et al., 2018).

However, concerns tend to grow amongst some individuals with regards to the places of FR technologies in the democratic society. The interests include the diminishing issue in accountability, civil rights being compromised, and the limitations of power concentration. Recent efforts have demonstrated to implement facial recognition being used in public, whereby some campaigns are successful in banning facial recognition use in public agencies in countries like San Francisco. According to Liu et al., the concerns are seen as varied. The potentials and consequences for the misrecognition are thus noted. The facial recognition that is computer-based and sophisticated has remained to be a fallible technology (Liu et al., 2018). There are repeated reports of the systems of facial recognition failing to recognize the faces of African Americans. This is due to the skewed data sets on matters of race, hence retaining the algorithms with glitches of being able to identify identical twins, thus confusing the system of facial identification. With all this, large-scale misidentification concerns are raised, and the machine's bias is failing to systematically recognize the relevance of skin color and ethical background. Some systems continue working better on demographic groups. At the same time, there are still short ones that are far in implementing the policy of facial recognition that can be able to accurately identify a large crowd, as stated by the recent studies.

Secondly, there are concerns regarding the technologies overreach, and the mission creeps primarily when being used by authoritarian governments and interests in the commercial. By use of an example, the FRT enables the users to create a detailed database on the actions of people and their whereabouts. According to Merghani et al., this tends to raise concerns about having control over the information that is personal and the use of the data. FR systems are also used to target political dissidents and create a restriction on their access to specific services that include trains and airplanes. The method of facial recognition can transform the spaces that we move into a system that is visual sensing and promises to reconfigure the experience of being in public and making tracking rules that are comprehensive rather than exceptional ones (Merghani et al., 2018). Facial recognition has managed to automate and systemize the roles of decision making in hiring by considering the styles of appearance and expression.

FACIAL RECOGNITION ALGORITHMS

The FR process has four interrelated, commonly identified phases. The step that begins is face detection phase, the second Phase is normalization step, the third Phase is the feature extraction step, and the final Phase is the steps that are cumulative in recognizing the face. All these steps adopt similar techniques and depend on one another. They can be described as a component that is separate from a typical FRS. Nevertheless, for clarity purposes, it is recommended that they should be separated conceptually (Kayali, 2019). Each step poses a challenge that is significant to the system to operate successfully.

DETECTING A PHASE

Recognizing a face in an image that is probable may be a simple task, but it is a different case for a computer. The computer decides the pixels in which the image is part of the face and which sections are not. It is typically easy to detect atypical passport photos when the background is transparent (Selwyn, 2019). When the context of the picture is filled with objects, the problem of detection becomes complex. Detection of faces traditionally was focusing on the facial landmarks such as the exes which detect the colors of the face in regions that are circular or have standard features.

NORMALIZATION PHASE

Once detection of the face is completed, the look is required to be normalized. It means that standardization of the image is needed in terms of illumination, size, and pose that is compared to the pictures in the database. Normalizing a probed image means allocating the key facial landmarks accurately. By use of the face landmarks, the algorithm for normalization can detect the image if it has variations. The corrections of the image variations are based on the inferred statistics and the approximations which are not entirely required to be accurate. It is, therefore, essential that the probe image be as close as possible to the

standardized face. All systems require facial landmarks as a critical aspect, irrespective of the recognition method overly. If the location of facial landmarks is impossible, then the identification process will fail (Simonite, 2018). The license can only become successful if the images in the gallery and the probe are the same in all the aspects. Normalization is therefore used to ensure that similarity is achieved in a higher or less degree of accuracy.

FEATURE EXTRACTION AND RECOGNITION

Once normalization of the image is completed, the feature extraction and the acceptance of the image Phase kicks off. In this Phase, a mathematical representation called a template of biometric or reference biometric is generated. This is kept in the database and forms the basis of the task of recognition. The algorithms for facial recognition differ in the manner at which they translate and transform the image of the face into a mathematical representation that is simplified to perform the task of identification. The database will, therefore, form the basis of the responsibility of attention. "The algorithms of facial recognition differ at how the translation or the transformation of a facial image is done into a mathematical representation that is simplified to perform a recognition task," as stated by Prasad et al. (2020) Successful recognition means that maximum information is retained in the process of transformation and the template of biometric analysis is distinctive sufficiently. If the credit is not achieved, then the algorithm will not have the ability that is required to recognize successfully (Prasad et al., 2020). The process of mathematical transformation and recognition by a biometric analysis is where the algorithms differ, particularly in a significant approach.

THE CASCADING LOGIC OF AUTOMATION

FR system relies on capturing data, automation, and passive to develop a biometric that is new and an active database. Automating the collections of information leads to automation of the process that is cascading. Therefore, large databases tend to require information processing that is automated that, in turn, creates a process of decision making. "Not only is a new monitoring tool introduced when a smart camera is installed, but also creates a database that can be used on several purposes that are growing, ranging from automating the risk detection tools to the automated content being customized," as stated by Doffman, (2018).

Therefore, the creep function and human judgment displacement are a question of the processes that are automated in making decisions. When facial recognition is successfully implemented, it can take several functions and for many purposes. These outcomes can successfully address human needs and subtract the decision-making chain (Grubb, 2018). However, it runs the risks of socially de-skilling people when it comes to matters of recognition of the needs of an individual; hence their behaviors are brought to terms. The danger of the essential forms of socialization will be encountered, which are part of the process of learning besides the efficiency, speed, and customization of the automated data collection system.

DISCUSSION

The technology of facial recognition sets to be integrated into a booming sector concerning whether or not it works according to the developers and vendors who are being motivated by the taking of the system. The meaningful question is not on whether the technology will work as advertised, but whether the users believe in them and act according to their beliefs. There is much need to integrate the technologies in various fields as a relatively severe proposition when one goes against this background. It is considered an essential factor to reflect on what is not being said as it has always been with the case of new technologies. Also, Hartzog and Selinger (2018) state that "considering the issues that are not being discussed in the same line." Considering the undesirable consequences that are most likely to occur and result from the system is also vital. With regards to any perceived fields, the technology of FR is supposed to be considered in solving the terms that are rendered as being problematic (Hartzog & Selinger, 2018).

Most of the research in this paper is yet to feature the debates on public, political, and professional aspects about the increasing implementation of FR technologies. According to Michalski et al. (2018), "this technology tends to raise a lot of concerns when it is implemented in different sectors." Some arguments in the paper suggest that some countries protest for the banning of facial recognition in some fields. Facial recognition is said to constitute the most dangerous and unique mechanism of surveillance that has ever been invented. Most of the researchers also argue for the shutdown of the technology in certain lines and

only leave them in the circumstances that are mostly controlled. They also say that this technology is dangerous when it fails, and when they work, they are harmful.

Therefore, it is essential to reflect on the distinct social order and build it around the facial recognition system. This may include power configurations, the disadvantages, and relations within the setting of the system. When this process approaches these aspects in Wright (2018), "there is more that will be discovered about facial recognition that merits it from being considered further." Also, one will be in light of the issues and concerns that will be raised in the implementation of the system. Perhaps, the interest that is rendered most oppressing at the moment is the question of whether the technology has a place that is justifiable in the society or not. The response that is rendered technical is that the developers of the system and the users are required to be able to work harder and ensure that the gaps and omissions are all erased. A good example is on the concerns that are raised over the nature that is reductive of what can be identified by the use of FR and the propensities that are currently holding due to the misrecognition of the groups that are the minority. "The response that is generally accepted" is for the developers to continue their work of expanding the scope and reach of the surveillance of facial recognition in Stark (2018) terms. Suggestions are also placed on these lines in that they tend to include systems for training on the more diverse data sets. It will ensure that the data that are more finely grained about the broader characteristics will ensure data visibility and individuals participating in producing and analyzing FR data.

When these adjustments are implemented, the professional calibration of the system of facial recognition will be improved. The more fundamental concern is if the oppression and coercion matters will be addressed and controlled. On the latter issue, "it will enhance active working on Americans to legitimize the forms that are inhuman of data mining" as Rossion et al., (2018) puts it. Some authors contend that the solution to these problems is not to be able to track better. Still, some points are considered in fighting and reforming the approved data-driven by the system, whose functionality poses harm to the marginalized population. This may include training the system of facial recognition on handling data that is more diversified. For example, it recognizes black faces more accurately, hence reducing the harm that the methods may pose to black individuals. It can be argued that a more logical response would be for the people to refuse being involved in a system that is designed to divide, control, and pose harm to them fundamentally.

Thus, the most realistic response to imposing facial recognition technology in the American aspects of life is likely to be emergent. These are the structures of technology that are countered to be the best through the improvised deployment and pose tactics for opportunities (Stark, 2018). Exploring by adopting the refinement of rehearsed arguments and empirical inquiry is vital since it indicates how different individuals work to reinvent the technologies of facial recognition. The research clearly shows how the FRT will help the Americans in the public sector since it has received backup that is significant from most of the population in the United States.

CONCLUSION

The need to discuss the fundamental question of whether the technology of FR has a place in society is critical. A more durable case can be developed in that any value-added or efficiency gained is overwhelmed with the sorting and classification of consequences being automated. Beginning to implement the technology of a technology that is digital is termed as a case of trading the enormous risks for gains that are relatively meager. The public places are being co0opted as a normalization site of the technology that is societally dangerous and described as a loss leader for facial privacy. The challenge that is key and facing many Americans is whether the realistic prospects of shaping the technology are more beneficial and brings purpose. On matters of education, this should not be an alternative, and it should not be applied whatsoever.

In many private and public sectors in the United States, facial recognition is a technology that should be given sustained attention throughout the decade. The technique of FR will continue being implemented with different intentions and justifications about all the concerns that the report has raised. Although we are the reason behind its implementation, the facial recognition implication is yet to be systematically considered. In this report, we have created an attempt to initiate the conversation of the technology being implemented in various lines of life. Over the next few years, some points of discussion will be formulated and refined, challenged, and tested by the researchers over the facial recognition technology.

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