Chapter 4
Unmasking the Masked: Face Recognition and Its Challenges Using the Periocular Region – A Review

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ABSTRACT

Today, COVID-19 is one of the most severe issues that people are grappling with. Half of the faces are hidden by the mask in this instance. The region around the eyes is usually the sole apparent attribute that can be used as a biometric in these circumstances. In the event of a pandemic, the three primary biometric modalities (facial, fingerprint, and iris), which commonly enable these tasks, confront particular obstacles. One option that can improve accuracy, ease-of-use, and safety is periocular recognition. Several periocular biometric detection methods have been developed previously. As a result, periocular recognition remains a difficult task. To overcome the problem, several algorithms based on CNN have been implemented. This chapter investigated the periocular region recognitions algorithms, datasets, and texture descriptors. This chapter also discuss the current COVID-19 situation to unmask the masked faces in particular.

INTRODUCTION

Biometrics is a field that looks at a person's biological characteristics that are unique. Biometrics methods used to determine the distinctive behavioural and physical characteristics of humans. It is the preferred means of identification, outperforming traditional methods such as passwords and PINs (*G. Liu, at al, June 1997)*. Biometric devices aid biometric system authentication and identification by utilising a number of unique human attributes such as fingerprints, vein patterns, DNA sequencing, hand geometry, iris pattern, voice pattern, face detection, and signature dynamics (*Kumari P, Seeja KR., 6 June 2019*). The

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fingerprint, which is a physical characteristic, is the first and most common thing that comes to mind when discussing distinct features (*U.J. Gelinas,at al, 2004*) (*N. Osifchin and G. Vau, 1997*). In our day-to-day uses for biometrics as a way of authentication, there are a variety of biometric traits that can be utilized to identify humans (*K. Kimura and A. Lipeles, 1996*). Biometric-based authentication is more secure than any other technique since it binds an identity to a specific person rather than a password or a code that anybody could use.

One of the most fundamental aspects in facial computation is the classification of certain facial traits from photos and videos. (https://www.koreatimes.co.kr/www/nation/2019/01/371_262460.html,2019*).* These significant traits, such as the distance between the eyes and the relative placements of the nose, chin, and mouth, are combined to generate a facial profile that aids in the identification of each individual.

Face biometrics stand out among other biometrics because they do not demand an individual's active engagement *(H. Zhang, 1997).* Many scientists are interested in face recognition, and as a result, it has become a gold standard in the field of human recognition. It has been the most exhaustively investigated field in computer vision for more than four decades *(J. M. Smereka and B. V. K. V. Kumar, 2013)*. Face recognition is a widely used biometric that works well in a controlled environment. Face recognition systems, on the other hand, perform worse when the face is partially obscured. Surveillance videos frequently do not show the entire face of crooks. Helmets, hair, glasses, and skiing masks are used to conceal the face in various settings. Furthermore, women in other nations conceal their faces partially owing to cultural and religious reasons. Face recognition suffers from a loss of accuracy and reliability when persons wear surgical masks *(L. Bass,at al, 2003)*, despite being unexpectedly accurate and reliable in the presence of partial facial occlusions.

Therefore, in this chapter we have discussed the various challenges in facial recognition research, different algorithms researched and developed for recognition of face. Mainly, the current situation of covid-19, has been discussed on unmasking the masked face. Section 2 briefs the challenges in facial recognition systems. Section 3 describes the social consequences of wearing a mask. Section 4 explains the emotional recognition of its valence and context. Section 5 explains the consequences of face masks that affect facial recognition. Section 6 brief about the periocular biometrics. Section 7 clarifies about the databases available for periocular biometrics. Section 8 describes the pre-processing of periocular images. Section 9 elaborates the detection and segmentation techniques involved in the periocular region. Section 10 is detailed on feature encoding and comparison. Section 11 explains about the various classification methods. Section 12 brief about the comparison of periocular with other modalities. Finally, Section 13 summarizes the chapter with future scope in periocular research area.

CHALLENGES IN FACIAL RECOGNITION SYSTEM

Illumination- Illumination is the term for light fluctuations. The tiniest change in lighting conditions can make automatic facial recognition extremely difficult and have a major impact on the results. If the lighting changes and the same individual is taken with the same sensor and in a nearly same facial expression and attitude, the results can be drastically different. The illumination variation of face and periocular region is given in Figure-1. The effect of illumination on the appearance of the face is dramatic *(P. H. C. Eilers and J. J. Goeman, r, 2004).*

Pose- Differences in posture are quite sensitive to facial recognition algorithms. The stance of a person's face changes as their head moves and their viewing angle changes. Intra-class variations are always