

Anthropometric Measurement of North-East Indian Faces for Forensic Face Analysis

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Abstract. This chapter presents a study of the facial structural differences between the various tribes and non-tribes of the north-eastern region of India. Distances between the various facial feature points are measured using the face images of the newly created database, named as, the Department of Electronics and Information Technology-Tripura University (DeitY-TU) face database. After careful observation of the human facial structure and conducting primary anthropometric measurements, a comparative study between different Mongolian tribes and the non-tribes have been done for face identification through the determination of resemblance, which may be useful in determining the facial characteristics of the criminals and terrorists of the north-eastern region of India, and also for strengthening forensic analysis to stop illegal emigrations.

Keywords: Mongolian faces, north-east Indian faces, DeitY-TU face database, fiducial point, anthropometric measurement, forensic application, face identification, ethnic group detection.

1 Introduction

Human face is an intriguing subject which has gained attention of countless artists, poets and scientists. Recognizing the face automatically has become one of the most active and widely used techniques because of its reliability in the process of verifying a person's identity. It is becoming more important in terms of security and privacy as face images can be acquired with or without any cooperation from the person of interest. Security, now-a-days, is given the top priority to counter the possible threats from terrorists and criminals, which includes improvising new dimensions of technological advancement for forensic investigations as well. Forensic science is the application of one or more scientific branches to investigate and establish facts of interest in relation to criminal or civil law [1]. Identifying an individual is generally based on a comparison of an unknown and a known and is used when there is someone to compare the evidence against or it is used to create the potential for comparing the evidence against a suspect in the future.

Considering the terrorist activities in India, the north-eastern region occupies one of the prime positions [2]. In this context, we may contribute an alternative perspective to increase the security and its developments for the north eastern states of India. So our ongoing research on face identification may be useful for the illegal migration as well as information security enhancement in homeland security. The primary aim of this study is to conduct anthropometric measurements on the different face images of the different north-eastern region of India for identifying the region based human faces.

In the field of face recognition, detection of the most important facial feature points and measurement of the distances between them are being developed by the application of anthropometric study. Anthropometry was first introduced to the field of forensics to identify individual criminals by their physical characteristics. The purpose of anthropometric analysis is to study the variation of human physical characteristics. It is also a key technique to find out the differences and similarities among numerous races.

At present, there are no available databases for the north-east Indian people. Recently, we are developing a database named as the Department of Electronics and Information Technology-Tripura University (DeitY-TU) face image database, which contains images of a different tribe and non-tribe people of different races, especially people belonging to Mongolian origin [3, 4] obtained from the north-eastern region of India. This region has been occupied by several streams of the Mongoloid people who came from the north and the east at different periods [5]. The diverse Mongoloid groups in the course of time settled down in different habitats and ecological settings of the north eastern region crystallized into separate entities which are referred to as tribes today [5, 6].

In this chapter, we have already collected face images of different Mongolian people like: Tripura, Reang, Chakma, Debbarma, Jamatia, Darlong, Mog, Halam etc. from the different states, and using these images we have measured the anthropometric distances between several feature points in the face, and also tried to find out the facial structural differences between the different tribe and non-tribe male/female people of the different north-eastern states of India. The aim of this study is to carry out a comparison of anthropometric values of Mongolians in the north-eastern region of India of similar socioeconomic status with special reference to five states: Assam, Mizoram, Tripura, Nagaland and Manipur.

The rest of this chapter is divided into seven sections covering existing techniques for the measurement of anthropometric values, anthropometry in forensics, people of the north-eastern region of India, creation of the DeitY-TU face database, anthropometric measurements of the face images, analysis and observation of the findings, and conclusion.

2 Existing Anthropometric Measurement Techniques

Popular methods to measure craniofacial anthropometry include direct measurements on the surface of the skin, radiographic cephalometry and photographic approaches. The direct measurement method has several advantages, such as non-invasiveness,