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A study to determine the facial Anthropometric measurements of Mongolian people

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Abstract

This research purpose is to study, calculate and determine the facial anthropometric data of Mongolian people. For example head breadth, face width, lip width, nose width and chin width etc.

This is the first study to determine some anthropometry of Mongolian people from image. This research project aims to develop software to collect, train and calculate Mongolian people's anthropometric measurements.
An Anthropometric measurements of the Mongolian people were taken from MSSQL database server of our face recognition project.

A part of this research, we studied the methods and technologies of facial recognition using artificial intelligence, and developed a database of Mongolian 1000 facial training data.

The facial Anthropometric measurements of Mongolian people were digitally analyzed using linear (vertical and horizontal) measurements made with standardized training data of database photographic records, taken in a natural head position.

Then we will determine an age, gender and ethnic using by facial Anthropometric measurements of Mongolian people.

Introduction

Anthropometry, or anthropometrics, is the study of human body measurements. At its most basic, anthropometrics is used to help scientists and anthropologists understand physical variations among humans. Anthropometrics are useful for a wide array of applications, providing a kind of baseline for human measurement.

Meunier and Yin (2000) proposed an anthropometric measurement system that can generate body measurements from two-dimensional images. However, Meunier and Yin (2000) reported, "linear measurements were more precise than circumferences, and neck circumference was more repeatable than other circumferences" [6].

Measurements of height, weight, neck circumference, and 18-22 facial dimensions (Figure 1, Table 1) are traditional anthropometric techniques[1,2]. Using a multivariate analysis of the data, it allows for analysis of any trend within the many dimensions to better visualize the relative differences of those facial dimensions for each gender, racial/ethnic, age, and occupational group.

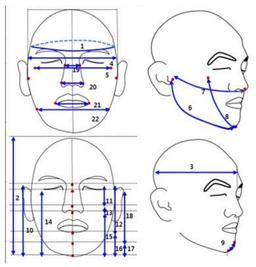

Figure 1. Measurement location

Table 1. Anthropometric dimension name.

№	Anthropometric dimension	№	Anthropometric dimension
1	Head circumference	12	Nose length
2	Head height	13	Nose protrusion
3	Head length	14	Menton –nasal bridge length
4	Head breadth	15	Lower face length
5	Face width	16	Menton –bottom lip length
6	Bitragion –menton arc	17	Menton –chin length
7	Bitragion –subnasale arc	18	Anterior chin projection – nasal bridge bread
8	Bizygomatic menton arc	19	Maximum nasal bridge breadth
9	Chin –menton length	20	Nose width
10	Face length (sellion -menton)	21	Lip width
11	Face length (sellion –bottom lip)	22	Chin width

Methods and Materials

Our training data used in the face recognition, detection and sizing systems were calculated and extracted with high quality and high recognition rates. The training data is stored in a database with jpg offering, size 100x100, 3.69 KB -7.39 KB, and black and white. The size of each training data should be the same, which will increase the processing speed. The conversion of the image in the training made the image clearer and more recognizable. More than one improvement algorithm was used in the training images.

For the trained images in the project, the image of one person have a capacity of 3.6 MB to 4.7 MB. In order to increase the black-and-white contrast of the images, the images to be trained were converted to Grayscale, and the values were multiplied according to certain values.

Also we developed a facial recognition system in C# programming language using by OpenCV and trained Mongolian people's 1000 facial data.

Results

We developed software in C # programming language using by OpenCV and created a database of Mongolian people's facial training data, that detected a facial and determined head, eye, mouth measures

This software/ system was implemented in several stages.

1. Research part: (To study a anthropometric, determine methods)
2. Create a database: (To include original and trained images of Mongolian people in the MSSQL server -Figure 1)
3. Create a training database: (To develop a software to train raw images in the database, create a database with trained images)
4. Face detection from image: (To develop a software that detected faces in given images)
5. Determine measures from image: (To develop a software that defined, displayed screen and saved MSSQL database server, some anthropometrics –Figure 3, Figure 4)

Figure 1. Original Images of Mongolian people

Figure 2. Trained images in database

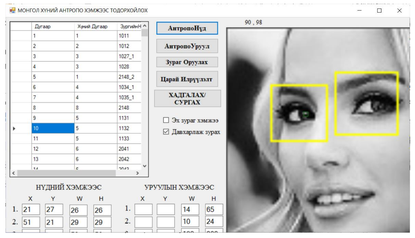

Figure 3. Determine eye measures

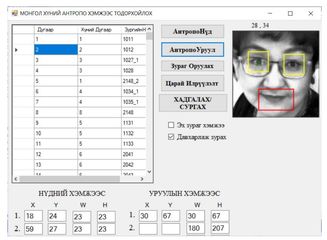

Figure 4. Determine eyes and mouth measures

Discussion

During the experiment, if the distance between the original image and the trained image is 2000 or less, the information that the person recognizes the face is displayed. This is similar to the 0.2 coefficient of other systems, which indicates that the identification is very good. This means that the distance between the person's face training or identification is more than 2,000. According to the results of the study, the system we developed was able to recognize and detect 80% -90% of people's faces.

One of the reasons for facial recognition is that the person's head in the image is too tilted, too much light and shadow, too much forehead and eyebrows are blocked, and the face cannot be identified.

If the human face in the image is distorted and many objects are found, the facial recognition process is continued by rotating the image and making some additional processing on the image.

During the anthropometric determination, the Mongolian people smiled, half-closed his eyes and had with glasses, mistaken the human eye for a mouth (Figure 5, Figure 6).

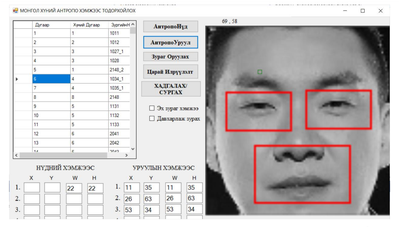

Figure 5. Mistake -determined 3 mouths

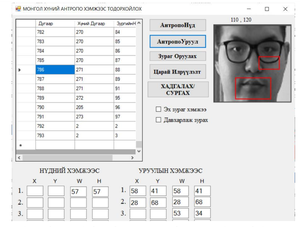

Figure 6. Mistake with glasses - determined 2 mouths

Conclusions

- In this project, we begun to develop software, that can determine the Mongolian people's age, gender and ethnicity using by facial 22 anthropometric measurements, body mass index (BMI) values, gender, ethnicity, age, occupation, weight, and height etc.
- We conducted research and experiments using the OpenCV lib, which is a commonly used facial detection and recognition method, and we developed a face recognition system and DB of Mongolian people's 1000 facial training data.
- We developed software on visual studio C# environment with the EmguCV and created a sample database in MSSQL server.
- Also our developed a facial Anthropometric measurements system shows that it is possible to detect the faces of one or more people at the same time from photos and videos, to determine some facial measures and to store facial measures into our MSSQL database server .
- The most prominent differences between the sexes are observed in the measurements taken from the face region.
- Our developed software can be used in military, police, defense, healthcare, and technology sectors.

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