

A Study on Texture Analysis of Facial Expressions

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Facial texture analysis deals with the facial feature changes appeared in facial expressions. Gray Level co-occurrence Matrix (GLCM) has been taken for texture analysis. The facial expression images have been taken from DeitY-TU face database which is still under development in Biometrics Laboratory of Tripura University. The standardization of facial expression images has been discussed here. The second order statistical approaches like energy, homogeneity, contrast have been calculated over different face images containing six basic expressions. Small values of energy and homogeneity reveal the heterogeneous feature of face images. Contrast provides a considerable distinction in closed and open mouth expressions.

Keywords : DeitY-TU Face Database, Facial Expression, Statistical Approach, Texture Analysis .

1. INTRODUCTION

Facial expression analysis has a growing research area in the field of human-computer interaction. Facial emotions are fundamental form of nonverbal communication for conveying feelings. In 1872, Darwin introduced the idea of basic emotions, which are principally in born emotions derived from similar habits [1]. Emotions are basic research topics used in cognitive science [2], neuroscience [3], social psychology [4] *etc.*. According to psychology, there are two theories of emotions: categorical theory and dimensional theory. The categorical theory is all about six basic emotions: happy, anger, sadness, surprise, disgust and fear [5]. The dimensional theory proposes two fundamental dimensions that form emotional spaces. The two dimensions are known as arousal and valence. Arousal ranges from calm to excited, and valence ranges from negative to positive. Each facial expression causes facial muscle movements which indirectly as-

sociates with facial texture. The variations of facial textures signify the intensity variations from normal one. Textures can be regarded as complex visual patterns comprising brightness, color, slope, size *etc.*. one complex pattern consists of several subpatterns that describes the uniformity, density, regularity, linearity etc of the whole texture [6]. In another sense, texture can be defined as a group of mutually related pixels.

Now in case of facial texture analysis, the facial features like eye, nose, and eyebrow play a major role. They act in active area which changes along with the expression changes. In this paper, a brief illustration is carried out on DeitY-TU face database. The six basic expressions of DeitY-TU face database are being analyzed. Then facial texture analysis is investigated using Haralick statistical approach that considers textures as the arrangement of spatial distribution of gray-values in images. The discussion about similarity and dissimilarity of

Table 1
Values of Energy for Different Persons and Expressions

Expression	Person	Energy
Anger	1	0.0291
	2	0.0187
	3	0.0158
	4	0.0263
	5	0.0389
Happy	1	0.0268
	2	0.0226
	3	0.0139
	4	0.0261
	5	0.0364
Disgust	1	0.0245
	2	0.0234
	3	0.0161
	4	0.0301
	5	0.0423

Table 2
Values of Homogeneity for Different Persons and Expressions

Expression	Person	Homogeneity
Anger	1	0.7070
	2	0.6586
	3	0.6081
	4	0.6945
	5	0.7125
Happy	1	0.6980
	2	0.6825
	3	0.5976
	4	0.6903
	5	0.7116
Disgust	1	0.7062
	2	0.6744
	3	0.6093
	4	0.7120
	5	0.7191

8. CONCLUSIONS

This paper only analyzes the second order statistical properties of the facial expression images. Three different properties of co-occurrence matrix have been computed over different facial expression images. After experimentation, it is observed that no such signif-

icant differences have been noticed in the values of energy for different expressions. The same statement can be made for homogeneity also. In case of contrast, some differences have been observed in expressions. This analysis will be extended in future by measuring statistical properties only for particular facial features like eye, lip, nose which are changed during expressions.

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