

Classification of Mouth Action Units using Local Binary Patterns

Sarah Adel Bargal

The American University in Cairo
Department of Computer Science, AUC, AUC
Avenue, P.O. Box 74 New Cairo 11835, Egypt
s_bargal@aucegypt.edu

Amr Goneid

The American University in Cairo
Department of Computer Science, AUC, AUC
Avenue, P.O. Box 74 New Cairo 11835, Egypt
goneid@aucegypt.edu

Rana el Kaliouby

Massachusetts Institute of Technology
Media Laboratory, MIT, 20 Ames Street,
Cambridge USA
kaliouby@media.mit.edu

Anas Nayfeh

Kuwait University
Center of Information Systems, KU, Shuwaikh,
Kuwait
anas.nayfeh@ku.edu.kw

Abstract

Automated facial expression recognition remains a grand challenge in computer vision. This paper lays the groundwork for building a system that automatically, and in real-time, accurately classifies Action Units (AUs) of the Facial Action Coding System. We use Local Binary Patterns (LBP) for the feature extraction stage, followed by support vector machines for classification. LBPs require no manual initializations, are computationally simple, run in real-time, are illumination tolerant, and do not require high image resolutions. Experiments compare the performance of LBP to that of image quantization in the spatial and frequency domains. Results show that using LBPs for feature vector extraction of mouth AUs yielded the highest average classification rate of 80%, suggesting that such LBP feature vectors may be used for classifying more AUs and AU combinations. Results obtained are consistent for template matching and support vector machines.

1. Introduction

Automated facial expression classification has many applications including Human-Computer Interaction, psychological and computer vision research, and medicine. Examples include interactive computer games, smarter interfaces, automatic database labeling, automatic monitoring of patients' moods, and driver state detection. Most of these applications require real-time implementations.

Ekman and Friesen's Facial Action Coding System (FACS) [5] is a comprehensive coding system for describing facial expressions. Muscle movements are coded as action units (AUs) and facial expressions are coded using one or more AUs. Humans produce thousands

of expressions, all of which can be objectively described using FACS. Thus, FACS has been used extensively for the automated analysis of facial expressions, e.g., [3,6,15,19], and is more descriptive than systems that only recognize a limited set of basic emotions.

Automated facial expression recognition consists of three main stages after image pre-processing: extracting the feature vector which describes the facial image, reducing the dimensionality of that vector if possible, and finally, classifying test images into certain classes after training using the reduced dimensionality vector. Feature extraction is key, because finding a descriptive, representative, efficient, and easy to compute feature vector of the facial image will largely impact the classification results.

This paper describes feature extraction and classification of mouth AUs from static images. Seyedarabi *et al.* [21] emphasize that the mouth has the most flexible deformability, while Liu and Wang [16] assert that the mouth contributes the most to facial expressions. The principal contribution of the paper is the feature extraction of mouth AUs using Local Binary Patterns (LBPs), a feature extraction technique that is efficient, is automated and runs in real-time, while maintaining classification accuracy. LBPs are also illumination tolerant, and do not require high image resolutions and are therefore suited to real-world contexts and environments.

The paper is organized as follows: section 2 surveys feature extraction methods for face analysis, as well as related work that use LBPs; section 3 gives an overview of Local Binary Patterns for representing mouth AUs. Section 4 describes classification using template matching and support vector machines; section 5 present experimental evaluation and result, while section 6 concludes the paper.

Classification Of Mouth Action Units Using Local Binary Patterns

Scott C. Dulebohn



Classification Of Mouth Action Units Using Local Binary Patterns:

Emotion Recognition Amit Konar, Aruna Chakraborty, 2015-01-27 A timely book containing foundations and current research directions on emotion recognition by facial expression voice gesture and biopotential signals This book provides a comprehensive examination of the research methodology of different modalities of emotion recognition Key topics of discussion include facial expression voice and biopotential signal based emotion recognition Special emphasis is given to feature selection feature reduction classifier design and multi modal fusion to improve performance of emotion classifiers Written by several experts the book includes several tools and techniques including dynamic Bayesian networks neural nets hidden Markov model rough sets type 2 fuzzy sets support vector machines and their applications in emotion recognition by different modalities The book ends with a discussion on emotion recognition in automotive fields to determine stress and anger of the drivers responsible for degradation of their performance and driving ability There is an increasing demand of emotion recognition in diverse fields including psycho therapy bio medicine and security in government public and private agencies The importance of emotion recognition has been given priority by industries including Hewlett Packard in the design and development of the next generation human computer interface HCI systems Emotion Recognition A Pattern Analysis Approach would be of great interest to researchers graduate students and practitioners as the book Offers both foundations and advances on emotion recognition in a single volume Provides a thorough and insightful introduction to the subject by utilizing computational tools of diverse domains Inspires young researchers to prepare themselves for their own research Demonstrates direction of future research through new technologies such as Microsoft Kinect EEG systems etc

Classification of Mouth Action Units Sarah Adel Bargal, 2012-05 Automated facial expression recognition is still a grand challenge in computer vision The process of facial expression recognition consists of three main stages after image pre processing and face acquisition These stages are extracting the feature vector which describes the facial image reducing the dimensionality of that vector if possible and finally classifying test images into certain classes after training using the reduced dimensionality vector A contribution to the first stage is chosen since the key issue in the analysis is finding a descriptive representative efficient and easy to compute feature vector of the facial image This work lays the ground for building a system that automatically and in real time classifies mouth action units of the facial action coding system with acceptable rates and that is illumination tolerant This is done by proposing the application of local binary patterns LBPs to the feature extraction stage of mouth action unit classification LBPs require no manual pre processing or initialization contribute to a real time system by being computationally simple are illumination tolerant and can be used in low resolution images Encyclopedia of Information Science and Technology, Third Edition Khosrow-Pour, D.B.A., Mehdi, 2014-07-31 This 10 volume compilation of authoritative research based articles contributed by thousands of researchers and experts from all over the world emphasized modern issues and the presentation of potential opportunities prospective solutions and future

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Human Emotion Recognition from Face Images Paramartha Dutta,Asit Barman,2020-03-26 This book discusses human emotion recognition from face images using different modalities highlighting key topics in facial expression recognition such as the grid formation distance signature shape signature texture signature feature selection classifier design and the combination of signatures to improve emotion recognition The book explains how six basic human emotions can be recognized in various face images of the same person as well as those available from benchmark face image databases like CK JAFFE MMI and MUG The authors present the concept of signatures for different characteristics such as distance and shape texture and describe the use of associated stability indices as features supplementing the feature set with statistical parameters such as range skewedness kurtosis and entropy In addition they demonstrate that experiments with such feature choices offer impressive results and that performance can be further improved by combining the signatures rather than using them individually There is an increasing demand for emotion recognition in diverse fields including psychotherapy biomedicine and security in government public and private agencies This book offers a valuable resource for researchers working in these areas **Advanced Planning, Control, and Signal Processing Methods and Applications**

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Algorithms Brain Storm Optimization Algorithm Bacterial Foraging Optimization Algorithm DNA Computing Methods Multi Objective Optimization Swarm Robotics and Multi Agent System UAV Cooperation and Control Machine Learning Data Mining and Other Applications **Deep Sciences for Computing and Communications** Annie Uthra R.,Kottilingam Kottursamy,Gunasekaran Raja,Ali Kashif Bashir,Utku Kose,Revathi Appavoo,Vimaladevi Madhivanan,2024-09-28 This two volume set CCIS 2176 2177 constitutes the proceedings from the Second International Conference on Deep Sciences for Computing and Communications IconDeepCom 2023 held in Chennai India in April 2023 The 74 full papers and 8 short papers presented here were thoroughly reviewed and selected from 252 submissions The papers presented in these two volumes are organized in the following topical sections Part I Applications of Block chain for Digital Landscape Deep Learning approaches for Multipotent Application Machine Learning Techniques for Intelligent Applications Industrial use cases of IOT NLP for Linguistic Support Convolution Neural Network for Vision Applications Part II Optimized Wireless Sensor Network Protocols Cryptography Applications for Enhanced Security Implications of Networking on Society Deep Learning Model for Health informatics Web Application for Connected Communities Intelligent Insights using Image Processing Precision Flood Prediction Models **Classification of Mouth Action Units Using Local Binary Patterns** Sarah Adel Bargal,American University in Cairo,2007 This thesis lays the ground for building a system that automatically and in real time classifies mouth action unites of the facial action coding system with acceptable rates and that is illumination tolerant **Language and Language Behavior Abstracts** ,1982 **Medi-kwoc Index** ,1975 English language papers presented at biomedical meetings during the previous 5 years Includes only non journal publications not indexed by major services and received by Washington University School of Medicine Library Arranged under 3 sections i e Key word index Author index and Register of conferences contains full bibliographical information **Documentation Abstracts** ,1996 *Linguistics and Language Behavior Abstracts* ,1996 **Aerospace Medicine and Biology** ,1985 A selection of annotated references to unclassified reports and journal articles that were introduced into NASA scientific and technical information system and announced in Scientific and Technical Aerospace Reports STAR International Aerospace Abstracts IAA Current Index to Journals in Education ,1979-07 *Sociological Abstracts* Leo P. Chall,1983 **Bibliography of Agriculture** ,1990 **Society for Neuroscience Abstracts** Society for Neuroscience. Annual Meeting,1995 Science Citation Index ,1995 Vols for 1964 have guides and journal lists *Society for Neuroscience Abstracts* Society for Neuroscience. Meeting,2001

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