

## Classification of Mouth Action Units using Local Binary Patterns

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### 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.

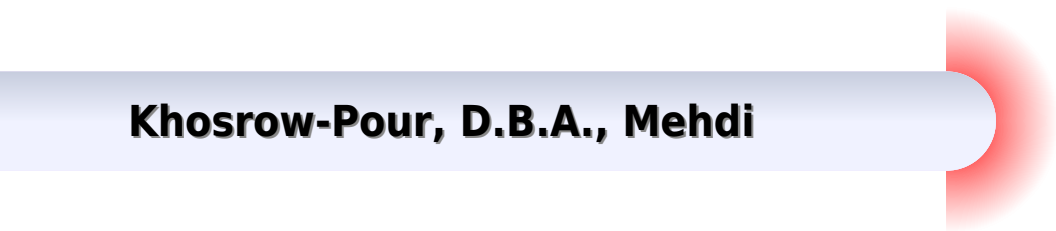
Automated facial expression recognition consists of three main stages after image pre-processing: extracting the feature vector which describes the facial image, reducing the dimensionality of that vector if possible, and finally, classifying test images into certain classes after training using the 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

**Khosrow-Pour, D.B.A., Mehdi**



## **Classification Of Mouth Action Units Using Local Binary Patterns:**

**Computational Intelligence for Human Action Recognition** Sourav De, Paramartha Dutta, 2020-09-27 Human Action Recognition is a challenging area presently The vigor of research effort directed towards this domain is self indicative of this With the ever increasing involvement of Computational Intelligence in our day to day applications the necessity of human activity recognition has been able to make its presence felt to the concerned research community The primary drive of such an effort is to equip the computing system capable of recognizing and interpreting human activities from posture pose gesture facial expression etc The intent of human activity recognition is a formidable component of cognitive science in which researchers are actively engaged of late Features A systematic overview of the state of the art in computational intelligence techniques for human action recognition Emphasized on different intelligent techniques to recognize different human actions Discussed about the automation techniques to handle human action recognition Recent research results and some pointers to future advancements in this arena In the present endeavour the editors intend to come out with a compilation that reflects the concerns of relevant research community The readers would be able to come across some of the latest findings of active researchers of the concerned field It is anticipated that this treatise shall be useful to the readership encompassing students at undergraduate and postgraduate level researchers active as well as aspiring not to speak of the senior researchers

**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

***Machine and Deep Learning Techniques for Emotion Detection*** Rai, Mritunjay, Pandey, Jay Kumar, 2024-05-14 Computer understanding of human emotions has become crucial and complex within the era of digital interaction and artificial intelligence Emotion detection a field within AI holds promise for enhancing user experiences personalizing services and revolutionizing industries However navigating this landscape requires a deep understanding of machine and deep learning techniques and the interdisciplinary challenges accompanying them Machine

and Deep Learning Techniques for Emotion Detection offer a comprehensive solution to this pressing problem Designed for academic scholars practitioners and students it is a guiding light through the intricate terrain of emotion detection By blending theoretical insights with practical implementations and real world case studies our book equips readers with the knowledge and tools needed to advance the frontier of emotion analysis using machine and deep learning methodologies

*Advances in Swarm Intelligence* Ying Tan,Yuhui Shi,2021-07-07 his two volume set LNCS 12689 12690 constitutes the refereed proceedings of the 12th International Conference on Advances in Swarm Intelligence ICSI 2021 held in Qingdao China in July 2021 The 104 full papers presented in this volume were carefully reviewed and selected from 177 submissions They cover topics such as Swarm Intelligence and Nature Inspired Computing Swarm based Computing Algorithms for Optimization Particle Swarm Optimization Ant Colony Optimization Differential Evolution Genetic Algorithm and Evolutionary Computation Fireworks 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 *Sentiment Analysis Unveiled* Neha Nandal,Rohit Tanwar,Varun Sapra,2025-04-02 This book is a comprehensive exploration into the realm of sentiment analysis From deciphering customer sentiments for businesses to understanding public opinions on social media or predicting market trends the applications are multifaceted and impactful Sentiment Analysis Unveiled Techniques Applications and Innovations is more than just algorithms and models it s about unraveling the emotions opinions and perceptions encapsulated within the vast sea of textual data This book explores topics from opinion mining social media analysis deep learning security concerns and healthcare systems and it also delves into the ethical and legal implications of sentiment analysis Through practical examples case studies and discussions on cutting edge innovations the editors aim is to provide a holistic view that empowers you to navigate this field confidently It involves the analysis of user generated content deciphering sentiments expressed on platforms like Twitter and Facebook and provides valuable insights into public opinion brand perception and emerging trends in the digital landscape This book is intended for professionals researchers and scientists in the field of artificial intelligence and sentiments analysis it will serve as a valuable resource for both beginners and experienced professionals in the field

Models and Analysis of Vocal Emissions for Biomedical Applications Manfredi, Claudia,2017-11-30 The International Workshop on Models and Analysis of Vocal Emissions for Biomedical Applications MAVEBA came into being in 1999 from the particularly felt need of sharing know how objectives and results between areas that until then seemed quite distinct such as bioengineering medicine and singing MAVEBA deals with all aspects concerning the study of the human voice with applications ranging from the neonate to the adult and elderly Over the years the initial issues have grown and spread also in other aspects of research such as occupational voice disorders neurology rehabilitation image and video analysis MAVEBA takes place every two years always in Firenze Italy **Emotional Intelligence** Xiaohua Huang,Qirong Mao,2025-05-08 This

book constitutes the proceedings of the Second CSIG Conference on Emotional Intelligence CEI 2024 held in Nanjing China during December 6-8, 2024. The 14 full papers and 2 short papers presented in this volume were carefully reviewed and selected from 41 submissions. These papers have been categorized under the following topical sections: Emotional Intelligence, Surveys and Databases, Emotional Intelligence Methods, Emotional Intelligence Applications. *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 directions in the field of information science and technology. Provided by publisher. *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. *Society 5.0 and the Future of Emerging Computational Technologies* Neeraj Mohan, Surbhi Gupta, Chuan-Ming Liu, 2022-06-07. This book discusses the technological aspects for the implementation of Society 5.0. The foundation and recent advances of emerging technologies such as artificial intelligence, data science, Internet of Things, and Big Data for the realization of Society 5.0 are covered. Practical solutions to existing problems, examples, and case studies are also offered. Society 5.0 and the Future of Emerging Computational Technologies: Practical Solutions, Examples, and Case Studies discusses technologies such as machine learning, artificial intelligence, and Internet of Things for the implementation of Society 5.0. It offers a firm foundation and understanding of the recent advancements in various domains such as data analytics, neural networks, computer vision, and robotics, along with practical solutions to existing problems in fields such as healthcare, manufacturing, industries, security, and infrastructure management. Applications and implementations are highlighted along with the correlation between technologies. Examples and case studies are presented throughout the book to augment text. This book can be used by research scholars in the engineering domain who wish to gain knowledge and contribute towards a modern and secure future society. The book will also be useful as a reference at universities for postgraduate students who are interested in

technological advancements

## **Classification Of Mouth Action Units Using Local Binary Patterns** Book Review: Unveiling the Power of Words

In some sort of driven by information and connectivity, the power of words has be much more evident than ever. They have the capability to inspire, provoke, and ignite change. Such could be the essence of the book **Classification Of Mouth Action Units Using Local Binary Patterns**, a literary masterpiece that delves deep in to the significance of words and their affect our lives. Published by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we shall explore the book is key themes, examine its writing style, and analyze its overall affect readers.

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