

## 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 (LBPs) 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

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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

directions in the field of information science and technology Provided by publisher **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

**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 in Robotic Systems** Zhan Li,Shuai Li,Yangming Li,Yan Wu,2022-02-22 **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

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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 Patters**

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## **Table of Contents Classification Of Mouth Action Units Using Local Binary Patterns**

1. Understanding the eBook Classification Of Mouth Action Units Using Local Binary Patterns
  - The Rise of Digital Reading Classification Of Mouth Action Units Using Local Binary Patterns
  - Advantages of eBooks Over Traditional Books
2. Identifying Classification Of Mouth Action Units Using Local Binary Patterns
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Classification Of Mouth Action Units Using Local Binary Patterns
  - User-Friendly Interface
4. Exploring eBook Recommendations from Classification Of Mouth Action Units Using Local Binary Patterns
  - Personalized Recommendations
  - Classification Of Mouth Action Units Using Local Binary Patterns User Reviews and Ratings
  - Classification Of Mouth Action Units Using Local Binary Patterns and Bestseller Lists

5. Accessing Classification Of Mouth Action Units Using Local Binary Patterns Free and Paid eBooks
  - Classification Of Mouth Action Units Using Local Binary Patterns Public Domain eBooks
  - Classification Of Mouth Action Units Using Local Binary Patterns eBook Subscription Services
  - Classification Of Mouth Action Units Using Local Binary Patterns Budget-Friendly Options
6. Navigating Classification Of Mouth Action Units Using Local Binary Patterns eBook Formats
  - ePUB, PDF, MOBI, and More
  - Classification Of Mouth Action Units Using Local Binary Patterns Compatibility with Devices
  - Classification Of Mouth Action Units Using Local Binary Patterns Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Classification Of Mouth Action Units Using Local Binary Patterns
  - Highlighting and Note-Taking Classification Of Mouth Action Units Using Local Binary Patterns
  - Interactive Elements Classification Of Mouth Action Units Using Local Binary Patterns
8. Staying Engaged with Classification Of Mouth Action Units Using Local Binary Patterns
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Classification Of Mouth Action Units Using Local Binary Patterns
9. Balancing eBooks and Physical Books Classification Of Mouth Action Units Using Local Binary Patterns
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Classification Of Mouth Action Units Using Local Binary Patterns
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Classification Of Mouth Action Units Using Local Binary Patterns
  - Setting Reading Goals Classification Of Mouth Action Units Using Local Binary Patterns
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Classification Of Mouth Action Units Using Local Binary Patterns
  - Fact-Checking eBook Content of Classification Of Mouth Action Units Using Local Binary Patterns
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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