Graduation thesis in Computer Science

Human emotion recognition based on facial landmarks

Trịnh Hoàng Minh

Phan Văn Tân

Ho Chi Minh City, Vietnam 2016

HUMAN EMOTION RECOGNITION BASED ON FACIAL LANDMARKS

Trịnh Hoàng Minh

Phan Văn Tân

Department of Computer Science

VIET NAM NATIONAL UNIVERSITY HCMC

UNIVERSITY OF INFORMATION TECHNOLOGY

Ho Chi Minh City, Vietnam 2016

Acknowledgements

We would like to express our appreciation to all those persons who contributed in our work. First and foremost we would like to thank our supervisor Dr. Nguyễn Thanh Bình. You are a great supporter and advisor. Furthermore we would like to thank Dr. Nguyễn Đình Hiển, whose advice and support is immeasurable.

Beyond friends there is family. Thanks for your love and support that we could complete my gradutation thesis.

Trịnh Hoàng Minh, Phan Văn Tân

University of Information Technology HCMC

E-mail: [minhth.cs2012@gmail.com](mailto:minhth.cs2012@gmail.com)

[Missing Tân]

Human emotion recognition based on facial landmarks

Trịnh Hoàng Minh

Phan Văn Tân

Department of Computer Science

University of Information Technology HCMC

Abstract

We present a novel approach for recognizing human’s emotion through facial landmarks. Since a human’s face has already provided us with lots of information, learning human’s facial emotions can help a lot in communication issues. Using the facial landmarks recognition which was represented on “One Millisecond Face Alignment with an Ensemble of Regression Trees” by Vahid Kazemi and Josephine Sullivan, we propose a set of useful features for learning and prediction. We also illustrate the approach by experimental results along with a demo processed through our application.

//Machine Learning (ML) is everywhere, since long that it has become a vital part of our life. From features like Facebook’s face recognition feature to tag your friend to even more complex ones like automatons, ML’s development is increasing significantly. Being a branch of ML, Image Processing also take part in being an important part of the whole. Realizing that there are researchers who are working on recognizing human’s face emotions, we also want to take part in improving that problem my approaching a different implementation that is recognizing human’s face emotions (RHFE) based on facial landmarks which was represented on “One Millisecond Face Alignment with an Ensemble of Regression Trees” by Vahid Kazemi and Josephine Sullivan.//

**Keywords**: machine learning, image processing, facial landmarks, human emotion

TOB (Update later)

## Introduction

In this thesis, we propose an implementation which performance is good enough to recognize people’s facial emotions. We begin with our motivation and then provides a brief overview of the problem (Section 1), describe the specific problem and our approach for solving it (Section 2) and outlines the rest of the thesis (Section 3)

### Motivation

Communication involves both verbal and nonverbal ways of making sure our message is heard. By only verbal ways, the subject’s real message may not be conveyed unless through nonverbal ways which consists of facial expression. Human alone can only discern a part of message lying under nonverbal expressions. With the rapid growth of social networks which could be an overwhelming resources, we want to build a system that could recognize human facial emotions with better quality so that it could be used for later applications.

### Related work

Given a human face in natural environment, we will predict 3 regular expression: positive, neutral, negative through features generated from 68 facial landmarks recognized through dlib’s algorithm. [FEATURE EXPLANATION NEEDED]

### Outline of the Thesis

We will provide our explaination of foundations (Chapter 3) and data collecting procedure (Chapter 4). After design and implement our system (Chapter 5), we will evaluate its result based on previous work from others (Chapter 6). Then we will discuss about the advantage and disadvantage of our implementation through Chapter 7 and reach out for a conclusion in Chapter 8.

## Preliminaries

### Facial landmark

### SVM

### Decision Tree

### Random Forest

## The proposed approach

### 1. Collecting data

Our main datasets are included in 300-W In The Wild Challenge paper which consists of: HELEN, AFW, IBUG, LFPW dataset. In this data human faces are captured in natural environment with various aspect like age, sex, nationality, etc... There are 2 types of face: frontal face and profile face with provided annotations. We also have an extra dataset which only have frontal face. In sum of these we got approximately 4000 images for processing.

2. Preprocessing data

All image are reprocessed to verify facial landmark annotation then we will rotate the image base on point [32] and [36] to make sure they parallel with the horizontal axis. After that we will crop out the face and resize it into 100 pixel wide. Our final step is to recalculate the coordinate of the landmark after editting our image.

*3. Building models*

*Fig Training*

*4. Application achitecture*

*Fig Application*

## Experiments

### Platform

Our application is in C++ language working under Ubuntu OS. Being an open source OS, Ubuntu is our choice for a totally free developing environment without restriction. Being programmed in C++, we can optimize our code more efficent for more performance.

### Library

* Dlib ver18.18: used for recognizing facial landmarks coordinate
* Opencv ver[]: used for image processing and live stream through webcam
* Libsvm ver[]: used to train SVM model for prediction

### Machine learning

## Conclusion

We use three metrics to measure our system’s performance: precision (denoted by P), recall (denoted by R) and F-score (denoted by F).

## references

* C. Sagonas, E. Antonakos, G, Tzimiropoulos, S. Zafeiriou, M. Pantic. **300 faces In-the-wild challenge: Database and results**. Image and Vision Computing (IMAVIS), Special Issue on Facial Landmark Localisation "In-The-Wild". 2016
* C. Sagonas, G. Tzimiropoulos, S. Zafeiriou, M. Pantic. **A semi-automatic methodology for facial landmark annotation**. Proceedings of IEEE Int’l Conf. Computer Vision and Pattern Recognition (CVPR-W), 5th Workshop on Analysis and Modeling of Faces and Gestures (AMFG 2013). Oregon, USA, June 2013
* C. Sagonas, G. Tzimiropoulos, S. Zafeiriou, M. Pantic. **300 Faces in-the-Wild Challenge: The first facial landmark localization Challenge**. Proceedings of IEEE Int’l Conf. on Computer Vision (ICCV-W), 300 Faces in-the-Wild Challenge (300-W). Sydney, Australia, December 2013
* Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar. **Foundations of Machine Learning**. MIT Press, 2012
* Kazemi, Vahid and Sullivan, Josephine. **One Millisecond Face Alignment with an Ensemble of Regression Trees**. In Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2014)