Synthesizing Neutral Facial Expressions on 3D Faces

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Master of Computer Science

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Author’s Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. It is original and is the result of my work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted at Universiti Malaysia Sarawak or to any other academic institution or non-academic institution for any other degree or qualification.

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Dedication

This project is dedicated to God Almighty for his Love and Grace upon my life.

Thank you so much, Lord!
Acknowledgement

I want to thank my parents and siblings for their unconditional love and endless support in numerous ways ever since I was born and specifically through the course of my studies. Without their encouragement, moral and financial support I wouldn’t have made it this far.

I want to thank my wife Flora for being my closest companion throughout this tough season, encouraging me every time I hit the wall in my research work.

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Abstract

Facial expression synthesis is a process of generating new face shapes from a given face and still retaining the distinct facial characteristics of the initial face. The generated facial expressions can be used to improve the performance of existing face recognition systems. Earlier work on synthesizing face shapes used 2D face images. As 3D scanners become more improved and widely available, the work has moved from 2D to 3D faces. The advantage of 3D faces over 2D image data is that 3D face holds more geometric shape data and is invariant to poses and illumination.

This project presents a new approach to synthesize neutral facial expression on realistic 3D faces called Expression Proportion Distribution (EPD). EPD uses statistical approach to derive a method to neutralise facial expressions. The main challenge is to neutralise facial expressions especially those with jaw dropped and opened mouth. Jaw dropped and opened mouth facial expressions may be generated during articulations, or expressing emotional facial expressions, such as laughing or surprise. Opening of mouth moves both the facial muscles and the mandible, which causes the geometric face shape to deform. Other facial expression with mouth closed is also looked into. The experiments were carried out on two realistic 3D face datasets from Imperial College London and from the Binghamton University - 3D Facial Expression Dataset (BU-3DFED). The proposed neutral expression synthesis approach is evaluated in a face recognition domain.
Abstrak

Sintesis expresi muka merupakan satu proses penghasilan bentuk muka baru daripada muka sedia ada dengan mengekalkan ciri-ciri asas muka sebenar. Expresi muka yang dihasilkan boleh digunakan untuk meningkatkan prestasi sistem pengenalan muka yang sedia ada sekarang. Kajian yang dahulu mensintesiskan bentuk muka dengan menggunakan 2D imej muka. Setelah mesin pengimbas 3D bertambah dalam keberkesanannya dan mudah untuk diperoleh, kajian sekarang beranjak daripada muka 2D kepada muka 3D. Kelebihan menggunakan muka 3D daripada data imej 2D adalah muka 3D mempunyai lebih banyak data bentuk geometri dan tidak menunjukkan perubahan dari segi posisi dan penggemerlapan.

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