COMPUTATIONAL MODELLING TO TRACK HUMAN EMOTION TRAJECTORIES THROUGH TIME

A thesis presented in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

in

Computer Science

at School of Engineering and Advanced Technology,

Massey University, Palmerston North,

New Zealand.

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2013

Acknowledgements

I owe the most sincere gratitude to my supervisors, Prof. Hans Guesgen and Prof. Stephen Marsland, for the continuous support during my Ph.D. study and research. Their patience, kind guidance, friendship, and immense knowledge helped me not only in my research and thesis writing, but also to deal with the daily-life challenges. Of course, it is not easy to do a PhD with a young family! I couldn't have asked for more supportive advisors and talented teachers.

Thanks to all the members of Massey University Smart Environment (MUSE) group for their encouragement, insightful comments, and valuable feedback on my research and presentations. Thanks to Michele Wagner for all the administrative support throughout my degree.

I would like to thank my office-mate and friend, Le Thu, for keeping my spirits high and giving useful advise to cope with personal and study-life problems. Many thanks to An, Linda, and Amissa for providing me with an ear to listen after hard comments from the supervisors. We did a lot of back-biting!

Heaps of acknowledgement go to Higher Education Commission, Pakistan for funding my research. Thanks to Universities New Zealand for granting me the Claude McCarthy Fellowship to participate in the conference. Thanks to Dilantha for kind guidance related to account issues, and Natalia for her friendly attitude and kind support for university issues. Many thanks to the authors of IEMOCAP dataset for providing me access to the continuous unsegmented data. A special thanks to Prof. Carlos Busso for helping me understand and use this dataset throughout the research.

Last but not the least, I would like to thank my parents Abdul Hakim Khanzada and Nasira Hakim and sisters Sahar, Mahrukh, Rabia, who encouraged me to go for Doctoral studies and gave me full support mentally and emotionally throughout my PhD, and my life. Many thanks to my husband Tariq and son Ali, who gave me happy moments after a tiring day at Massey. I love and respect all of you from the depth of my heart.

Abstract

There has been a lot of research into the field of affective computing over the past three decades. In the context of this thesis, affective computing is the computing that relates to emotion recognition, representation, and analysis. Much of the past work has focused on the basic emotions. However, most human emotions are not pure examples of one basic emotion, but a mixture of them, known as complex emotions. Emotions are dynamic, they change continuously over time. This thesis focuses on computational modelling to recognise, represent, and analyse continuous spontaneous emotions through time.

Emotions are internal, and hence impossible to see directly. However, there are some external presentations of emotions enabling computational tools to be used to identify them. This thesis focuses on the use of facial points as a measure of underlying emotions. The main focus is the development of computational models to track the patterns of facial changes in order to analyse the paths followed by emotions over time.

While there has been lots of work on shape models to classify facial expressions into discrete basic emotion categories, they are generally based on the analysis of the full face. However, the research shows that some expressions are better recognized by muscle activity in the upper half of the face, while others use muscles primarily from the lower half of the face. This thesis introduces a joint face model based on

shape models of full, upper, and lower parts of the face separately that significantly improves the accuracy.

The set of shape models gives a degree of match to each basic emotion. Using this information, this thesis addresses the problem of complex emotion recognition by developing a mixture model that combines each basic emotion in an appropriate amount. The proposed model represents emotions in the activation-evaluation space, which is the most widely-used representation of emotions in psychological studies. It represents emotions on the basis of their polarity and similarity to each other. This thesis uses a mixture of von Mises distributions for emotion recognition, which is an approximation to the normal distribution for circular data and is the most common model for describing directional data. The results show that the proposed mixture model fits the data well.

Emotions vary continuously with regard to intensity, duration, persistence with time, and other attributes. In addition, their appearance on the face varies, and the transition in facial expressions is based on both the change in emotion and physiological constraints. This thesis examines the trajectories between emotions in activation-evaluation space and shows that these trajectories are smooth and follow 'common' paths between different emotions. In the past, very few efforts have been made on the analysis of continuous emotion dynamics. The findings presented in this thesis can be used and extended in several directions to improve the emotion recognition as well as emotion synthesis.

For my papa and mama

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