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Author(s)	Nguyen, Viet Hung
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Abstract

In our day-to-day life, communication plays a very important role. Emotion is a convenient way for human to communicate. As a result, research on human emotion estimation has become a key focus area of Human Computer Interaction (HCI), Human Robot Interaction (HRI) and Computer Vision. There are lots of works done on this topic, and many promising approaches have been proposed. The current dominant approaches to human emotion estimation reply on visual-based signals that are on or over the skin. Through analyzing expression, they want to predict the emotions behind the expression. However, there exist several hard problems had not been solved well for real system to handle naturally occurring emotions such as uncontrolled environment, poker-face, fake emotion, deliberately displayed and exaggerated expression of prototypical emotions. Our work presents a novel framework for human emotion estimation based on fusion of visible-based and thermal-based signals to fill these gaps.

The motivation behind this effort is to capitalize on the permanency of innate characteristics that are under the face skin using thermal Infrared (IR) signals. To establish feasibility, we propose special methodologies, temperature spaces and thermal Regions of Interest (t-ROIs) for feature-based level, thermal Principal Component Analysis (t-PCA) and norm Eigen-space Method based on Class-features (n-EMC) for decision-based level, and fusion models of visible-based and thermal-based features. To conduct experiments, a multimodal facial emotion database (KTFE) with strict procedures is built. The positive experimental results show that the proposal framework has merit, especially with respect to the problem of poker-face and/or uncontrolled environment. More importantly, the results demonstrate the feasibility of fusion of visible-based and thermal-based in human emotion estimation and open the way to solve challenges for complex emotions.

Keywords: Estimation of Human Emotion, t-ROIs, t-PCA, n-EMC, Thermal Infrared Image, KTFE Database.