Real-time Emotion Detection Technologies for Potential Health Applications

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Objective The main objective of our work is to recognise human emotions using the state-of-the-art wearable devices.

Methodology We present two developed real-time emotion detection technologies in Figure 1 and 2. To unobtrusively and continuously record users' emotion footprint over time, we develop a smartphone-based application to collect accelerometer data and infer users' emotional states such as neutral, happy, sad, scared, and angry. We apply the signal processing technique to interpolate raw acceleration data, extract time- and frequency-domain features, and use neural networks to learn gait features and recognize emotions.

Motivated by the need to help visually impaired people to capture visual social cues to enhance their confidence in social situations, we develop a vision-based system that captures users' facial images via streaming video through imaging glasses, track their head movement, recognize users' emotional states, and deliver feedback to users. We apply the haar feature-based cascade classifiers to recognize faces in images, track difference in consecutive frames in video, use machine learning techniques like Nearest Neighbor and Decision Tree to infer users' facial emotions such as happy or sad, nodding or shaking.

Figure 1. Emotion Detection via accelerometer data

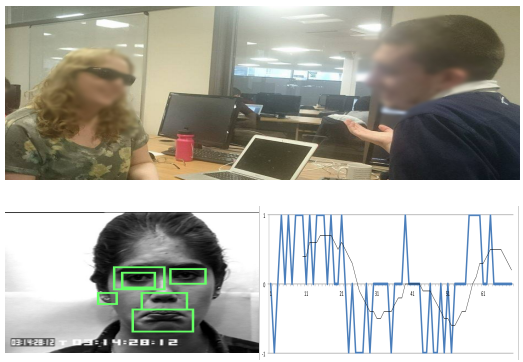


Figure 2. Emotion Detection via streaming video from imaging glasses

Result For the above two systems, we have conducted controlled lab user studies to inspire users' natural emotion expressions using imaginative scenarios, text/video sources, and real-world conversations. We conduct subject-specific evaluation methodology; that is, randomly shuffle each subject's data and split them into training and testing. Figure 3 presents the accuracies of accelerometer data-based emotion recognition over 18 subjects: averaged recognition rate is 76% with the minimum 47% and 94%. Figure 4 presents the

accuracies of vision-based emotion recognition over 4 subjects: averaged recognition rate is 52.7% with the minimum 0% and 100%.

Figure 3. Emotion recognition accuracies via accelerometer data

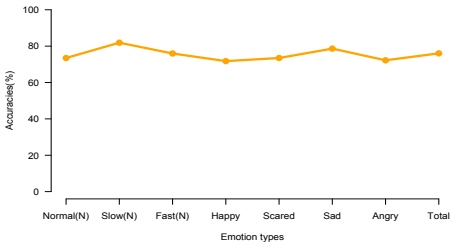
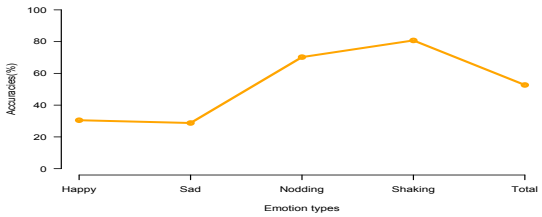


Figure 4. Emotion recognition accuracies via streaming video



Conclusion Both systems can reasonably well detect emotional types in real-world situations, still with significant improvement space. We are particularly interested in applying and adapting these technologies to mental health applications.