Infrared Imaging Based Access Pathway: A Study of Baseline Characteristics

Brian R. Nhan[1,2], Tom Chau[1,2,3]
[1]*Institiute of Biomaterials and Biomedical Engineer – Univeristy of Toronto*
[2]*Pediatric Rehabilitation Intelligent Systems Mobile (Prism) – Bloorview Kids Rehab*
[3]*Bloorview Research Institute – Bloorview Kids Rehab*

We propose infrared imaging as a potential physiological access pathway for non-verbal individuals with severe motor impairments. Previous work has shown that increased blood flow in the frontal vessels of the supraorbital and periorbital regions is correlated with user stress, arousal and emotion. Changes in blood flow can affect skin temperature as convective heat dissipates to the skin surface and is detectable with infrared imaging. This change in temperature has potential to serve as a non-invasive access pathway for the aforementioned population. In this study, we aim to characterize the hereto unknown baseline characteristics of average facial skin temperature signals, so that deviations from baseline can be more reliably identified. Using infrared imaging, frontal recordings of the face were obtained from 12 asymptomatic adults; average skin temperature signals of the nasal, periorbital, and supraorbital regions were evaluated. Over 70% of the signals were non-stationary ($p<0.05$) while over 80% were determined to be first-difference stationary ($p<0.05$). Correlation coefficients between regions were significant ($p<0.02$) and ranged from values of 0.30 (between periorbital and supraorbital regions) to 0.75 (between left and right supraorbital regions). Using information measures, it was found that the nasal region carried the most information and that some degree mutual information was shared across all regions. These results will be used in future studies to identify which regions of the face are most promising as an access pathway, and to provide insight into detecting changes from the baseline state.