Illuminating Engagement: Real-Time Thermal Imaging of Child Affect During Child-Robot Interactions

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***Abstract*— Providing assistive robots with an understanding of a child's affect during child-robot interactions in physical therapy environments enables the robot to better adaptively support the intervention. Current real-time affective measurements using traditional RGB cameras and computer vision are available, but the performance of these methods varies significantly by child, and these algorithms struggle with changing environment conditions. Thermal imaging with infrared (IR) cameras shows promise as a non-invasive and more objective method for determining child affect by analyzing the changes in temperature of regions (e.g., nose tip) of a child's face. However, most of the efforts in this space have used expensive IR cameras, and few have analyzed the efficacy of real-time thermal imaging for children with motor disabilities. Thus, our research goal is to *incorporate and evaluate real-time low-cost thermal sensing of the affect of a child with a motor disability during child-robot interactions in physical therapy sessions*. To accomplish this goal, we will first collect data during stationary child-robot interactions with our end user population against a ground truth of continual parent rating of child engagement. We will use machine learning methods to train a model for affect recognition based on our collected data. The model will be integrated into the sensing system of our mobile assistive robot, GoBot, and evaluated through in-person child-robot intervention sessions. The products of this work can benefit roboticists working in child-robot interaction, as well as clinicians and researchers interested in technologies for estimating child affect.**

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