**Title: Developing A Non-Intrusive 3D dynamic Multi-View Based Stress/Anxiety Indicator**
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The objective of this project is to develop a novel system for automatic detection of human's anxiety levels using a non-invasive and non-intrusive approach through a multi-view 3D dynamic facial behavior analysis. The project tackles a number challenging issues of interpreting human emotions under stress, including how to detect and model subtle facial behaviors associating with the anxiety under stress, how to link a set of micro-expressions to the corresponding physiological data under stress, how to collect a set of genuine data showing the sign of stress (e.g., anxiety), and how to evaluate the fidelity of the collected data and the viability, utility, and efficacy of the proposed system for the multi-level stress/anxiety detection.

A stress/anxiety detection system is essentially a pattern recognition system which indicates the anxiety status of a person under stress by determining the physiological and behavioral characteristics of that person. Traditional stress analysis through the physiological data collection requires the subjects' cooperation and physical contacts of detectors. Vocal-based stress indicators are able to work in a non-invasive way. However, the voice may not always be a stress reaction under the behavioral stressors.

There are some emerging advanced technology in the field of psycho-biometrics to predict thoughts and behavior from fMRI scans, or using advanced electrodes, infrared spectroscopy, and subtler magnetic imaging equipments. Such so-called mind-reading machines require to work in a strict and controlled environment by an intrusive contact of human subjects with cooperations.

The PIs propose to develop a stress/anxiety indicator using multiple cameras, in a non-intrusive and uncontrolled circumstance. The system will use multiple static/active camera pairs for high-definition 3D dynamic facial analysis in both spatial and temporal domains. The long-term goal of this research is to increase scientific understanding of human facial reactions to stress along with the physiological reactions, provide a window into the human mind to revolutionize the study of human cognition, and thereby lead to the development of intelligent human computer interaction technologies for assessment of occupational stress, subjects' test anxiety, and operators' workload and mental efforts. The research findings and the resulting system will benefit the development in areas of security, law enforcement, mental health, human computer interaction, behavior science, and education.

The project will develop a computational method as well as a working system to prove the concept for anxiety/stress analysis using 3D dynamic visual indicators, including a multiple static/active camera system for 3D dynamic face modeling and micro-expression analysis, and a spatio-temporal 3D dynamic facial behavior analysis framework by integrating multiple facial stress/anxiety cues from lips, pupils, pose, 3D action units, and facial surface primitive features. The project will also investigate the relation of anxiety/stress related facial behavior and the corresponding physiological data.

There are four major perceived contributions of this project. Firstly, the research using an non-verbal approach for multi-view dynamic face modeling and spatio-temporal analysis would advance the technological development of the field, and help increase the understanding how the face behaves along with the status change of stress. Secondly, it is the first work to investigate the relation between the intrusive data (physiological signals) and the non-intrusive data (facial appearance signals) under stress. It will provide a scientific understanding, on a detailed level, of how variance in facial appearance is related to anxiety under stress. Thirdly, it will include the development of the first extensive 3D stress-facial database along with the physiological data, which can be the benchmark database to foster research in this relatively new discipline. Fourthly, a computational method as well as proof-of-concept system will be developed and evaluated in a working scenario.

This project will facilitate research on the next generation of human-computer interaction technologies through the explicit modeling of facial behavior under stress/anxiety. It could be extended to the application in public venues with surveillance in distance, which is a complete non-cooperative environment. The resulting stress/anxiety facial database will be made available to the research community, which is valuable for applications in security, law-enforcement, mental health, psychology and behavior science, and education. As an academic institution, Binghamton University has a large and diverse student and staff population. Our BU enginet (tele-education) classroom recording system will facilitate the data capture from people of diverse ethnic backgrounds for the database. We will also involve undergraduate students in the research project through the proposed project and our existing REU program.