Continuous Objective Multimodal Pain Assessment Sensing System
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Abstract:
The current pain measurement techniques rely solely on the patient’s subjectivity, thus creating an incomplete picture of a problem where doctors have to fill in the blanks to solve it. Hence, a need exists for a comprehensive and objective system to evaluate pain. This need stems from the general difficulty doctors and patients experience when self-reporting their pain levels, as well as cases where the patients may be untruthful or unable to communicate their pain levels. An objective system, one used in parallel with the current subjective methods, may help doctors effectively manage pain and prescribe the correct medication, as well as the appropriate doses. The goal of this project is to develop a pain measurement system that is accurate, efficient, and useful in a hospital setting, using the physiological responses humans have to pain. This is to be done with physiological sensors, the ones to be tested in this experiment include the electroencephalograph (EEG), respiration rate (RR), galvanic skin response (GSR), and electromyograph (EMG). A preliminary guideline is set as to how to collect the data, the population is chronic lower back pain (cLBP) patients at Brigham and Women’s Hospital, approximately fifty patients with cLBP and fifty patients with cLBP and other conditions. The patients will be instructed to go through a series of maneuvers and the sensors attached will record the pain level of the subject. From there, the data collection will be analyzed to determine any statistically significant sensors.

Data or Results:
Classification was performed using linear discriminant analysis (LDA), artificial neural network (ANN), and support vector machine (SVM). Classification confusion matrices are shown in this section.

Method:
• All seven physiological sensors were used and attached to the subject.
• The subject gets to relax for 30 seconds to establish baseline for data.
• Then the subject is then asked to place their hand into the bucket filled with room temperature water. The ice is then added gradually using a scooping device.
• Every 20 seconds the subject is prompted to give a verbal pain rating on a scale of 0-10.
• The test is concluded when 10 pain ratings were recorded, or the subject decides they can’t do anymore.

Value Proposition:
This study serves to eliminate the need for the verbal scale that doctors currently use. Should a single biosensor, or variation of them, turn out to be statistically significant Dr. may begin to start incorporating them. Therefore, it allows the Dr. to perform their job even better since they have an accurate reading for the patients pain levels, and be able to administer medicine to relieve their symptoms quicker.