Online Proceedings

Poster Session 2

MGH 241, Easel 140

1:00 PM to 2:30 PM

Wearable Gesture Sensing in an Industrial Setting

Maxx Naoyuki (Maxx) Yamasaki, Senior, Extended Pre-Major
Mentor: Rose Hendrix
Mentor: Santosh Devasia, Mechanical Engineering

This work describes an inexpensive and accurate gesture control implementation designed for an industrial setting. Sensing hand movements and being able to remotely operate devices without use of a tangible control can be useful, particularly in manufacturing applications where other methods of communication may not be available. One gesture recognition method is to use a camera or set of cameras to capture the motions of the user. However, this method imposes line-of-sight workspace constraints and is sensitive to environmental factors, such as consistent lighting conditions. My approach is to use an instrumented glove that detects the amount of bend in specific joints and sends those positions to a central processor that is programmed to recognize control gestures. Similar glove controllers are available but are either not well suited to an industrial setting because the sensors are vulnerable to metal dust and debris, or are not accurate enough to identify commands quickly and consistently. My version has custom sensors exactly fitted to this application and aims to have all sensors sealed and self contained to protect against contamination. This system is able to capture high resolution movement from the wearer and either save that data for machine training or send it immediately to be acted on. Going forward, onboard capabilities such as local gesture recognition will be added, as well as allowing the user to add custom gestures suited to their particular application.

Poster Session 2

Commons East, Easel 47

1:00 PM to 2:30 PM

Technology Effects on Labor Force Market

Grace Shi, Senior, Economics
Ju Eun (Esther) Ahn, Senior, Economics, Psychology
Ivana Kolinek, Senior, Economics
Mentor: Elaina Rose, Economics

Development of technology, including artificial intelligence, has been controversial due to the potential negative effects. Many believe it is an auspicious industry and that technology will eventually replace the work of the human labor force. In this research project, our team analyzed the effects of technology in the labor market on the labor force within the next few decades. To accomplish our goal, we developed a model that can interpret the correlations between various factors. Specifically, this research analyzed data, including the employment rate, unemployment rate, number of occupation categories, and involvement rate of technology from varied industries. In addition, the Bureau of Labor statistics database was primarily used to regress the model. We expected to see a decrease in low-skilled occupations, such as cashier, in a short run. These types of occupations will be replace by IoT or artificial intelligence. High-skilled occupations, such as lawyer and surgeons, will still be demanded and irreplaceable in a short run, but would eventually be displaced in the long run. A shift would occur from low to high skilled occupations, due to factors such as social demand, working efficiency, and wage polarization. The employment rate goes down during the short run since more jobs are replaced by artificial intelligences and robotics. However, in a long run, more occupations will be created which will recuperate the fall in employment rate occurred during the short run. This research is very crucial and necessary because of the rapid growth of technology and its immense impact on the human labor force market. This research could ultimately provide information for governments and policy makers regarding potential growth sectors in the economy due to technological changes. Also, future generation can be more aware of this technological change, so that they can choose majors with accurately reflecting future employment trends.

Poster Session 3

Commons West, Easel 19

2:30 PM to 4:00 PM

Understanding Risk Taking: The Role of Anhedonia as a Transdiagnostic Predictor

Isabelle Amina Tully, Senior, Psychology
Mary Gates Scholar, UW Honors Program
Mentor: Lori Zoellner, Psychology
Mentor: Rosemary Walker, Psychology

As anhedonia, characterized by a blunted sensitivity to reward, is associated with decreased goal-directed behavior, increased risk taking in those with high anhedonia may reflect a lack of concern for the outcomes of risk-related behaviors. Observational studies indicate anhedonia is associated with some risky behaviors, with skydivers endorsing higher levels of anhedonia than non-skydivers and high-risk sports players who report higher anhedonia taking fewer precautions. Gender has also been shown to influence riskiness, with men reporting more recreational and health-related risk taking than women. Despite having behavioral tasks that show predictive validity in assessing real-life risk taking, the relationship between anhedonia and risk taking has not been examined using a controlled, experimental paradigm, which is critical to establishing a predictive association between these constructs. This study aims to characterize the relationship between anhedonia and behavioral risk taking. Sixty individuals, either high in anhedonia (15 female, 15 male) or within a healthy range (15 female, 15 male), were recruited. Risk taking behavior is operationalized with the Game of Dice Task, a gambling task that has shown validity in assessing risk taking in clinical samples. We hypothesized that individuals with high anhedonia would score significantly higher on risk taking compared to those with low anhedonia. Further, we hypothesized a moderating role of gender, such that male participants with high anhedonia would be even riskier than females with high anhedonia. As risk taking often precipitates harm, understanding this association is an important public health concern. Moreover, characterizing the relationship between anhedonia and risk taking may provide insight into high rates of suicidal behavior observed in individuals with high anhedonia.

POSTER SESSION 4

MGH 241, Easel 152

4:00 PM to 6:00 PM

Modelling Moments in Shoulder Joint to Assess Fatigue Damage

Megan Naomi Inouye, Senior, Mechanical Engineering
Mentor: Rose Hendrix
Mentor: Santosh Devasia, Mechanical Engineering

Manufacturing workers are often subjected to many rigorous and repetitive shoulder and arm motions, usually leading to shoulder injuries. Assessing the likelihood of an injury before it occurs and adjusting practices accordingly can keep the individual from the severe pain that shoulder injuries can cause. This research focuses on creating such a predictive model to warn individuals before they sustain an injury. I created a mathmatical model to assess critical positions that would cause the most stress in the shoulder joint. A Kinect sensor locates the arm joints in space and my Matlab code calculates the expected reaction forces in the shoulder. My current results focus on single, static positions defined by common industry working positions. Future work will focus on dynamic positions and comparing the results from the mathematical model with biological indicators to determine if this predictive model is indicative of injury.

POSTER SESSION 4

MGH 241, Easel 151

4:00 PM to 6:00 PM

Supraspinatus Tear Meta Analysis

Cato D Cannizzo, Sophomore, Engineering Undeclared
Mentor: Rose Hendrix
Mentor: Santosh Devasia, Mechanical Engineering

Supraspinatus tendon tears are a type of rotator cuff tear, accounting for 15% of overhead workplace musculoskeletal injuries. These tears disproportionately affect blue-collar workers and cost millions in healthcare every year, but there is still relatively little known about the appropriate work-rest cycles to prevent the risk of occurrence during work. Directly measuring the rotator cuff *in vivo* is difficult because the supraspinatus is covered by the bursa sac, the acromion, and the deltoid, making its material properties hard to accurately record. This presents a need for a material that can model an *in vivo* shoulder tendon. There are many options of what materials can be used: organic and *in vitro* models are the most common, with relatively new inorganic models being designed. However, none of these models fulfill all modeling needs; overlap between all models is needed to get an idea of how an *in vivo* tendon accumulates damage. Organic models can provide tissue repair and degradation rates and these can be projected for a human supraspinatus. From *in vitro* studies stress-strain curves and maximum load can be recorded, and from inorganic models tear propagation can be observed. This work compiles research on candidates for tendon proxy materials by cross-referencing a variety of papers in tendon literature to find the foundational papers. Then builds off those with other works by the foundational authors or other highly regarded works that cite those foundational papers. From the collection of these papers, the shortcomings of current tendon modeling can accurately be seen, showing what research is needed to better model *in vivo* tendons. For instance, to confirm the hypothesized projection from organic models, psychophysical testing that isolates the supraspinatus needs to be conducted. Better modeling of tendons will allow for better prediction of appropriate work-rest cycles that may slow tendon fatigue damage.