Thesis Project Portfolio

S.U.R.E: SOFT UPPER- LIMB REHABILITATION EXOSKELETON

(Technical Report)

AI AND HEALTHCARE: A CASE STUDY ON GOOGLE DEEPMIND'S USE OF AI TO DIAGNOSE ACUTE KIDNEY INJURY

(STS Research Paper)

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Executive Summary

Technical Project

The motivation for my technical project is that stroke is a leading cause of disability and it is very common for victims to lose function of their limbs, specifically the lower arm. It is estimated that approximately 3.83 million Americans are living with a stroke-related disability. Research shows that repetition of exercises that target the affected muscles can lead to patients re-gaining partial control of the limbs. Not all patients have access to rehabilitation therapy due to a variety of reasons such as lack of access to a physical therapist or financial insecurity. Our objective as a group was to address these difficulties by designing a rehabilitation machine that is inexpensive, lightweight, and easy to use without the supervision of a trained rehabilitation professional. To begin, we consulted designs made by other research groups and found that there were not any designs that were both comfortable and incorporated fine motor rehabilitation of the hand. Therefore, we added these two criteria in addition to inexpensiveness and ease of use. From there, we determined via a theoretical model the resistance of both the forearm and the hand, since these are the two parts of the lower arm that were going to undergo repetition of motion.Next, we determined the mechanisms to use in order to move the arm. Our design consisted of two motors, one for the forearm and one for the hand, programmed by a microcontroller. An elastic rope was wound up around a reel that the forearm motor would rotate. This rope was then fed through bowden cable and attached to the wrist in order to pull on the arm. A glove was designed for the hand and a small motor was placed on the glove that turned a small reel wound with elastic rope

that would pull on the hand causing it to rotate. The entire motion was dictated through the use of a push button that was used to stop and begin the repetitive motion. At the conclusion of our project, we achieved the ease of use, comfortability, and lightweight design however we were over-budget by approximately $140 and the motion of the hand was not fully accomplished. This was due to the cost of manufacturing the mount for storing all of the electronic components, the use of two microcontrollers rather than one, and needing a stronger motor for the hand. Future work should be focused on reducing costs and tuning the fine motor rehabilitation of the hand.

STS Project

My STS project involves researching an agreement between Google DeepMind, an artificial intelligence research company that strives to discover breakthroughs using AI to advance society and improve billions of lives, and the Royal Free London NHS Foundation Trust, a subset of the NHS consisting of three hospitals located in North Central London. The two began working with one another in 2015 with the intention of Google DeepMind developing an algorithm to diagnose acute kidney injury (AKI) much more effectively and efficiently in order to save lives and money. The presumption by much of the general public was that Google DeepMind was prioritizing the use of artificial intelligence to discover a solution and in the original ethics request by DeepMind to the NHS, the former officially confirmed the use of machine learning to diagnose AKI. This generated much backlash by the general public, who was not fully aware of the situation, and assumed that their confidential medical history was being taken and fed into an artificial intelligence system. I investigated the agreement between Google DeepMind and the Royal Free, in addition to analyzing the public's response and why they exhibited such extreme skepticism. The framework I used in my

research was the actor- network theory, abbreviated ANT, in which I defined human and non-human actors that formed a network of interaction that gave rise to the events that followed. Specifically, the human actors are the founders of Google DeepMind and hospital patients, while the non-human actors are the NHS hospitals, privacy laws and patients records, software, and the diagnosing procedures for AKI. One of the major concerns was the invasion of privacy, however there was also the issue of where the research was taking place. North Central London is an area that is predominantly occupied by minorities and African-Americans and this gives the impression of another scientific research project with racially-motivated intentions. Google DeepMind and the NHS were under investigation by Linklaters, a law firm located in London that put many of these suspicions to rest. Linklaters concluded that there was not any invasion of privacy going on nor any racially- motivated intentions, and zero use of artificial intelligence. The verdict is that the entire misunderstanding came about due to a lack of communication and knowledge of what artificial intelligence is and capable of.