Creating Bio-inspired robots

Based on the article by Rolf Pfeifer, Max Lungarella, and Fumiya Iida titled “The Challenges Ahead for Bio-Inspired Robotics” which says that “Biological inspiration does not imply that we attempt to copy nature. Rather, the goal is to understand the principles underlying the behavior of animals and humans and transfer them to the development of robots. For example, when we walk, our muscles constantly change their stiffness: they are loose when the leg is swinging forward; they stiffen up when we put the foot on the ground. This idea can be employed on robots without having to apply the same "technology" as biological muscles. The important principle is the smooth change in stiffness achieved, for example, with tunable springs, that is, actuators where the spring constant can be dynamically varied.”

Pfeifer, R., Lungarella, M. & Iida, F. (Nov 2012). The Challenges Ahead for Bio-Inspired Robotics *Communications of the ACM*, Vol.55, No.11, Pages 76-78

The initial thought of people upon hearing the term Bio-inspired robots, is thinking too far ahead by questioning its morality, which is actually a case for A.I. and cannot be entirely involved in Bio-inspired robots. Bio-inspired Robots does not involve decision making because it only functions based on the principles from animal or human activities thus is limited to these principles and functions.

Brain-Computer Interfaces

Brain-Computer Interface (BCI) otherwise known as a Brain-Machine Interface (BMI) is an emergent technology whose goal is to create a real-time and direct communication pathway between the brain and external devices such as computers, robots, artificial limbs and wheelchairs. In BCI, cerebral or brain activities control these devices by transmitting and receiving signals from the brain. BCI is applied in healthcare to improve the communication capabilities of people living with disabilities or locked in syndrome such as traumatic brain disorders, Amyotrophic Lateral Sclerosis (ALS), spinal cord injury, brain stem stroke and other severe motor disabilities.

One of the basic limitations of BCI is that the signals received from the brain are prone to interference. Furthermore, legal and ethical concerns such as the risk of infection or hemorrhage, psychological Review Article Olaronke et al.; CJAST, 29(6): 1-17, 2018; Article no. CJAST.44358 2 harm caused when a patient's intention to control an external device fails as well as privacy and confidentiality of patients' data are some of the challenges faced by BCI in healthcare.

Olaronke, I., Ikono, R., Ojerinde., O., Gambo, I. & Olaleke, J. (October 2018) Prospects and Problems of Brain Computer Interface in Healthcare, 29(6):1-17

Technological development will always need to explore human thoughts and principles to work on and to base on. So naturally, in the field studies that mainly involves humans such as the Brain-computer interface, data to work on will be extremely difficult to obtain due to issues such as ethics, morality, and safety.

Medical robotics with more autonomy

Professor Chatila began by outlining the many domains that robots and AI are used in healthcare from processing and analysing medical data for diagnosis to enhancing motor sensory applications in active prosthesis. He described the benefits of these applications and how they can enhance quality of life, for example by assisting or helping humans through emotional support (e.g., robot companions), helping people with impairments or disabilities perform or enhance motor functions (e.g., active prosthesis) or supporting surgeons in performing various surgical functions (e.g., interactive instruments and augmented reality). He also described how robot and AI applications are being used in predictive medicine to give people more control over their health, highlighting the example of the Watson System produced by IBM which uses statistics, a patient’s profile and other similar profiles to identify the probability of a person developing any diseases. He noted the most commonly used applications of robotics and AI occur in the category of processing and analysing medical data for diagnosis, falling within the scope of the four ‘Ps’ of medicine (e.g., predictive, preventive, personalized, and participative).

Prof. Chatila continued by explaining that despite the many benefits of these applications, such systems and devices, including the results they produce, have created new ethical and social risks and tensions in the legal system. He provided an outline of these risks, highlighting in particular the impacts to privacy, human dignity and autonomy (e.g., isolation), the possibilities of human augmentation and technical dependencies which can have the opposite effect of fostering learning (e.g., medicine without doctors). In showing how the use of data raises privacy issues and what can be done to minimize this risk, he provided the example of the Health Datahub project in France which provides a platform for the exchange of health data between public and private institutions.

Prof. Chatila then emphasised the importance of ethics and values in guiding the applications of these technologies. He noted the current ethical framework in medical practice, which is based on the principles of beneficence (e.g., do good), non-maleficence (e.g., do no harm), autonomy (e.g., preserve human agency), and justice (e.g., be fair), is a good starting point but insufficient in addressing all the ethical issues that arise in AI-based systems. While the Commission for the Ethics of Research in Information Sciences and Technologies (CERNA) has sought to address some of these issues with the development of recommendations concerning robots, Prof. Chatila argues these are incomplete, with specific principles needed for guiding the use of AI and robotised systems.

Dolic, Z., Castro, R., & Moarcas, A. (April 2019) Panel 2: Ethical evaluation and responsibilities of AI and robots in healthcare *Robots in healthcare: a solution or a problem?* Page 15-16

According to the article all the existing ethical framework in medical practice which is based on the principles of beneficence is designed for medical practitioners and is definitely enough but the same cannot be said to AI based systems. More autonomy definitely for me doesn’t, mean complete take-over of AI especially in medical field since moral and unique situations cannot always be answered by AI systems which is why the assistance of a medical professional will always be a must.