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Applications of machine learning techniques in healthcare

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***Abstract*—Machine Learning is modern and highly approached technological applications which became an enormous trend within the industry.Machine Learning is widely utilized in various applications.it is playing an important role in many fields like finance, life science, security and in health care.**

***Index Terms*—machine learning, health care.**

I. INTRODUCTION

Machine learning is a type of artificial intelligence (Al) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do.so Machine learning algorithms use historical data as input to predict new output values.Using machine learning in healthcare operations can be extremely beneficial to the company.Machine learning was made to deal with large data sets and patient files are exactly that-many data points that need through analysis and organizing and will get the results much faster.

Machine learning is playing an important role in healthcare, particularly in the area of prosthesis. Machine learning algorithms are being used to develop prosthesis limbs adaptive to more responsive and adaptive to the users needs.For example,machine learning algorithms can be used to detect the users movements and adjust the prosthesis accordingly.Additionally machine learning algorithms can be used to detect changes in the users environment and adjust the prosthetic accordingly. this allows for a more personalized experience for the user.Machine learning algorithms can also be used to detect changes in the users body and adjust the prosthetic accordingly. this allows for a more comfortable and natural experience for the user.

II. IMPORTANCE OF AI

The healthcare industry is in a productivity crisis. Machine learning will dramatically improve healthcare. From imaging to prediction to reality, medical applications already have endless implications. But there are also expensive initiatives that have not met their expected goals. there are a lot of benefits and some of them are to

- reduce human mistakes.
- make accurate descision.
- save time.
- reduce costs.

and there are many other benefits .
The point is that artificial intelligence is well established in healthcare. What is becoming an industry staple is a question of time and usage. Ensuring optimal use and continuous updating to meet the diverse needs of the healthcare sector is a joint responsibility of all key stakeholders

III. HISTORICAL PERSPECTIVE , OUTCOMES AND APPLICATIONS OF AI

For the last half century, technology, agriculture and manufacturing corporations have outpaced health care's innovation. However, today artificial intelligence offers a tool that can help medical doctors, administrators and other stakeholders break out of this crisis. It is estimated that if implemented correctly, AI could improve health outcomes by up to 40 percent and reduce treatment costs up to 50 percent by improving diagnosis, increasing access to care, and enabling precision medicine. in fig(1) shows the expected outcomes in the next few years . [1]

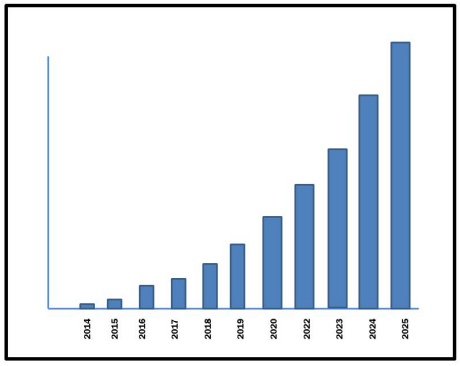

Fig. 1: a figure shows the increasing in outcomes of AI through years

"The hope is that, in not too many years, human brains and computing machines will be coupled together very tightly, and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today." (Licklider, 1960) Almost 60 years later, we are closer but not there yet.

IV. APPLICATIONS OF AI IN HEALTHCARE

There are already existing applications of artificial intelligence in healthcare one of them is **Prosthesis**
It is an artificial replacement for a missing body part that may be lost due to trauma, disease, or a condition at birth (congenital disease). A prosthesis is designed to restore the normal function of a lost body part. Simple prostheses have been used since 600 BC. Already used. These primitive substitutes, such as wooden legs, metal arms, and hand hooks, gave the wearer the appearance of movement and function, but were often uncomfortable, cumbersome, non-functional, and unusable. It didn't look appealing either.

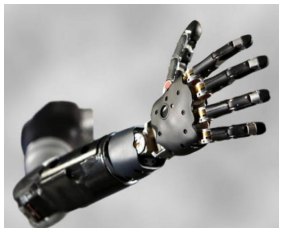

Fig. 2: a figure of an example of prosthesis

Types:
A prosthesis must be designed and constructed according to the person's cosmetic and functional needs. For example, even if a transradial prosthesis is desired, one must choose between aesthetically functional devices, myoelectric devices, body-powered devices, or activity-specific devices. Personal future goals and financial opportunities can help you choose from one or more devices..
Limb prostheses:
Limb prostheses include both **upper- and lower-extremity prostheses**.
1.Upper extremity prostheses: are used with varying degrees of amputation. Forequarter, disarticulated shoulder, transhumeral prosthesis, transaxial elbow, transradial prosthesis, disarticulated wrist, full hand, partial hand, fingers, partial fingers. A transradial prosthesis is a prosthesis used to replace a missing arm below the elbow. Upper limb prostheses can be classified into three main categories: **Passive devices, body-powered devices, and externally powered (myoelectric) devices**.
Passive devices: are either passive hands,primarily used for cosmetic purposes, or passive tools primarily used for specific activities . Passive devices can be static. Meaning, The device has no moving parts or may be adjustable. Meaning, Its configuration can be customized (eg adjustable manual opening). it is very useful for bimanual tasks that require the fixation or support of objects.
Body Powered: For example, manual or cable-operated limbs work by attaching a strap and cable around the shoulder opposite the injured arm.
myoelectric arms: are powered externally and use batteries and an electronic system to control movement. Each prosthesis is individually made and attached to the stump using suction technology. Once securely attached, the device uses electronic sensors via electrodes as the muscles in the upper arm move, causing the prosthesis to open and close to detect the slightest traces of muscle, nerve, and electrical activity in the remaining limbs. increase. This muscle activity is transmitted to the surface of the skin, where it is amplified and sent to a microprocessor, which uses that information to control the movement of the prosthetic limb. In the prosthesis industry, transradial prostheses are often referred to as "BE" or subelbow prostheses.
2.Lower-extremity prostheses: offers alternatives for varying degrees of cutting. These include hip amputation, thigh prosthesis, knee amputation, lower leg prosthesis, Syme amputation, foot, partial foot and toe. His two main categories of lower limb prostheses are **trans-tibial** and **trans-femoral**.
A transfemoral prosthesis: A prosthetic limb that replaces a missing leg (above the knee). Transfemoral amputees can have great difficulty regaining normal movement. In general, a femoral amputee expends about 80 percent more energy to walk than a person with two legs. This is due to the complexity of the movements associated with the knee. The new and improved design uses hydraulics, carbon fiber, mechanical linkage, motors, computer microprocessors and innovative combinations of these technologies to give the user more control. In the prosthesis industry, transfemoral prostheses are often referred to as "AK" or above-the-knee prostheses.
A transtibial prosthesis: A prosthetic leg that replaces a missing leg (below the knee). Below-the-knee amputees usually regain normal movement more easily than femoral amputees. This is mainly because the knee is held, which makes it easier to move. A lower limb prosthesis represents an artificially replaced limb below the hip joint level. In the prosthesis

Fig. 3: A prosthetic leg worn by Ellie Cole

industry, lower extremity prostheses are often referred to as ”BK” or lower extremity prostheses.

Osseointegration: is known as ’osseointegration’ (OI). Derived from the Greek word “osteon,” meaning bone, and the Latin word “integrare,” meaning “to make the whole,” the process involves directly bonding the surfaces of living bone and synthetic (often titanium-based) implants. make contact. First performed in 1994, this procedure uses a skeletal titanium implant that connects to an external prosthesis through an opening (stoma) in the stump. A direct connection between prosthesis and bone has several advantages.

- It can improve stability and controllability and reduce energy consumption.
- Easier and more convenient for users as no suction is required to hang.
- Weight bearing is returned to the femur, hip, tibia, or other bone, reducing the potential for degeneration and atrophy associated with traditional prostheses.

Mind-controlled bionic limbs: The next advancement in Bionic Limb technology is the emergence of mind-controlled Bionic Limbs. These are prostheses that can be incorporated into body tissues, including the nervous system. They are highly evolved and able to respond to commands from the central nervous system, thus more closely replicating normal movements and functions while also inducing desired movements with less ”lagtime”. Various processes and technologies are currently in the research and development stage.

V. RESULTS AND DISCUSSION

After knowing some information about Prosthetic Limbs you may be curious about the results. Let the results be shown!

Actually the results have shown that there are many patients who live peacefully with their artificial limb. The New England Journal of Medicine had a study [5] which reported on three patients who enjoyed their lives, for many years, with this technique. All the amputees who had the chance to have a prosthetic limb expressed their feelings as having a new opportunity for living with total freedom of movement and doing daily activities. On the other hand, Some patients complained about many cons of the prosthetic limb such as its high cost and the issue is not solved just by having the prosthetic limb. You have to follow physical therapy as long as you have the limb in your body to know all about it and how to deal with it . In addition , a new concept has been applied successfully for the last few years. This concept is called “Neuromusculoskeletal Prostheses” which means adding a sensation of touch in the artificial limb due to its connection to the nerves, muscles, and skeleton of the patient. Another interesting study [6] has been done to compare between the performance of the amputees and non-amputees(NA) athletes to know if the non-amputee athlete has an extra advantage as a mechanical aid. The study was done as a race over 400 m between the two athletes. The results have shown that no athlete having a prosthetic leg -including the fastest one- has a 400 m better performance than the NA athlete. Here are some detailed results of the prosthetic-limb athlete :

Maximum velocity	1-3% slower
Initial acceleration	40% slower
Velocity at aerobic capacity	19% slower

Thus, these results prove that athletes with prosthetic leg are considered not to have extra advantage over NA athletes during 400 m races.

VI. CONCLUSION

In conclusion, the key issues for future research were divided into:

- Economic Impact of Health Care
- Tools for Rehabilitation Guidance
- Activity Restrictions and Performance Standards
- Pain and Comfort
- Quality of Life

The group emphasised that there will be overlap among the five priority categories, which is both normal and frequently encouraged. For instance, discomfort and agony will certainly limit an amputee’s capacity to wear a prosthesis and go to work, which will directly effect the situation’s economics. Tools that measure socket fit and comfort may therefore provide a better financial benefit to the payer. Additionally, a person with less pain i s more likely to be more active, perform better, and report having a higher quality of life. As technology has already been invented that enables prosthetic limbs to be moved by brain processes, conclusion is drawn that prosthetics will only get better in the future. scientists will figure out how to enhance a limb’s motor capability while also trying to hide it better and make it appear more lifelike.

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