

# **Applications of Artificial Intelligence in Healthcare-**

## **To be more precise, the "Stroke."**

### **A. Introduction**

With the advancement of technology, the human working style is gradually changing. People have changed the working style from basing on labor to work based on brainpower during the past decade. For most people, it sounds not bad. Compare with consuming lots of physical energy, people prone to have less energy expenditure on working activities. However, due to the lack of activities and the increasing stress, the risk of cardiovascular disease is increasing tremendously.

First of all, we need to put an eye on the sedentary lifestyle. "Sedentary" is a trending word over these years and attracts the attention of many researchers. The reason is that although lots of people have a sedentary working style in their working time, they still have a certain degree of physical activity at the weekend or their rest time and can be label as "active" people. However, the question is: Does the cardiovascular disease rate decrease merely base on the weekend activities? Or what we need is decreasing the time spending on the chair instead of jogging every Sunday morning? According to the previous study, some exciting and dumbfounded findings were explored. A cohort study was performed as a form of longitudinal tracking of a specific group and achieving a cross-section at intervals through time. In their study, subjects were divided into two groups. One group is the people whose working style relies more on physical activities but is defined as light to moderate energy expenditure, e.g., elementary school teacher, nurse, police officer ...etc. The other group is the people whose working style is much more passive, but they still have some regular exercise habits. This study aims to underset the impact of a sedentary lifestyle and convince people that although we always emphasize how important exercise is, the most crucial part is decreasing the time spent on the chair. After specific years of tracking, the researcher concludes that people with a sedentary lifestyle indeed increase the risk of cardiovascular disease and significantly increase the potential risk of stroke. From the above, we know the sedentary lifestyle harms our health and lacks regular activities based on the passive working style. Those people have the highest risk of chronic disease, e.g., diabetes, high blood pressure, and high cholesterol level.

Nowadays, the working style is more relying on human intelligence. This kind of transformation increases the loading of our brain with no doubt. Moreover, the intense thinking and the high-mental-pressure working environment significantly impact the social-psychological effect, including worried, stressed, nervous, and tense. With these symptoms, people have a greater risk of depression and anxiety syndrome. According to the previous finding, people with higher anxiety and depression correlate with the stroke incident and compare to those with well-regulated mental health, they have a 33 percent higher stroke risk.

## **B. Prevention**

### **Persuasive Technologies to Change Sedentary Behavior**

Fortunately, our technology brings us more benefits and aids than disadvantages. The persuasive Technology system is a novelty computational system and aims to change human behavior by an interactive base. Interaction is an exciting approach to change a person's behavior. Traditionally, human behavior is hard to change, so lots of research emphasized using feedback to change human behavior. For example, the Pavlovian Theory is a traditional approach to understand the link between the stimulation and the behavioral response. For persuasive technology, the background scenario gradually changes one's behavior by changing one's mind first. From time to time, the objective will be reached without forcing the human being. Unlike traditional behavior theory, this strategy is based on a feed-forward approach, and AI plays a vital role. This Persuasive Technologies model will collect the user's habit and try to predict the outcome behavior.

The most important thing is that this model will know the preference of the user. Users need to achieve a specific goal to get what they want. For example, when a user completes the dream: "After 20-minute sitting, you need to stand up for a while" or "You need to exercise 3 times a week, and 30 minutes at least", they will get a reward badge icon. This little badge lets the user share on Instagram or any other social media. Furthermore, users can get a token by cumulating the badge to unlock some little game or buy some app features. All of these are increasing and strengthen the internal motivation of the user. This kind of model can gradually change someone's behavior and finally reach the goal. Surprisingly, the user changes their behavior with a pretty good feeling compare to the traditional theory.

### **Evaluate Mental Health by AI Chat Bot**

In some cases, people fall into depression without knowing by themselves. Language is powerful. As humans being, language gives us a chance to learn from the outside world and convey our real feelings. Language can deliver one's deep feelings and motivation. More precisely, how we provide communication can reflect the current mental status. Language gives us a way to understanding people's mental situations and offers more help. AI has a considerable possibility to deal with the human language through powerful computer-based natural language processing. This technique can collect an abundance of user's language by typing or talking to evaluate the mental status. When the AI agent detects the level of depression or anxiety is high, the agent will provide some solid method to help users release their brains and minds. Or even more accessible, lots of depression or anxiety result from the lack of interaction with other people. The AI agent can give the user some warm words by having a conversation with the user. In the worst case, the agent can report the emergency condition and save a life.

## C. Diagnosis

### Stroke diagnosis by MRI and CT scan

Traditionally, the stroke severity and occurrence cite was determined by the CT scan and MRI. There are two categories of stroke, include hemorrhage and ischemia. For hemorrhage type, it means that the blood flows into the closed cranial cavity. For ischemia type, it represents that some areas of the brain lack oxygen due to the blood supply's insufficiency. Hemorrhage stroke has a higher mortality rate compare to ischemia stroke. The region of the ischemic stroke in brain tissue is darker, and on the contrary, the part of the hemorrhagic stroke in brain tissue is brighter. And most of the CT and MRI was read by the professional radiologist. For the ischemia stoke type, emergency care is the (tPA) IV injection, a tissue plasminogen activator to dissolve the blood clot. However, based on the nature difference between two different stroke types, if the patient with hemorrhage stroke and the tPA was given, that will lead to an irreversible deadly result.

Fortunately, AI is widely used to differentiate the medical image. The robust AI algorithm can help physicians precisely diagnose which type of the stroke is and the appropriate treatment. According to the previous finding, the AI can precisely differentiate the two kinds of stroke compared to the ground truth. AI can identify the large region stroke compared with the small region and better determine the ischemic stroke. The reason may be that the prevalence of ischemic stroke is 3-times higher than the hemorrhage stroke. It means that the database for ischemic stroke will have abundant cases with enough diversity. However, the hemorrhage stroke database may have enough medical image, but not enough for each variety. It may result in the AI not having a comprehensive ability to differentiate hemorrhage stroke from ischemic stroke. Nevertheless, the overall performance for the AI agent still good enough and close to reality. With AI help, the misdiagnosis rate will reduce significantly, which can also alleviate the physician's pressure. AI can help evaluate the stroke but detect other related diseases and rule out the irrelevant possibility. The FDA also approves this kind of prestige technique. The capability of AI decreases the time for the diagnosis and increase the accuracy.



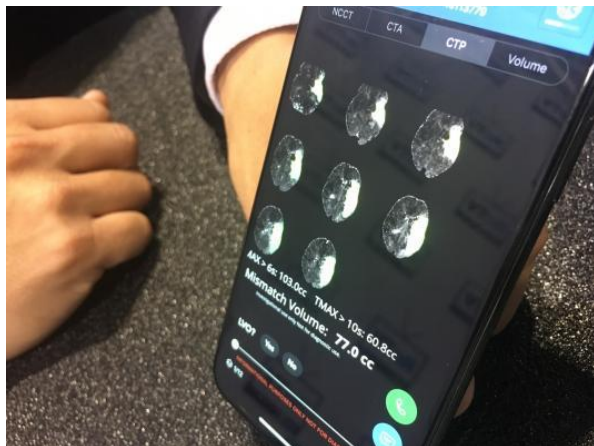
Figure 1. Ischemic stroke and the hemorrhagic stroke

## D. Prognosis

### Stroke outcome prediction to help determine the treatment plan

After the patient went through the acute phase, all the medical personnel would have the same question "What will be the next step?" To fully recover from the stroke, the appropriate medical strategy is needed to construct a comprehensive treatment plan. However, we will never know what will happen tomorrow. The patient's condition is fluctuating, and some time is unpredictable. Even if two patients have the same medical image outcome for today's examination, we cannot say that they will have the same condition for tomorrow. For the stroke, many complications will bring the patient into even more urgent circumstances. Secondary intracerebral hemorrhage is a common complication with a high mortality rate. There is some potential risks factor will lead to secondary intracerebral bleeding. For instance, the onset age of stroke is increased. The patient has multiple possible chronic diseases (high blood pressure) or a patient with cardiovascular stenosis. Traditionally, lots of the evaluation form evaluates the secondary damage from stroke, e.g., Hemorrhage After Thrombolysis (HAT) and National Institute of Health Stroke Scale (SEDAN) scores. Both of the scores reflect the potential risk for intracerebral hemorrhage but not the instantaneous patient status change.

AI can collect all the patient's immediate information and lab data and calculate the potential risk for intracerebral bleeding. The physiologic data, which are blood oxygen level, heart rate, blood pressure, are monitoring by AI comprehensive system. According to the previous finding, combining the image and the lab information, AI can predict the prognosis by using SVM model based on the big data. Surprisingly, the AI agent has a higher CI (0.738–0.74) at a 95% confidence level than the traditional HAT and SEDAN score. AI can help physicians process decision-making by a concrete outcome and with tremendous information processing operations. With a suitable treatment plan, the prognosis's product can improve and reduce the patient's medical burden. However, there is some worth-thinking point for this kind of technology. First of all, the AI agent is like a black box, and the outcome cannot convince lots of the physician without a reliable derived process. Furthermore, the training data set plays a crucial role in the predicting model. However, according to the statistical point of view, no one can know which sample can fully represent the population. If the training set is from a specific region, the outcome can only be used in the same place. This increase some potential risk for misdiagnosis.



## E. Treatment

### Telemedicine can track the patient's progression and guide the treatment program

After the stroke phase progresses into the chronic stage, patients start to conduct their rehabilitation programs. However, it is not an easy task for lots of patients with the post-stroke syndrome. Stroke affects the central nervous system (CNS). Generally, patients lose a certain degree of motor and sensory function and have some cognitive function impairment. Early rehabilitation is encouraged by most of the physician and physical therapist. The patient needs to perform its rehabilitation program at home with reliable safety and supervision. Traditionally, patients will need a caregiver to take care of their daily living activities and bring the patient to the out-patient department to execute the rehabilitation program. For most of the patients, transportation is time-consuming and inconvenient. Nowadays, AI applications can be used in telemedicine to monitor and collect data from time to time from a specific device. For example, the balance ability can be estimated by using the inertia measurement unit. When the patient is practicing walking, the inertia measurement unit can record a specific geometric point acceleration from the human movement. The AI can help to evaluate the balance ability and report to the physician what the progression is. The most important thing is, this sensor can detect the falling by censoring the high vertical acceleration and immediately report to the hospital. The telemedicine system can change the current in-person visiting based medical system to the wireless-based.

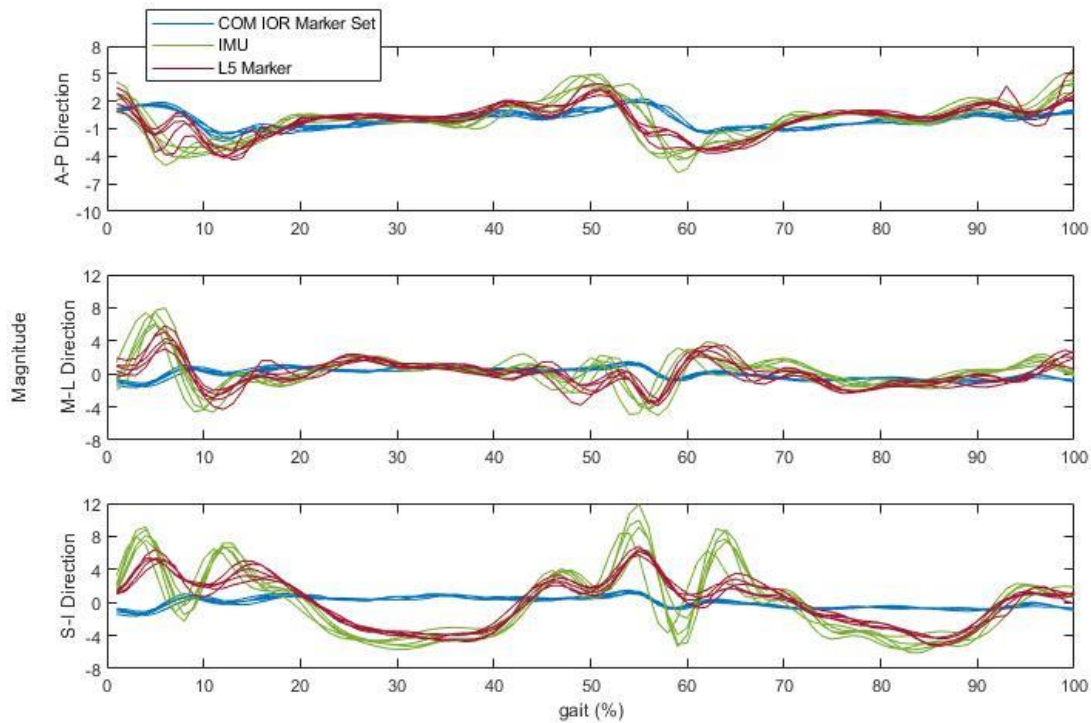


Figure 2. The acceleration change in gait measuring by the inertia measurement unit

## F. Conclusion

From the prevention, diagnosis, prognosis, and treatment, the AI perfectly presents the professional ability to help the physician and society deal with the enormous amount of information from the patients. AI has shown data processing power and can accumulate and keep people's data in a single place. It can utilize this information to see into the previous and current health condition. AI can quickly obtain patient insights to discover key areas of patient care that require improvement. It increases diagnosis and treatment accuracy in personal medicine and enriches the senses to enhance cohort treatment. Implementing AI to healthcare can potentially reduce operating costs and save money and could also reduce the workload of physicians and healthcare workers. Overall, AI can dramatically improve our medical environment's efficiency and augment the work humans can do. In the long term, AI could promote humanity's welfare and increase the quality of life.

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