

# Deep learning on Wearable Devices

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## introduction

Today, almost everyone in the field of artificial intelligence talks about deep learning. As we all know, deep learning is an artificial neural system established by imitating the structure of human brain neurons. It can process external input information layer by layer through multiple networks and has a strong self-learning ability. Deep learning is widely used in various fields, such as man-machine games, speech recognition, image recognition, natural language processing, etc., and has achieved quite good results. Similarly, deep learning has a good application prospect on wearable devices. Therefore, I will introduce the application of deep learning on wearable devices in this article. Of course, I believe this article will give you a deeper understanding of deep learning on wearable devices.

Currently, with the popularity of wearable devices, more and more people are using devices such as smart watches. At the same time, the rapid development of science and technology has made human beings more and more demanding to use technology to improve their quality of life. Obviously, people expect that small wearable devices can realize more functions than they could have imagined in the past. This is why the application of deep learning on wearable devices has become an important research direction, and has achieved good results so far.

In the following content, I want to introduce the application of deep learning on wearable devices from several aspects. First, what is a smart wearable device? And how does deep learning redefine wearables? Second, what has deep learning achieved on wearable devices until now? Third, what challenges do we encounter when applying deep learning to wearable devices? Fourth, the development prospects of deep learning on wearable devices.

## Definition

With the advancement of science and technology, human needs have become greater and greater. Using technology to improve one's life has become an important topic. In the past, a wearable device was a portable device worn directly on the body or integrated into a user's clothing or accessories. Today, smart wearable devices are a combination of hardware, software, and high technology, such as deep learning, that revolutionize human life. Needless to say, deep learning is providing support for complex algorithms, helping to expand the application scenarios of wearable devices and enabling wearable devices to achieve more unimaginable functions.

## Application

Deep learning technology makes wearable devices intelligent. The coming of the

era of wearable intelligent devices means the intelligent extension of human beings. Through these devices, human beings can better perceive the external and their own information, can process information more efficiently and achieve more seamless communication with the help of computers, networks and other people.

Broadly speaking, the application areas can be divided into two major areas, namely self-quantification and in vitro evolution. More generally, the application of machine learning on wearable devices is mainly in the following three areas, which are healthcare, sports fitness and intelligent assistants.

First, let's look at the role of deep learning in wearables for healthcare.

In everyday life, work, and a more connected world, wearable medical devices play an increasingly important role, and the demand for creating and developing wearable devices is also increasing. The various functions of wearable devices, especially wearable medical health, the health all-in-one provides great protection for our health and is an area that needs everyone's attention. Recent advances in wearable mobile medicine, cardiovascular physiological modeling, and non-intrusive sensing technology, especially the development of flexible, stretchable, and printable sensing technologies, have made high-precision and convenient non-intrusive sleeveless continuous blood pressure measurement is possible. By detecting and analyzing data such as physical indicators, we can respond to changes in the body faster. For example, we can use deep learning to create meaningful data by monitoring physiological signals, emotional stimuli, and markers of stressors in children with autism spectrum disorders, and caregivers can provide preventive care.

I plan to use an example to help explain the application of deep learning technology on wearables to health care. In southeast England, patients discharged from a group of hospitals serving 500,000 people are being fitted with a Wi-Fi-enabled armband that remotely monitors vital signs such as respiratory rate, oxygen levels, pulse, blood pressure, and body temperature. Under a National Health Service pilot program that now incorporates artificial intelligence to analyze all that patient data in real time, hospital readmission rates are down, and emergency room visits have been reduced. What's more, the need for costly home visits has dropped by 22%. Longer term, adherence to treatment plans have increased to 96%, compared to the industry average of 50%.<sup>i</sup>

Next, let's take a look at the role of deep learning in wearables for sports and fitness.

Nowadays, wearables are coming in different forms and technology advancement such as Intelligent Voice assistant integration. Advanced sensors are embedded into these wearables for tracking, analyzing and improving fitness or sport specific activities of users by generating real-time user insights. Going the extra mile, these smart wearables provide actionable insights to the user to reduce the risk of injuries as well, such as smart helmets for bikers, smart glasses, smart watches, fitness bands, yoga pants which assists for correct poses.

Wearables can assist fitness with their routine training activities. Most fitness wearables help the user to track their activities. If a user walks 12000 steps, the wearable device will count the steps and display it. However, the limitation with these wearables is that after a certain point people don't understand how to utilize the data. Technology

enabled wearables can not only track the data, but also defines what the user needs to eat, how much they should sleep, and how they should train to improve their fitness among others insights.<sup>ii</sup>

In general, manufacturers use lightweight watches, bracelets, and accessories as the main form to monitor, analyze and service sports or outdoor data such as heart rate, cadence, air pressure, diving depth, and altitude.

Finally, let us look at the amazing effects of deep learning on smart assistants with wearables as the carrier.

This type of wearable smart device can help users achieve information awareness and processing capacity improvement. Its application fields are extremely broad. From leisure and entertainment, information exchange to industry applications, users can have a variety of Wearable devices with display capabilities to enhance or innovate your skills.

Similarly, we have learned from several scenarios in which smart wearable devices have helped us. First, deep learning algorithms and wearables can help travelers or anyone who needs to communicate in different languages to translate incoming speech, so they can talk directly without the need for third-party translation. Second, deep learning can analyze conversations and help people with symptoms such as social anxiety or Asperger's syndrome to better understand and discover social cues in everyday conversations. Computer vision with face detection can also provide sentiment recognition analysis. If combined, they can help people understand the overall mood of a conversation and respond appropriately, just like a social coach.

## **Challenge**

In the process of applying deep learning to wearable devices, we will encounter various difficulties and challenges. Broadly speaking, one is a technical problem, the other is a privacy and security problem. At the technical level, how to make all the senses and cognition, such as vision, hearing, emotion, touch, etc., be processed by deep learning technology to achieve a high accuracy and input into a single application and smaller equipment is a problem that can be further explored. On the other hand, privacy management and security issues are also important criteria for measuring whether people will use this device. As we all know, the application of deep learning must design a large amount of data, and collecting a large amount of data will inevitably involve privacy issues. At present, the solution is for sensitive information, which must first be obtained by the user's permission. In addition, for security-sensitive functions, developers try to process data on the device side instead of transmitting it through private cloud or public cloud services. Avoiding data transfers provides the best level of privacy.

## **Prospect**

The era of wearable computing is full of unknowns and temptations. Whether we accept it or not, the era of wearable computing has come to us. Although it takes some time to improve, this trend is undoubtedly an inevitable. At the same time, the original intention of wearable smart devices is to explore a new way of interaction between

people and technology, to provide everyone with exclusive and personalized services, and the computing method of the device must undoubtedly be based on localized computing-only then can it be accurate To locate and perceive the personalized and unstructured data of each user, to form a unique and exclusive data calculation result on each person's portable mobile device, and to use this to directly reach the truly meaningful needs of the user. Touch the rules to launch a variety of specific targeted services. There is still much room for improvement in deep learning algorithms. Only by continuously improving the accuracy of algorithms can intelligent wearable devices be more convinced to use them with confidence. There are still many unknowns in this area waiting to be solved, and the application of deep learning to wearable devices will still be a hot research area for a long time.

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<sup>i</sup> Moni Miyashita and Michael Brady, The Health Care Benefits of Combining Wearables and AI, May 28, 2019.

<sup>ii</sup> SAYALI SAWAT, How AI Enabled Wearables are Changing Healthcare and Fitness Industry, JULY 23, 2019.