The application and development of artificial intelligence in smart clothing

XIONG Wei
College of Textile Garment, Southwest University, Chongqing 400700, China

Abstract: This paper mainly introduces the application of artificial intelligence in intelligent clothing. Starting from the development trend of artificial intelligence, analysis the prospects for development in smart clothing with artificial intelligence. Summarize the design key of artificial intelligence in smart clothing. Analysis the feasibility of artificial intelligence in smart clothing.

1. Introduction
Artificial intelligence is a combination of computer science, control theory, information theory, neurophysiology, psychology, linguistics, philosophy and so on the many kinds of mutual penetration and development of the subjects of a cross discipline. [1] Google’s Alpha Go against the would champion at Go Lee se-dol and KeJie become the new world champion in May 2017. The development of Alpha Go makes us excited about development of artificial intelligence. A professor at the university of Massachusetts institute of technology in United States Swinton has publicly “Artificial intelligence is to study how to make computer to do some work only humans can do before”. The Alpha Go as one of artificial intelligence is the imitation board game between the human activity. [2] In the early years, a number of well-known fashion designers have applied high technology to fashion design, and then smart clothes gradually appeared in the public view. Smart clothing refers to the simulated life system, which can not only perceive the external environment, but also the change of internal state, and the clothing can respond to this change in real time. [3] In the intelligent life environment, artificial intelligence and smart clothing can adapt to people's various wear needs.

2. The Development Prospects of Artificial Intelligence in The Smart Clothes

2.1 The necessity of intelligence transformation traditional garment industry
The concept of “industrial 4.0” began to emerge in the new round of revolution of science and technology which is made “smart” as the leading the fourth industrial revolution. Artificial intelligence will become the focus of the development direction and the virtual world will fuse with the real world in the era of industrial 4.0. The future manufacturing will achieve higher engineering efficiency use shorter time to market and achieve production flexibility. [4] From the point of view of the world development, the development of artificial intelligence to the world economy is more and more fast in the arrival of industrial 4.0. According to the Accenture global twelve in developed economics. Artificial intelligence will help them to speed up the economic growth. Based on the traditional theory, capital and labor are the two elements of mass production of boosting the economy. [5] The traditional pattern of industrial development is made up of capital, labour and total factor productivity. Capital and labor are variable elements that determine economic development. Adding artificial intelligence to the new industrial development model makes it another variable element associated with capital and labour development, which will be more efficient in promoting economic development.
China, as a major labour force, has abundant labour resources. As a basic consumer goods industry, garment industry is highest degree of marketization in China, one of the strongest industry international competitiveness. The rapid development of China's economy and the expansion of the national dress of consumer demand, is the fundamental motivation for the development of China's garment industry. At the same time, high-quality labor resources, good investment environment and to form a complete set of upstream and downstream industry chain, for the development of China's garment industry provides an important conditions and powerful guarantee. For the apparel industry of intelligent transformation provides a good bedding.

2.2 Efforts of artificial intelligence in the costume design
Some clothing need the multi-discipline frontier technology. It is primarily through two kinds of methods to implement the intelligent of the clothing. One is using intelligent clothing materials, including shape memory materials, phase change materials, colour materials and stimulus-response hydrogels, etc. The second category is the microelectronics technology and information technology in People’s Daily wear clothing, including the application of conductive material, flexible sensor, unlimited communication technology and power supply, etc. [6] At present, some fashion designers began to design with artificial intelligence’s assistance. With the development of science and technology in the future, artificial intelligence can be inserted in the clothing to become human's closest aides.

2.2.1 Artificial intelligence and cognitive dress. In early 2016, IBM will work with Marchesa in the theme of "Manusx Machina: Fashion in an Age of Technology" the Met Gala. They built the first cognitive dress for it. IBM's artificial intelligence Watson has been involved in the design of the dress. It not only provides the inspiration for the design of the dress, its technology is woven into the fabric of the dress. Dress in 150 flower embroidered on a built-in LED lights. LED by Watson Tone Analyzer API real-time monitoring label content changes which with # Met Gala# and# Cognitive Dress# in Twitter. It can analysis the emotions to change colours in real time. First of all, Watson study science report accurately choose the right material. Watson analysis massive gallery choose the five most popular colour for LED lights. Then designers started to design production of the dress. When the model walked down the aisle, Watson began to read fan mood real-time feedback change colour. In addition, Watson has a good ability to learn, through expert training and optimization of constant progress. Australia’s fashion designer Jason Grech using Watson “visual identity” to analysis of the past decade fashion data and social information in time. In order to analysis and forecast trend, so as to help him find a new way
to deal with material, color and texture. Watson also help designers build image and fashion image to match each other. It makes designers convenient from line, curve and inspiration in the edges and corners. Watson cross-border cooperation with designers tell us that artificial intelligence can make a designer more diverse and creative.

![Figure 2. The process of Watson with fashion designer to design the dress.](image)

2.2.2 Related to intelligent technology for AI clothing design inspiration. Face recognition refers to the input face image or video, determine whether there is a face. If there is further human face, and then gives the location of each face, size and the location of the main facial organs. And based on these information, further extract each face is the identity of the characteristics, and comparing with the known face the library face, so as to identify of each face. [7] In the design of smart clothing, this technology can be combined with artificial intelligence. It can make the garment itself to face recognition, and to identify the face of the corresponding effects such as colour, fabric shrinkage, etc. Or directly to store the human face information in the memory in order to extract information when it needed. Such as the artificial intelligence to help its memory across the person’s identity information. Through the wearable device for human-computer interaction. “wearable devices” broadly understood that can wear in the body of the electronic equipment, or into a dress or similar dress a portable electronics equipment. From a practical sense, “wearable device” is not just a dress or a similar dress to electronic equipment, but also be able to use data interaction. The cloud interaction and software support to realize the special function can be worn in or worn on the body of technology products. Fore example, Intel has started using wearable device for people to interact with technology. Grammy awards ceremony in 2016, Lady Gaga with Intel’s Digital Skin, Interactive Video, Robotics, Interactive Holograms in collaboration with the performance. Through take based on Intel Curie platform development of wearable devices to control the show which with the human body in the big screen effect. In the design of intelligent clothing, it can join wearable devices to interact better with artificial intelligence or wearable device using the electronic, circuit into clothing, in order to achieve the functional requirements. In the design of wearable devices can be micron or nanometre embedded, make the garment of sensors and drive with wireless connection between the surrounding environment. At the same time, the micro or nanometre electronic components such as small size can better invisibility within the clothing, to make the dress more fashionable appearance. In this way, there is a visual gap between wearable devices and ordinary clothes which can basically be invisible and minimize. [8] The emergence of new flexible energy storage elements has greatly improved the comfort
of smart clothing and wearable devices, which has brought infinite possibilities to the design of artificial intelligent clothing.

![Figure 3. The dynamic hologram of in Lady Gaga’s Face](image)

### 2.2.3 AI clothing design key point

Traditional clothing is mainly composed of ordinary fabric cutting, the aim function is to clothing, beautiful and fashionable. And smart clothing is mainly composed of intelligent materials, such as optical fabric, memory fabric, etc. Smart clothing need to consider electronic components configuration issues, both to ensure that the intelligent and want to wear comfortable. [9] we also need to consider in the design of clothing and artificial intelligence interactive equipment, the availability of intelligence clothing material, and form a complete set of services for intelligent clothing combined with artificial intelligence. The focus of the artificial intelligence clothing design can be summarized as the following several aspects.

**Clothing Wearing Comfort.** Smart clothing is intelligent technology and clothing integrated high-tech products. It is a combination of electronic information technology, sensor technology, textile science and cutting-edge technology in the field of material science or related. Due to the combination of a variety of new frontier technology, inevitably will use new type of smart materials and wearable devices to improve the intelligent level of clothing. Smart clothing while considering the functional. It need to consider when fabric or wearable devices with the comfort and safety of human body skin contact with the human body. Consider the question of whether or not to accord with human body engineering, etc. The user need. Smart clothing as a function of clothing, the main purpose is to serve a particular user. It as a carrier of wearable devices. It is necessary to serve different needs and withstand the subjective choice of buyer’s market. Due to the different of the user's living environment, social class, education environment, lead to their different acceptance of new intelligent products. Designers need to pay attention to the release of new technologies and integrate with the development of science and technology to better adapt to the needs of users. This needs constantly to evaluate the users cognitive, the experience of new intelligent products and the acceptance of the artificial intelligence emotion in the design. These meet the user’s physiological and psychological needs.

**Interactions with The Equipment of Artificial Intelligence and Cognition.** Because smart clothing need induction for interacting with artificial intelligence. Artificial intelligence need to people’s emotion. Designers should be considered in the design of clothing or wearable devices in use when the operation is convenient. Smart clothing is for a specific customer service. So designers should consider the user's point of view in a simple operation that artificial intelligence to complete more efficient instruction.

**Provide Supporting Software and Services.** Smart clothing is based on software systems and the internet platform. It with the intelligence of the combination with cloud computing and big data. Fashion designer need to consider with specific software test procedure and the combination of digital media to
artificial intelligence clothing which collection of data for storage and management. In order to better will be the result of the user needs to feedback to the user.

3 The feasibility of artificial intelligence in the smart clothes and analysis the difficulties in design

3.1 the feasibility of artificial intelligence clothing
From the choice of the market and the future trend of the society, smart clothing to meet the needs of people and cater to the development of the times. In such an era of intelligent fast rhythm, the emergence of smart clothing is a necessity. Artificial intelligence industry investment increased year by year; The relevant policies of artificial intelligence has risen to national level; Artificial intelligence will become the commanding heights of the enterprise strategy layout; Artificial intelligence in some professional task performance is often better than humans. In such an era of intelligent fast rhythm, the emergence of smart clothing is a necessity.

3.2 Artificial intelligence clothing promotion difficulty
The use of artificial intelligence in the smart clothes also has the obvious disadvantages. The smart clothing is in the theoretical test phase in the current. If we want a wind range of promotion, we need to overcome a lot of difficulties. The future need to overcome the difficulty has the following several.

3.2.1 Design and Technical Difficulties. In intelligent garment design need to consider all aspects. Many creative ideas are not achievable because of fabric constraints or technological backwardness. To apply theory to practice, still need to conquer all kinds of technical difficulties. Such as smart clothing clean energy storage components in water whether to go bad and wearable equipment maintenance, etc. We need to development the science and technology to solve these problems.

3.2.2 The Prize Problem. Smart clothing at the time of design need to use special intelligent fabrics or intelligent wearable devices. And these fabrics and equipment cost much more expensive than ordinary fabrics. A smart clothing prices than the price of the same style of clothing is much higher. So, the price will be a big factor restricting the development of smart clothing. Such as smart clothing clean energy

3.2.3 Security Issues. Smart clothing is shared with the Internet resources. It also makes many kinds of intelligent clothing involves the user's private information, location information and other sensitive information. It gave hacker a lot of opportunities to steal the information. This also reflected the development of intelligent clothing is a double-edged sword. On the one hand, it has facilitated people’s lives. On the other hand, it also provides a more criminals. In the future, if we want to promotion the intelligent clothing, designer should thoughtful and be better to improve the safety.

3.2.4 Difficult Points to Promote in The Market. Consumers in the market have different levels of consumption level and consumption view. Many consumers are sitting on the fence about new smart products. This makes it difficult to promote many new smart products. On the one hand, smart clothing is more expensive than ordinary clothing. It is also in the experimental phase of its use. This makes most consumers give up buying for these reasons. On the other hand, due to the imperfection of technology, many intelligent products boring poor user experience to consumers. These are the inevitable problems in the process of smart clothing promotion.

4 Conclusion
Today, intelligent has become a trend in the development of the era. The development of science and technology, the development and application of new technology materials provide guarantee for the future development of smart clothing. Through the constant progress and development of science and technology, we can predict the future is the development of textile and clothing industry has a broad prospect. Smart clothing will become an important indicator of garment industry. And the development of artificial intelligence can also make smart clothing have more limitless possibilities. From the
Development prospects of artificial intelligence in the clothing design. The rapid development of science and technology, the transformation of clothing industry is inevitable, combining science and technology development is also necessary. Designers and Watson successful cooperation let us see the clothing design and artificial intelligence cooperation in the future. As long as we have confidence in smart clothing. It will assist in the development of artificial intelligence industry have their new era.

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