Construction of ECG High Technology Architecture and Application Platform based on the Integration of Related Basic Knowledge

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Abstract: Objective To explore how to build a high-tech technology platform for effective discipline strengthening and multidisciplinary intersection, the ECG detection technology and clinical application are illustrated. Methods According to the process of ECG software detection and application, this paper separates the related branches and basic knowledge of ECG technology, and then strengthens these basic knowledge to form an open technical framework for the overall improvement of ECG technology, and then applies this technology to clinical medicine, which also fully absorbs background knowledge in order to build ECG application technology including the algorithmic application and instrument design. Results ECG technology was greatly enhanced and breakthroughs were made in medical applications. Conclusion This method not only enhances the original technology, but also produces interdisciplinary results, which can be used for reference in other fields.

1. Introduction

Initial research and development and major theoretical breakthroughs are a common problem in China, which is reflected in the fact that there are few top-level high-tech talents, that high-end medical equipment and high-end equipment are mostly made in foreign countries, and that semiconductor chip technology is backward [1,2]. The reason is not that there are no professional person who are really diligent in doing things for decades in our country, but that there are still cognitive deviations in the thinking way and method of doing things. These problems can't solved only by hard work, and it is not necessarily effective to often go to academic exchanges frequently and learn from domestic and foreign knowledge. Based on the experience of ECG algorithmic application and instrument design from us and other colleagues, this paper considers the construction of a high-tech framework based on the integration of related basic knowledge, and effectively applies it to the medical background industry [3-5].

2. ECG Detection Algorithms

Taking ECG detection algorithm as an example, the aim of this algorithm is to detect the characteristic waveforms of ECG, such as QRS wave group (representing depolarization of ventricles or contraction of left and right ventricles). According to the common method, the first way is export the digitized data of ECG, then program using the C language or other programming languages, at last we can detect the high peak QRS wave group through a threshold. The waveforms of ECG are shown in Fig. 1.

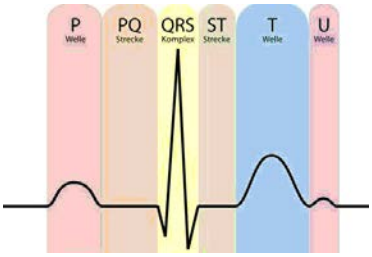

Figure 1 Composition of ECG

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However, the accuracy of QRS detection based on the above intuitive method is not high. Because the ECG waveform may be disturbed by EMG, motion, noise and the baseline drift, leading to some QRS waves far higher or lower than the baseline. It may not be judged on the threshold, or even be covered by noise. In addition, the threshold changes by the changes of QRS complex according to some arrhythmias such as ventricular premature beats occur. Therefore, it is needed to consider improving the detection algorithm, so we need to add many programming methods and strategies. The core element embodied in these methods and strategies is the basic knowledge of association. For example, the knowledge of digital signal processing is needed to eliminate P wave and T wave of different frequencies considering filtering the original waveform. Digital signal processing also needs a certain engineering mathematical basis, and mathematical knowledge plays an important role in threshold analysis, and measurement in wave shapes. In order to observe the filtering effect and detection effect, graphic programming technology is needed. Therefore, in the aspect of ECG detection algorithm, the five kinds of basic knowledge are needed: digitized data extraction technology, programming knowledge, digital signal processing knowledge and mathematical knowledge, drawing technology. Otherwise the fundamental knowledge of clinical ECG is needed in the process of the ECG detect algorithms**.**

In order to apply ECG detecting technology to, the relevant medical background knowledge is needed. There are also much background knowledge, such as cardiovascular disease knowledge including heart, physiology, neurobiology, electrocardiogram, arrhythmia and many other aspects. It is also needed to learn how to deal with doctors and hospitals, which also requires technical workers to have certain medical knowledge in the clinical application. Seen in Fig. 2 is an illustration of ECG detection algorithm and its application to clinical background. Then the accuracy of ECG detection algorithm is greatly improved, and it can also be used to ECG clinic easily by using these methods. In addition, it greatly accelerates the independent design and medical applications of monitoring equipment, with more precision and extendibility in the ECG field. Thus, engineering and medicine achieve a clever combination.

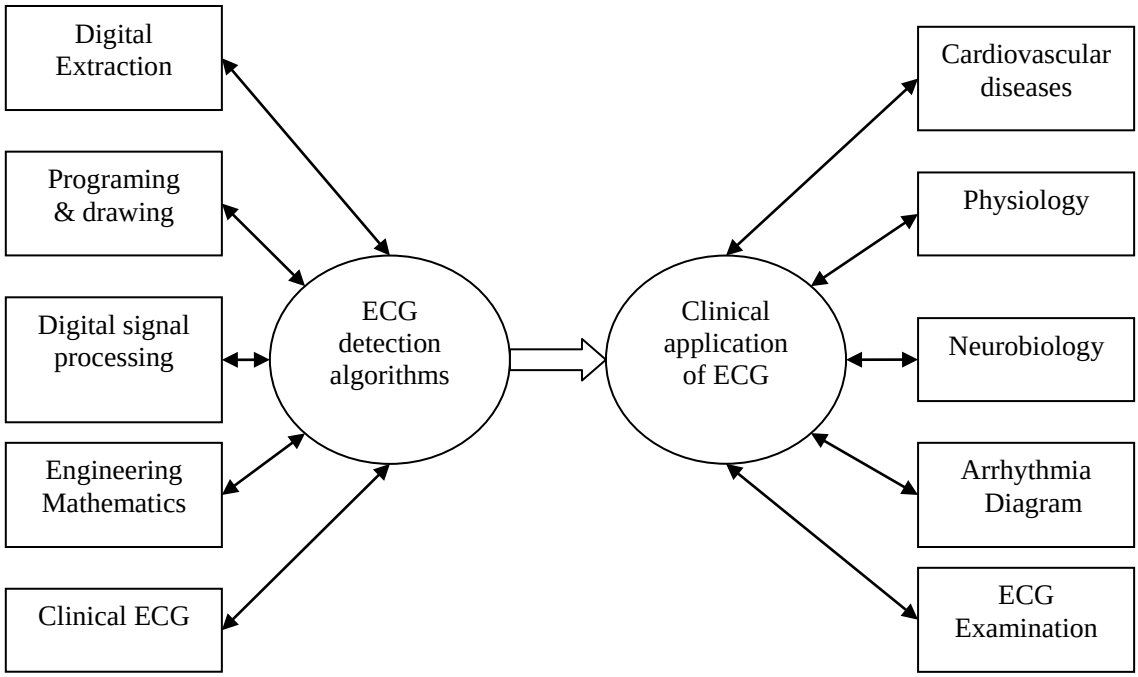

Figure 2 ECG detection algorithm and its application to ECG clinic

3. Requirement of the forming technology architecture

The existing new high-tech, in fact, consists of many old knowledge and old technology effective integration. To build a new, it is needed to understand how to decompose the foundation and to explore the details. This requires technical workers to have a certain degree of academic literacy, as

shown below.

1) Be good at discerning branch knowledge. Many high and new technologies are effectively combined by a variety of technologies. To decompose the technology into various professional aspects or books requires keen observation.

2) Learning ability. The branch basic knowledge of a technical architecture, including the branch knowledge of the application field, is sometimes not learned and mastered by researchers, but needs to be learned from a new perspective. Learning new knowledge is more time-consuming and energy-consuming. To master the proficiency, it is more necessary to repeat the training. However, it is enough to learn first or master a little and then even hire professionals in the process of new architecture building.

3) Strong integration ability. After learning the branch knowledge, it can be effectively merged together. The the blind spots and difficulties will be solved one by one using the basic knowledge and the way referenced. Finally, a reliable technical architecture or platform is formed, and the overall ability of the algorithm has been improved. In the process of forming this algorithm, interface aside for each branch technology could be introduced, so as to help later generations to improve the tech, thus becoming an opening technology architecture. If the basic knowledge of ECG clinical field is added, it will form a high-tech platform which can be applied to clinic.

In the practical application process, scholars should turn to the second technology after the success of the first technology in order to form the advantages of interdisciplinary. As shown in Fig. 3.

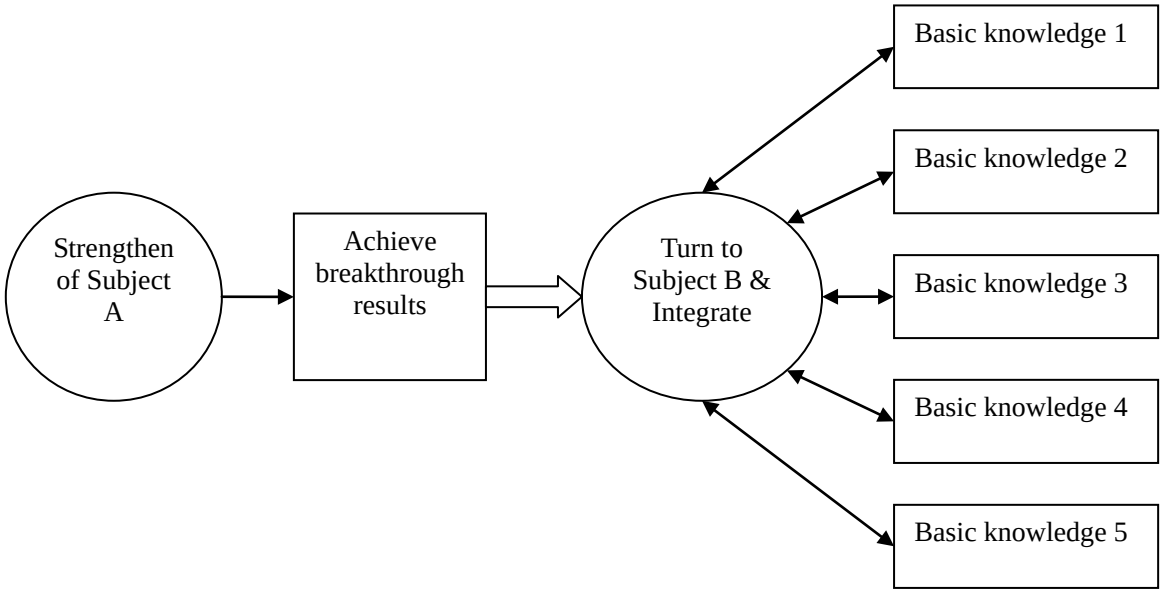

Figure 3 schematic diagram of interdisciplinary integration with other disciplines after breakthroughs

4. Advantages of this approach

1) The ability of technological innovation has been greatly improved. If a technical worker understood some industry background knowledge and focused on grasping and training many branches of knowledge and technology, he will hopefully become an expert in the technical field.

2) The ability to transform to other fields and new discipline been enhanced. Some domestic medical devices focus on the detection of physiological signals, such as X-ray machines and ultrasound equipment. These devices provide more attention on physical detection of physiological signals than analysis of clinical diseases. If the basic clinical knowledge and the doctor's ideas can be added, the disease analysis of artificial intelligence can be better carried out, and the efficiency of disease detection can be improved. There are advantages in the transformation of AI industry, as shown in Fig. 3.

3) Open platform to produce interdisciplinary results. It is beneficial for later generations to

develop and improve on this platform purposefully and directionally, so as to effectively form technology accumulation for decades or generations. If technicians make closed technology in order to keep it secret, the way for future generations to upgrade this technology can only be delayed and fail, which increases a lot of unnecessary time and manpower costs.

5. Results and discussion

The improvement of ECG signal detection technology, including its clinical application, is rooted in the enhancement and improvement of related basic knowledge, besides the individual communication skill and thinking organization ability of technical workers. If the basic knowledge of these branches is well done, the technology can be upgraded, just like "the foundation is well laid, the house is more stable"; if the corresponding background knowledge is well done, the application will achieve greater results. In this way, new interdisciplinary and achievements have been formed. Meanwhile, the branch subjects are not necessarily five, or they would be more. Of course, this is easier said than done.

On the other hand, some employees who look promising in a company or unit are well-knowledgeable. They may not have noticed that subconsciously applying this knowledge to work improves the innovation of technology and products. Some scientists have good knowledge of mathematics. When they study physics or image processing, they find that they can produce many high-level papers. Many times he did not know how it was caused and was called a genius. In fact, a solid knowledge of mathematics, combined with the technology in the field of algorithm or application, can make breakthroughs and innovations at a certain point or in a certain area, and ultimately reflect the improvement of accuracy and the reduction of bugs.

In other non-programmable areas, this idea of decomposition to associated knowledge is still valid. For example, in addition to motor design, more and more people also realize the degree of steel smelting, the reliability of various accessories is the more important factor [5]. If these branch technologies are to be done well, the reliability of the motor will be improved. One hundred years ago, modern physics, chemical technology and advanced equipment were applied in the field of life and then developed the life sciences. Now, the shadows of branch classes could be seen by decomposing the research in many biological fields.

It is worth mentioning the protection of intellectual property rights. It takes a long time to play the platform, and the use of basic knowledge and technology, initially seems to have little technical content. In early time it can not show dazzling results, with slow promotion and passive projects because of the process of knowledge accumulation is long. As a result, those who build basic technology architecture and application platform should need have their own status and influence, and know how to avoid all kinds of patented risks. It is ridiculous that the result attribute to those who only do only one job without who do four or five aspects.

As far as domestic and international situation is concerned in china, it is an extremely efficient way to enhance technological capability by actively analyzing the related basic knowledge to learn. That will lead to great theoretical breakthroughs and advanced equipment manufacturing. Otherwise, this work need strong knowledge carrying capacity, excellent psychological quality, ingenious ideas to solve problems, and good communication skills, which are not discussed in this paper.

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