



the most significant national development strategies. Taking advantage of the above favorable policies, Chinese high-tech industries are devoting to develop AI-related technology and build the AI ecosystem. Telecom operators are no exception. For instance, in 2016, China Telecom proposed the transformation 3.0 strategy in 2016 to be the leading integrated intelligent information service provider. Through the way to AI, they will positively respond to the national development planning in the field of AI, closely keep pace with the emerging forward-looking technology, both domestically and abroad, and dedicated to providing the AI infrastructure. Furthermore, telecom operators are also seeking the entry point for cooperation in the way of the intelligent network, smart operation and business ecology, and to cooperate with the potential industry, push forward the research on AI core technology and promote the development of relevant intelligence applications.

## 2. THE UNIQUE ADVANTAGES FOR OPERATORS TO DEVELOP AI

In the tide of AI research and development, the operators are also searching for ways to transform themselves from “traditional operator” to “intelligent operator”.

Most of the well-known operators of the world are carrying out AI-related work: 1) France Telecom Orange and Deutsche Telekom AG recently announced that the voice assistant platform Djingo which was based on AI, is being developed. It was expected to compete with the existing voice platforms such as Apple’s Siri and Amazon’s Alexa in the market. 2) Vodafone, the giant European operator also stated that it will launch a customer service robot called "TOBi" to help handle customer service issues and enhance the user experience. 3) Japanese telecom operator NTT has also launched its AI platform. Its main research interests include assistant – AI, echocardiography – AI, environmental AI and network AI.

From the telecom operators’ point of view, there are four key advantages to develop AI: big data resource, superior computing power, lots of investment in AI algorithmic research and a broad customer base. 1) In terms of a big data resource take China Telecom as an example, which has 816,000 mobile base stations and 425 data centers all over China. The mobile subscriber scale has reached 212 million and the broadband subscriber scale has reached 142 million. China Telecom possesses the world's largest data infrastructure and greatest number of subscribers.

Characterized by the wide coverage, numerous varieties, large volume and high quality, their data resources will create remarkable value through data mining and analysis. 2) To enhance computing power we have established an advanced infrastructure platform of big data, including the big data management platform, big data applications and operating platform, big data capability platform and enterprise-level big data acquisition system. So far, we have mastered the super-large-scale data processing and analysis capabilities. 3) In the algorithms research area, by combining open source technology and independent research and development ability, telecom operators’ AI teams focus on the direction of natural language processing and has achieved some technical breakthroughs in terms of information extraction, domain knowledge base establishment, information recommendation and filtering and so on. 4) In order to satisfy the internal requirements of operators and meet the needs of customers, by taking full advantage of the above strengths, telecom operators are trying to merge AI technology with innovative technologies such as cloud computing, big data, blockchain and Internet of things, to satisfy the internal and external demands of enterprises. Undoubtedly, this move will shape the characteristic intelligent technology architecture and support intelligent strategies.

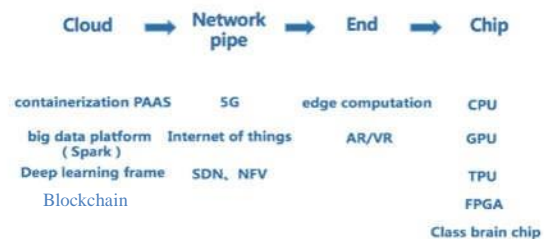


Fig. 1. The road map of AI development of China Telecom

## 3. TELECOM OPERATORS' PRACTICES IN THE FIELD OF ARTIFICIAL INTELLIGENCE

Based on these unique strengths, telecom operators have implemented a series of effective practices to satisfy the internal and external demands of enterprises. For example, in order to save energy in our internal data centers, by referring to the related algorithms published by Google Corporation, an algorithm based on deep learning has been proposed, which has got great results in energy saving during the tests in the data centers of telecom operator [4]. To help improve public security, by making full use of the “big data resource” advantage, and with a series of





Fig.3. CTBRI data center power saving design based on AI

CTBRI has conducted some tests in the lab and obtained some good results. The lab resource pool consists of 16 physical machines, divided into 120 VMs. During the two months' test period, the total amount of power saving is up to 698 KWh, meaning 11.44 KWh every day. A total of 837 Yuan is saved. A practical test is conducted in Inner Mongolia Autonomous Region by China Telecom Tianyi Cloud Company. The Resource pool consisted of 340 physical machines and was divided into 3250 VMs. Results show that about 528 Yuan was saved for each physical machine, indicating an average power saving rate of about 34%. AI-based energy saving products in data centers could not only lower production cost greatly, but also reduce energy consumption effectively.

### 3.2. AI-based public security management platform

Government customers are one of the major customer groups for telecom operators. The world's mainstream operators are all trying their best to help government make city management easier and more efficient. At present, the city administrators in China are confronting the increasingly complicated public security management problem. One of the facts is that the rapid development of urbanization has been constantly impacting the urban "steady structure" shaped in the planned economy period, and the urban management is facing increasing challenges with the growing population, especially in metropolises. In this context, the contradiction between the lower-level police deployment and the persistently ascending new cases has posed great challenges for the investigation and interrogation of cases; the conventional way cannot meet the needs of public security. Therefore, it is urgent to apply the intelligent means in investigating and comparing from multiple dimensions, such as suspect's funds, action track and associated figures, which helps to improve the efficiency of interrogating information, find out the

crime clues and the total pieces of crime evidence and greatly reduce the investment of investigator resources. In this way, the prosecutors can focus more on determining the nature of the case, the directions and the means of investigation, so as to strengthen the detection efficiency.

The "intelligent police" as the AI relation insight system is researched and developed to work for public security, urban comprehensive management and other industries. The industry customer can apply "intelligent police" to establish a public safety management solution for intelligent cities.

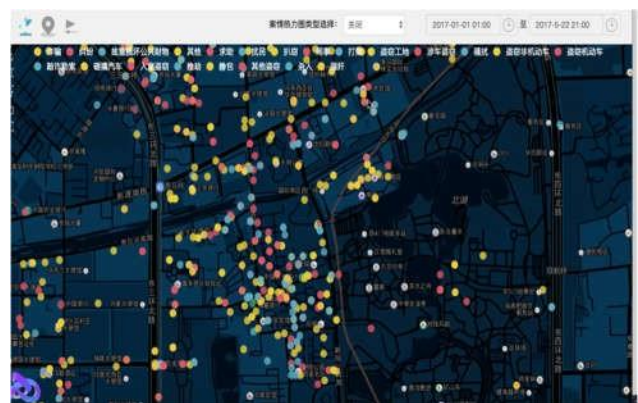


Fig.4. The interface of the "intelligent police"

Based on AI, cloud services, big data and the Internet of things technologies, this program accesses public security data and telecom data to help the urban administrators quickly transform various complicated unstructured data into knowledge mapping. After demonstrating, in the form of data visualization, the intelligence association based on the location information is completed and the comprehensive reports for processing tasks are presented, so as to supervise the multidimensional public opinion of the target object and events. An "intelligent police" AI relation insight system works to provide the varied customized features which center on three modules of case, map and association, including case analysis, clue extraction, case relation display, crime early warning, case thermodynamic diagram, suspect tracking, external population detection and urban road flow analysis. It has vastly enhanced the intelligence of public security management.

During the process of adopting AIT in the realized function of crime prediction, we have conducted a variety of effective algorithm exploration and research. (1) After the preliminary data analysis and technical investigation, random forest algorithm is selected to predict the type of crime, and months, days, periods, latitude and longitude are perceived as the features to



90% and above. At the same time, the medical image cloud diagnostic center, image data center and image computing center have been constructed to realize remote image diagnoses, remote ECG diagnoses and remote test diagnoses effectively. Also, disease information database have been established. When the patient inputs his own disease information, the steps of extracting, normalizing, judging, and modeling the characteristic words could be immediately completed in turn, which could realize the AI guide. Additionally, by using the intelligent Q & A system (AIJust), common questions, such as how to register, how to pay, how the department is distributed and so on, could be answered intelligently.

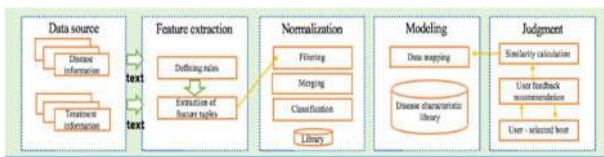


Fig.6. The technical framework of the AI guide

Take chronic disease management for example. AI could be used to predict the trend of the morbidity for one particular disease, by going through the following two stages:

- 1) Construct a comprehensive disease control index model. By accessing the data provided by a residents' health database, this index model was built upon comprehensive consideration of various factors such as disease morbidity, climax, humidity and so on.
- 2) Construct an artificial neural network model. The existing residents' health data can be used to get the artificial neural network model, while the patients' data could be utilized as a test set to determine the model accuracy.

For AI research in medical fields we believe that the technology of intelligent identification and diagnosis has been relatively mature, while data "quantity" and "quality" is the key to success.

At the application level, a "cloud + big data + AI" big data solution has been framed by China Telecom, which also effectively promotes the development of optical fiber broadband, cloud computing and cloud network integration. The operators' practice in the medical field mainly focuses on six application scenarios, that is chronic disease management, AI diagnosis, big data on meteorological medicine, prevention and control of infectious diseases, decision-making of drug use, and big data prediction. Among them, AI diagnosis works based on logical inference, of which the subjectivity is stronger, and

neural network framework based on intelligent inference. Refer to the data from China Telecom, Logical inference could affirm the type of disease by correlating the 5000 diseases and 6000 symptoms in the structural database, while the F1 (assessment values of comprehensive accuracy and recall rate) of intelligent inference could be up to 0.5876. In the field of chronic disease management, operators have also achieved fruitful results. By classifying slow disease users according to their geographical distribution and presenting the distribution condition on the map, we can provide a city health department's visual disease distribution information and help them control chronic disease in some way. The product of preventing and controlling chronic disease has been recognized by the National CDC and put into use. This product will not only transform the existing medical image cloud and other resource-based business to the application-oriented business, but also increase the business input-output ratio.

#### 4. SUMMARY AND PROSPECT

As the advancements of deep learning and other technologies, AI is now in the stage of being used in specific industries to increase efficiency and reduce costs. AI has been successfully applied to automatic pilots, medical treatments and health, finance, retail, entertainment, AR, VR and many other fields with unprecedented importance. Some experts say that AI may become the new productivity and even one of the key drivers of the fourth industrial revolution. For telecom operators, the opportunities and challenges coexist behind AI development. On the one hand, the largest big data infrastructure and the massive data resources greatly facilitate telecom operator's AI development. Rich data resources can greatly help to study AI algorithms and train models. On the other hand, there are still many obstacles to overcome, such as the gap between operators and Internet enterprises in the aspect of algorithm design and market promotion. In the future, telecom operators will make greater use of the traditional advantages, seek more distinctive areas for AI development and cooperate with other enterprises to create a development ecosystem and promote industrial change more efficiently.

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