Research Statement

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Overview

I have a 15-year experience on the research of the theory and application of Intelligent Information Processing, including Intelligent Information Systems, Natural Language Processing, Artificial Intelligence, Data Mining, and Machine Learning. Nearly 30 papers have been published with novel algorithms and approaches in these fields on a variety of academic journals and international conferences. Moreover, as a principal investigator or co-investigator, I have participated in many relevant projects, which were granted by Chinese government or industries, and more than 10 million RMB have been granted to me and my team.

This research statement is not only a summary of my previous research but also an introduction to my current and future research. My research interests and motivations will be also introduced in this article. I hope more academic or industrial cooperation activities can be carried out in the future.

Research Motivation

I have a very strong self motivation in the research of Intelligent Information Processing, which is widely used in many domains at present, such as the Internet, robot system, and intelligent control. I am delighted to innovate novel computational intelligent approaches and apply them in different aspects of industries and human lives. Moreover, because of the upcoming aging society, I believe that we will have great demands in smart systems and robots in the future, thus it is inevitable that more intelligent machines or systems will be employed by our human beings in the future. Therefore, the Intelligent Information Processing will be more and more important.

In my opinion, the ultimate goal of Intelligent Information Processing is to build a machine

with mind and let it pass the Turing Test. I was quite interested in the human mind when I was a very young boy. Human mind is very mysterious as the same as the size of universe, the origin of life and the principle of material. However, different from the other three mysteries whose theories have already been developed in the last several centuries, human mind has little progress in theory. People know little about mind. Hence this will become a barrier for us to develop intelligent machines and robots. To against such a barrier, it is necessary for us to find a window of human mind, so that human mind can be researched via this window.

I believe that languages are the windows to human mind. What we do is always based on what we think, and when we think, we use our languages. Hence if we want to build an intelligent system with mind, we must let it understand some languages. However, it is manifest that we still have a very long way to go based on our current technologies, if we want to build a machine with mind. What we can do at present is to build some smart systems, which can response our demands, support our decisions and provide us services automatically. Therefore, apart from my long-term research interest in machine mind, my short-term research interest is in simulative Intelligent Information Processing. Accordingly, my current research motivation is to apply computational intelligence in information processing, and let smart machines can help us in information acquisition, knowledge discovery and decision making.

Current Research Interests

The following aspects are my current research interests:

1. **Feature Analysis in Machine Learning Preprocessing for Pattern Recognition**
   Feature Analysis is very significant to Quantitative Analysis like Pattern Recognition which is an important domain of Intelligent Information Processing. It consists of pattern classification and regression, which are crucial to decision support. Machine Learning and Statistical methods are often used in Pattern Recognition. However, before these methods are employed, data should be sorted by their features, which are also known as the attributes in the data sets. Features are very useful in computation. A proper feature definition often brings better final results in Pattern Recognition. My research on Feature Analysis focuses on the Feature Selection, Feature Extraction, Feature Ordering, Feature Grouping and some integrated methods of these basic feature analysis approaches. Especially, the former two are widely used in almost all high-dimensional Pattern Recognition preprocessing, while the latter two are often employed in Feature-based Incremental Learning, which was often called as Incremental Attribute Learning in my previous studies.

   In my previous studies of this aspect, I have been granted by China Postdoctoral Science Foundation as a principal investigator, granted by China National Natural Science Foundation and Jiangsu Provincial Technology and Science Foundation as a

co-investigator. 7 journal papers have been published and 12 international conference papers have been presented. Moreover, a Chinese patent has been applied.

2. **Natural Language Processing for Multilingual Big Data, and Machine Translation**

   Natural Language Processing can transfer qualitative data to quantitative data, so that many uncountable things can be computed and predicted objectively. At present, the technologies of Natural Language Processing are rapidly developed by scholars all over the world, but there is still an obstacle existing in this field, which is Machine Translation. So far most of the results of Machine Translation still cannot be accepted by lots of people. As a results of that, information in different languages cannot be automatically fused together. Nowadays, there is a great deal of information written in dozens of languages on the Internet. Multilingual knowledge and information sharing by cross-language Information Retrieval depend on the developments of Machine Translation technologies.

   In the field of Natural Language Processing, I have participated in two projects on knowledge system construction, and two China provincial scientific grants. Besides that, I have published 6 journal papers in Chinese, and one conference paper in English.

3. **Search Engine and Information Retrieval for Social Media and Online Journalism**

   Social Media and Online Journalism are important information source for investment and decision making. At present, users often get information by key words on search engines like Google. However, this is not a user-friendly way. Users must click the hyperlinks, otherwise they will not know whether the content of this hyperlink is useful or not. Thus this information retrieval way is inefficient and the results maybe not the exact one the user needs. Automatic Question-Answering System is regarded as a next generation search engine. Information Retrieval for Social Media and Online Journalism will be integrated into the Automatic Question-Answering System, which can be also treated as an assistant for investment and decision making.

   As a co-investigator, two China provincial scientific grants supported my previous research in this field, and one Chinese journal paper has been published.

4. **Smart Health Platform for Home-based Aging and Disabled Nursing**

   Health is a very hot spot focused by a great number of researchers all over the world. My Smart Health Platform was designed for home-based aging and disabled people. By the end of the year 2016, there will be more than 250 million aging people and 80 million disabled people in China. Therefore, the market of health industry is very large. In the meanwhile, the healthcare of these people is also very important. Smart Health Platform is quite desired.

   My smart health platform consists of two parts: Health Big Data Platform and Smart

Wheelchairs based on Intelligent Control Mechanisms. The former is an information system for health data storing and analysis, including web system, iOS and Android APP; the latter one is a client carrier with a tablet, where the Health Big Data Platform can be visited via this tablet by the elder or the disabled people themselves. Furthermore, a new Intelligent Control Mechanism for wheelchair control has been invented by hand gesture. Apart from the platform and the wheelchair, one Chinese journal paper has been published and one Chinese patent has been applied in this field. Moreover, our Man-machine Interactive Smart Wheelchairs and Internet-based Health Big Data Platform won the competition of "Startup In Shanghai, 2016" held by Shanghai Technology Innovation Center with a fund 200, 000 RMB.

Previous Research

A. Intelligent Systems

1. **Junk Email Filtering Model Based on Natural Language Processing**
   System Analyzer and Programmer, 2006.10--2008.12, RMB12,000
   This project was granted by the Education Department of Guangxi Province Government. As a MSc student at the Guilin University of Technology, I wrote the proposal with the guidance of my MSc supervisor, Prof. Fanjin Mai, and successfully applied the project. In the project, I took charge of system analysis, algorithm design, coding, and testing.

   This project aimed to design a model for junk email filtering based on Chinese Natural Language Processing technologies. The structure is shown in Figure 1. Before the junk email filtering model was built, we firstly constructed some semantic resources, including junk email corpus, Chinese word dictionaries, and semantic networks called Graphite-like Semantic Framework. After that, to classify whether an email was a junk email or not, data clean was firstly employed. In the second step, for the emails written in Chinese, we used Chinese word segmentation algorithms to segment words based on dictionaries and the Graphite-like Semantic Framework. The Graphite-like Semantic Framework is a two-layer semantic network, which divides positive and negative words into different layers. The numbers of positive and negative words were calculated and treated as a feature in junk email classifier. Lastly, a Classifier based on Naive Bayes was build for junk email classification based on a labeled junk email corpus, which has more than 6000 different emails. In the experiments, more than 4000 emails were employed in testing. Experimental results showed more than 98% junk emails can be successfully recognized.

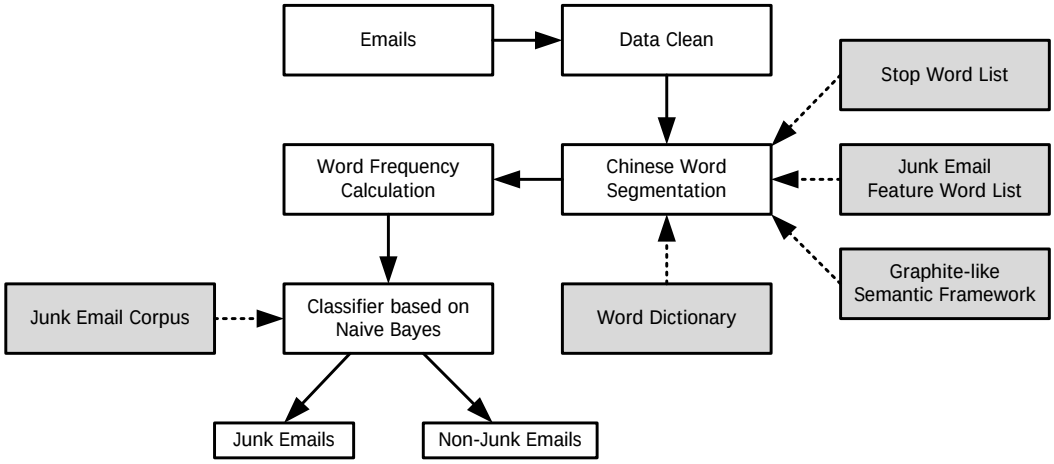


Figure 1. The System Structure of Email Filtering Model

2. Search Engine based on Natural Language Processing

System Analyzer and Programmer, 2009.01-- 2011.12, RMB80,000

This project was granted by Nature and Science Fund, Guangxi Province Government. In this project, I wrote the proposal with the guidance of my MSc supervisor, and successfully applied the project. In the project, I took charge of system analysis, algorithm design, coding, and testing.

In this project, a small search engine was built based on Natural Language Processing Technologies. At the beginning of the 21st century, many search engines were built based on the key words. This kind of search engine can only show the results which contained the key words precisely. If there are some similar or correlated results, the search engine will miss the results. We developed a search engine based on the Graphite-like Semantic Framework, which can bring the correlative results to the users by the computing of the sentiment, similarity and relevancy of words. Experimental results showed that the precision ratio of this search engine is 86.1%. The structure of this search engine is shown in Figure 2.

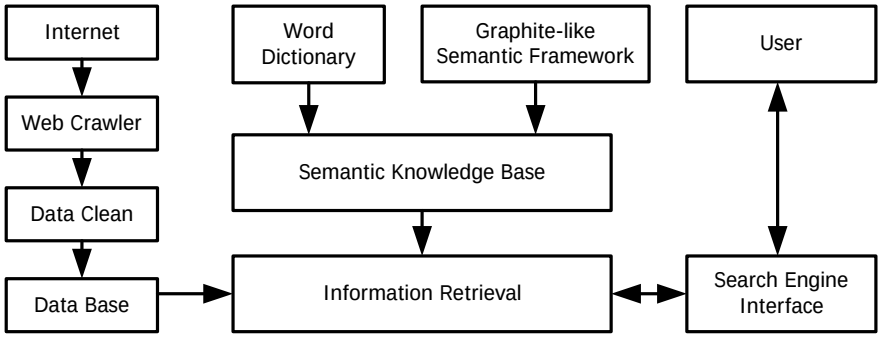


Figure 2. The Structure of Search Engine

3. XJTLU Platform for Mathematics and Financial Computing

Financial Data Analysis and Software Development, 2009.10-- 2012.09, RMB 25,0000

This project was implemented in Xi'an Jiaotong-Liverpool University, and was granted by China-Singapore Suzhou Industrial Park. In this project, my job was financial data analysis using Matlab and software developing.

In the aspect of software development, a financial search engine was developed. Results of this search engine consist of a financial wiki, corresponding news and articles for the students. URLs of Wikipedia, some blogs, and some websites were put into the list of web crawlers, then a financial wiki was built based on Reuters Financial Dictionary and Wikipedia. Search engine updates information from these web links every several days. Figures 3-5 show the interfaces of the search engine.

Figure 3. The Main Interface of the Search Engine

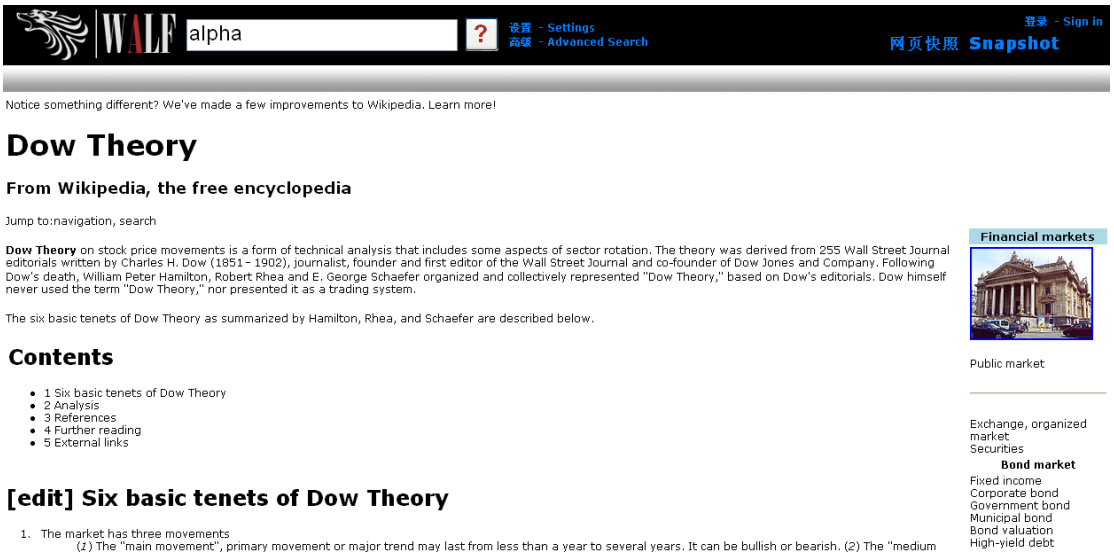


Figure 4. The Contents of the Search Results

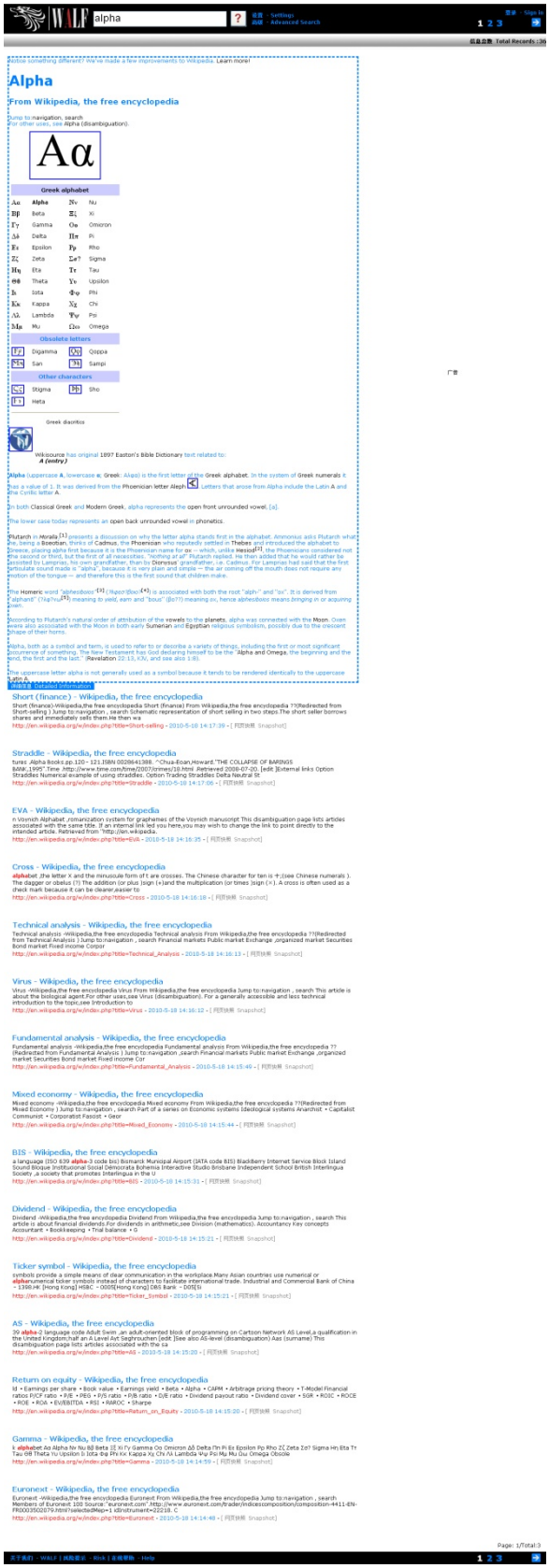


Figure 5. The Search Result List

The web crawler is named "Seeker". Figures 6 and 7 illustrate the interfaces of the web

crawlers. Moreover, it has five different functions: (1) The Spider imports the URLs, and searches them according to depth-first search or breadth-first search. (2) The Explorer is developed as an web navigator, but it can extract web links, HTML tags, contents, and graphic links from web pages. (3) The Preprocessing module is designed for data clean and knowledge base construction. (4) NLP module aims to calculate the relationships between words, and print out the word semantic cloud by the knowledge base. (5) The Classifier module is designed for text classification.

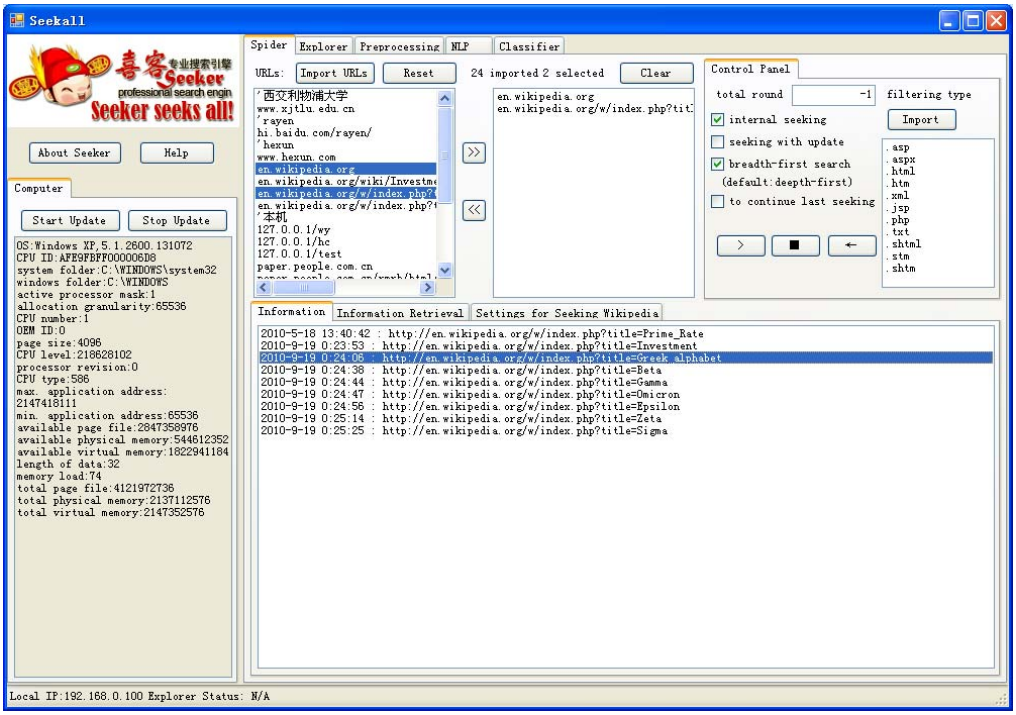


Figure 6. The Spider of Seeker Search Engine

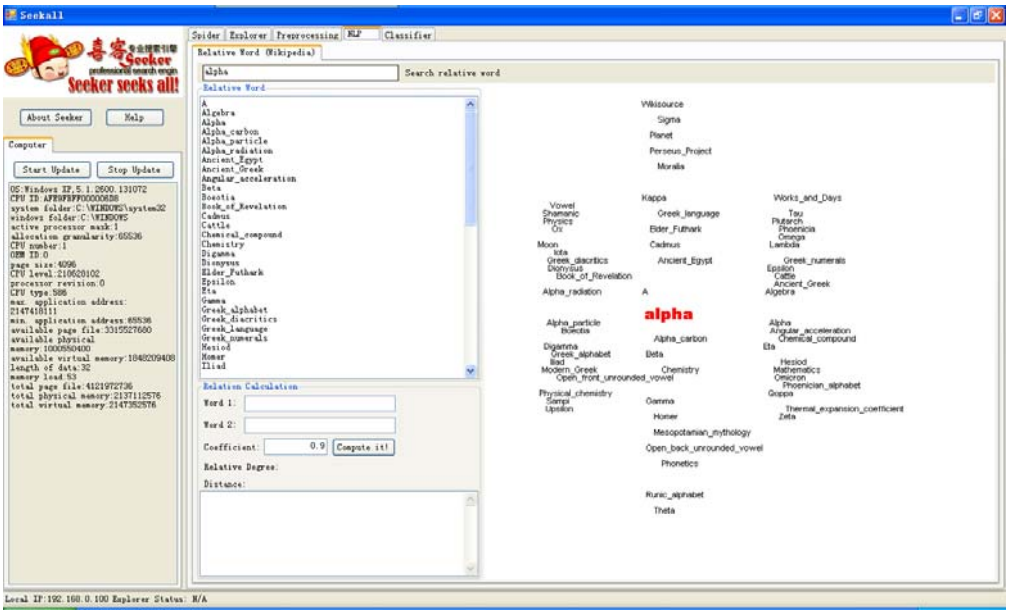


Figure 7. The Interface of NLP Module

In the aspect of financial data analysis, the influence of news reports to the real estate and stock markets has been studied. News, reports and articles were downloaded and stored into the database by search engine, then persona of these reports and articles were drawn by the number of keywords. Positive or negative sentiments were shown in different colors. The more frequency of the keywords, the bigger size of the keywords. Therefore, an overall view of the trend of real estate and stock markets can be given to the users.

4. The Construction of Medicine and Health Knowledge Service System

Principal Investigator, 2014.12--2015.06, RMB400,000

This project aimed to construct medicine and health knowledge bases for the Institute of Medical Information, Chinese Academy of Medical Sciences (also known as Peking Union Medical College). These knowledge bases are now being used in the library of the College.

The knowledge bases consist of two parts. One is a wiki for medicine and health, which includes the information of hospitals, doctors, papers and prescription. The other is an opinion monitoring system of medicine and health. Figure 8 shows a rapid change of the number of the short messages in 10 different topics on Sina Weibo around February 28, 2015, when a very famous documentary film called "Under the Dome", made by Jing Chai, a very famous journalist in China, was released on the Internet. Figure 9 shows the numbers of people in different provinces focused on the topic of environment pollution on March 1, 2015, just after the documentary film was released.

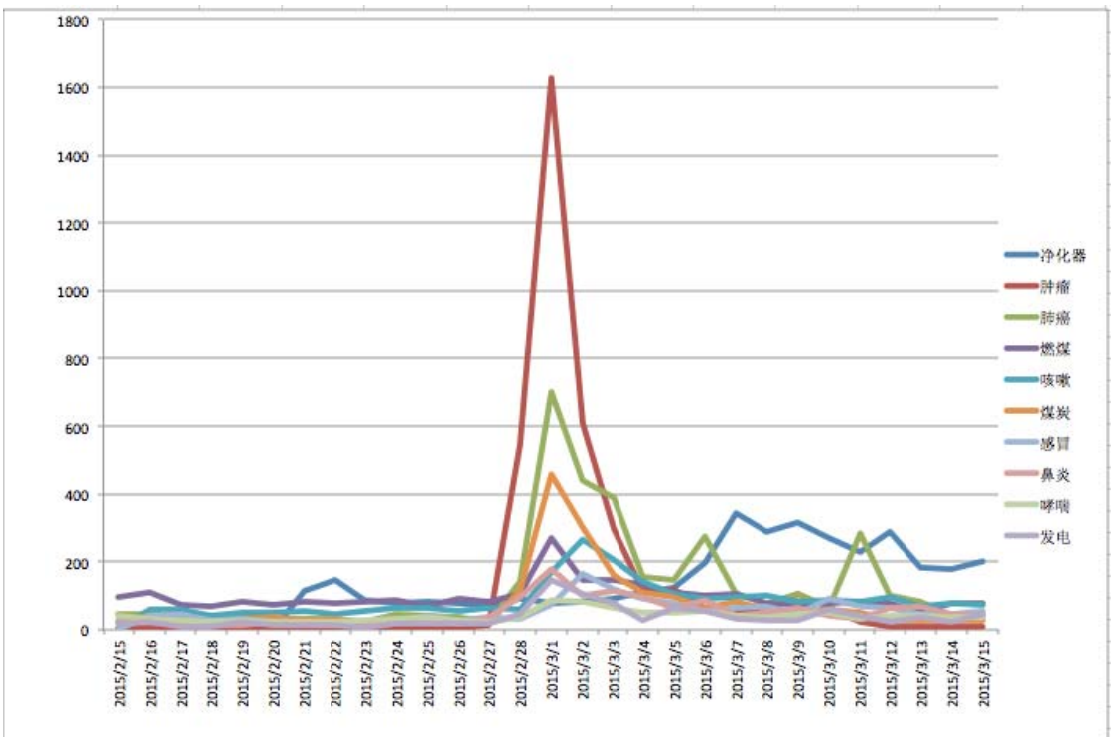


Figure 8. A Rapid Change of Weibo

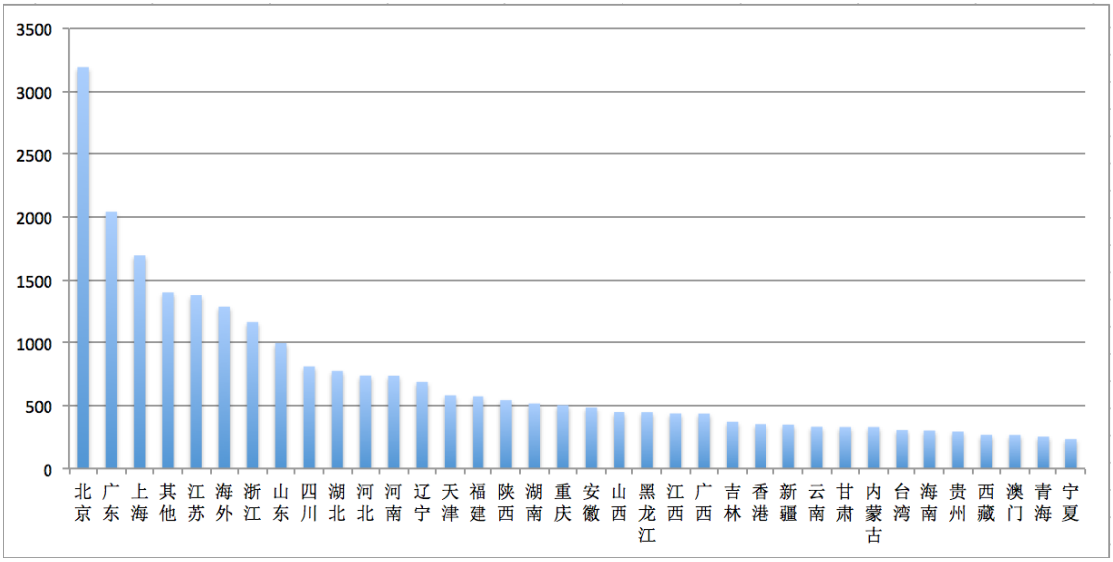


Figure 9. The Numbers of Environment-concerned People in Different Provinces

5. Knowledge Base System Testing and Corpus Construction

Principal Investigator and Coordinator , 2016.03--2016.09, RMB 128,200

This study belonged to Foundation Theory Research on Social Perception Data Processing, which is a sub-project of National Basic Research Program of China (973 Program). This project was granted by the State Key Laboratory of Intelligent Technology and Systems, Tsinghua University, Beijing, China, and was implemented at the Research Center of Web Information and Social Management, Wuxi Research Institute of Applied Technologies, Tsinghua University, Wuxi, Jiangsu Province, China.

The knowledge base system was made by researchers in Beijing, and engineers in Wuxi research center took charge of the testing procedure. Moreover, more than 200,000 dialog sentences were collected for corpus construction, and Wuxi researchers annotated comments to each sentence according to the regulations made by researchers from Beijing. Further, APIs of the corpus was also made by researchers in Wuxi.

6. Expert System for Radar Signal Analysis

Principal Investigator, 2015.06-- 2016.07, RMB 700,000

This project was granted by Tsinghua University, Beijing China, and was implemented at the Research Center of Web Information and Social Management, Wuxi Research Institute of Applied Technologies, Tsinghua University, Wuxi, Jiangsu Province, China. It was a confidential military project for radar signal analysis. This project aimed to provide a smart platform for the soldiers when they come across some strange radar signals in the frontiers. It consisted of three different modules: Radar Signal Wiki, Question- Answering Component, and Expert System for radar signal types recognition according to some professional flows. I was the Principal Investigator of this project and took charge of the whole software development task.

B. Machine Learning

1. Theory, Algorithm and Application of Incremental Attribute Learning

Co-Principal Investigator, 2011.01-- 2013.12, RMB 435,000

This project was granted by National Natural Science Foundation, China Government (RMB290,000) and Suzhou Industrial Park (RMB145,000). It was finished at the Xi'an Jiaotong-Liverpool University. As a PhD student, I wrote the application proposal with the guidance of my supervisor, Prof. Steven Sheng-Uei Guan, and became the co-principal investigator after the project was granted.

This project is about Incremental Attribute Learning, which is a novel machine learning strategy, where features are gradually imported into the predictive system in one or more size. Such a process is quite different from the conventional supervised machine learning process, where features are introduced into the system in one batch. Previous research demonstrated that Incremental Attribute Learning can exhibit better performance in final classification results than conventional batch-training machine learning approaches. One of the most important reasons of that is the feature training process of Incremental Attribute Learning divides features one by one, or group by group. Such a process can effectively isolate the interference among features. Therefore, being different from conventional batch-training machine learning approaches which only have feature selection and feature extraction preprocessing methods, Incremental Attribute Learning has two more and unique feature preprocessing methods, which are feature ordering and feature grouping.

Incremental Attribute Learning is an algorithm-free machine learning strategy. It has been successfully carried out by Neural Networks, Genetic Algorithms, Decision Tree, SVM and PSO by researchers all over the world. In our study, I employed neural networks which were developed by the research at the National University of Singapore. The structure of Neural Networks for Incremental Attribute Learning, also known as ILIA, is shown in Figure 10.

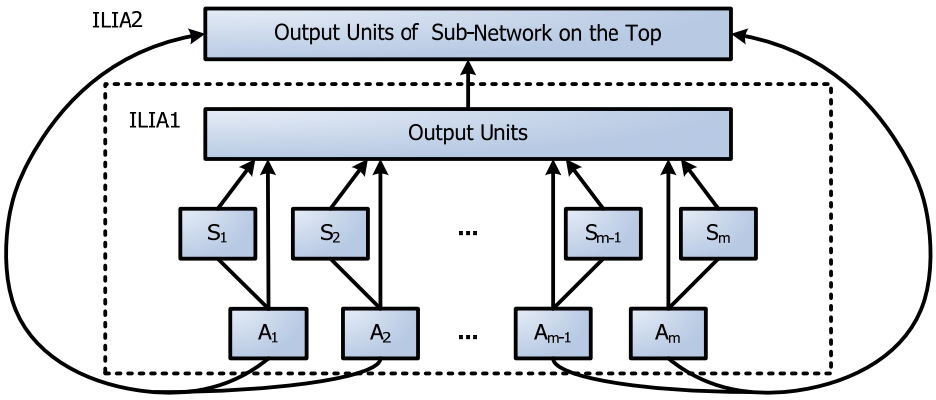


Figure 10. The structure of ILIA Neural Networks

During the project implementation, my research only focused on the feature preprocessing algorithms, including feature selection, feature extraction, feature grouping, feature ordering and some integrative methods.

In the aspect of feature selection, we employed filter and wrapper approaches for Incremental Attribute Learning, and compared the results and efficiency of these two approaches. Experimental results show that filter feature selection is better than wrapper approaches in two aspects: lower error rate and less computing time. Some popular filter feature selection approaches were employed during the experiments of Incremental Attribute Learning, such as feature correlation, mutual information, Fisher Score, and mRMR (minimum-redundancy maximum-relevancy).

In feature extraction, we employed Principal Component Analysis for dimensional reduction of classification problems. This computing is very useful for high-dimensional problems. Moreover, such an approach is not individually employed. It should be used jointly with feature selection.

Feature ordering is unique in feature preprocessing of Incremental Attribute Learning. In conventional machine learning, all the features are trained in one batch, thus there is no feature ordering. However, in Incremental Attribute Learning, features are gradually imported into the system one by one, thus it is necessary to determine which feature should be introduced in the first place, which one can be imported later. Accordingly, feature ordering is very important to Incremental Attribute Learning. Experimental results illustrated that an optimal feature ordering often brings lower error rate in final classification results.

During our study, we found that the feature ordering approaches can be developed based on feature selection approaches. A feature selection approach, no matter it is a filter of a wrapper, if it ranks features, then it can be employed in feature ordering. Similarly, filter approaches are more efficient than wrapper approaches in feature ordering. Features selection methods like correlation, mutual information, Fisher Score, and mRMR were also employed in our experiments and exhibited good performance.

In addition, I found a very significant criterion for Incremental Attribute Learning feature ordering, which is called Maximum Mean Discriminative Criterion. This criterion aimed to obtain the most accurate classification result in IAL. During the process of feature ordering, when a new feature was imported into the predictive system, namely, the feature dimension was increased from d to d+1, the datasets must still be guaranteed to have the greatest discrimination ability in d+1 dimensions. Therefore, the criterion for optimum classification results, as well as the greatest discrimination ability, was to produce an optimum feature ordering which contains the greatest discrimination ability in each round of feature importing. Hence a novel feature ordering approach called Accumulative Discriminability (AD) was developed, and

experimental results showed that feature preprocessing using AD often obtains lower classification error rates.

The study of feature grouping focused on two aspects: the input and the output. For the input side, feature grouping aims to enhance the efficiency of feature ordering. Features have little interference among themselves can be put in one group, and can be imported into the training in one round. Pre-training sometimes is a necessity to this approach. For the output side, feature grouping converses a multivariate classification problem into a univariate problem, thus the classification process becomes much easier, and faster.

Generally speaking, in this project, my studies focused on the feature preprocessing theory of Incremental Attribute Learning. Data sets, such as Diabetes, Cancer, Thyroid, Glass, Musk, Ionosphere, Flare, and Semeion, from UCI machine learning repository are employed as benchmarks. Experimental results showed that, comparing with some state-of-the-art results, feature ordering using AD exhibits better performance. Moreover, some integrations of different feature analysis approaches can obtain better results. Thus this could be treated as a new direction for further studies in the future.

2. **Interference-less Machine Learning: Research and Applications**
   Co-Principal Investigator, 2014.01-- 2016.12, RMB100,000
   This project was granted by Jiangsu Provincial Technology and Science Foundation. Previous studies validated that interference is ubiquitous in the training processing of conventional machine learning approaches. Dividing features into different groups is a feasible way to reduce the negative influence of this interference. Therefore, feature grouping is crucial to reduce interference among features. Studies in this project focused on feature grouping and its integration with some other feature preprocessing approaches of Incremental Attribute Learning. Benchmarks from UCI machine learning repository were employed to the validation experiments. Results showed that feature grouping can reduce the interference, and improve the classification rate.

3. **Integrated Feature Analysis for Classification based on Incremental Attribute Learning with High-dimensional Feature Space**
   Principal Investigator, 2015.06--2016.09, RMB 50,000
   This project was granted by China Postdoctoral Science Foundation, and was finished in the State Key Laboratory of Intelligent Technology and Systems, Tsinghua University.

   Nowadays, because of the big data, high-dimensional classification problems are more and more popular. This project was about how to integrate different feature analysis approaches for high-dimensional classification problems solved by Incremental Attribute Learning. Previous studies showed that feature preprocessing, like feature selection, feature extraction, feature ordering and feature grouping, are crucial to improve the performance of final classification results. However, before this project launched, almost all relevant studies employed only one single feature preprocessing

method. Therefore, it is not very clear whether better classification performance can be bought by an integration with different feature preprocessing methods for high-dimensional classification problems. Hence four different feature preprocessing methods (feature selection, feature extraction, feature ordering and feature grouping) were employed together in the experiments of this project. Experimental results showed that Integrated Feature Analysis can effectively reduce the error rate by Incremental Attribute Learning for High-dimensional classification problems. Figure 11 shows our research methodology of this project.

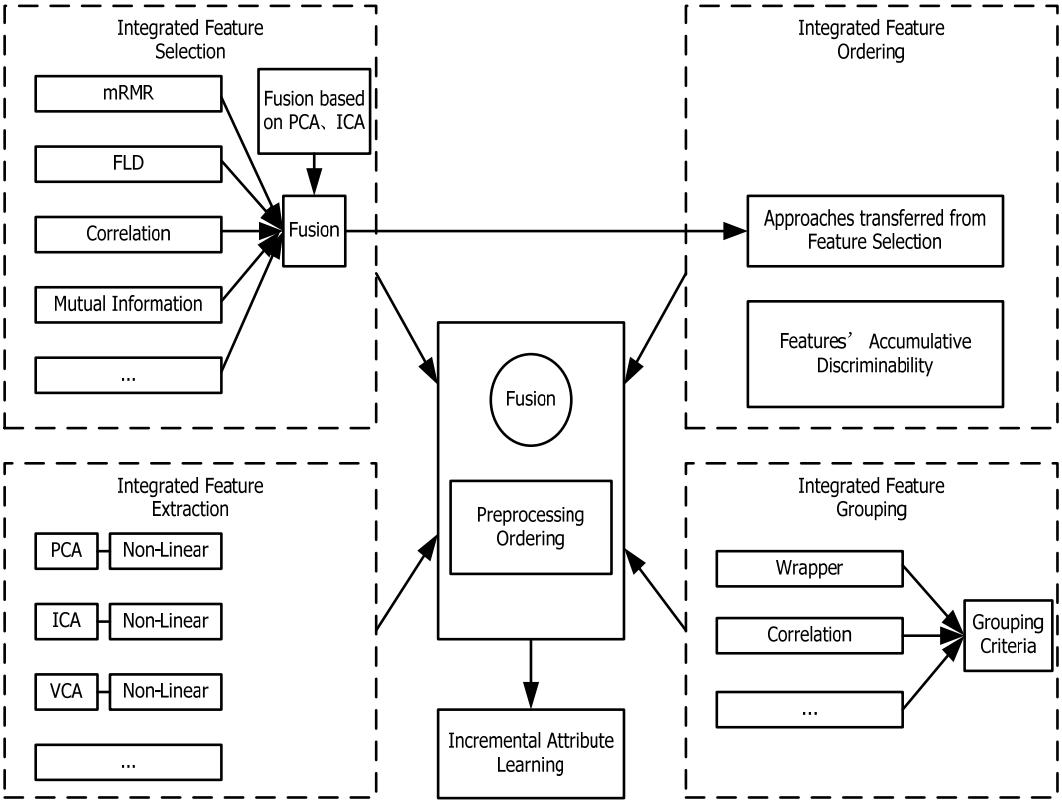


Figure 11. Research Methodology of the project

C. Others

1. Cloud Computing Service System for Digital Music and Film Making

Co-Principal Investigator, 2015.01--2017.12, RMB 7,840,000

This project is a National Key Technology Support Program, granted by the Ministry of Science and Technology of China. This project was implemented in Wuxi Studio (State Digital Film Industrial Park, Wuxi). It aimed to build a cloud computing platform for cooperative work of digital music and film making. This project established a database for storing a great number of different materials, including pictures, videos, music and so on. As a co-principal investigator, I took charge of the research on Multimedia Information Retrieval. This study aimed to develop a search engine to find corresponding multimedia files. Tags in natural language were firstly added to all

pictures, videos, and music. Then the search engine seeks the files according to tags.

2. **Industrial Efficiency Promotion Comparison of Three Culture and Technology Fusion Model Bases in Jiangsu Province**
   Co-principal Investigator on Data Analysis 2014.07--2015.08, RMB20,000
   This project was granted by Jiangsu Provincial Key Culture Research Project, and was jointly completed with Dr. Yu He from Jiangnan University. Dr. Yu He took charge of the qualitative research, while I was responsible for the quantitative research.

   This project aimed to investigate three Culture and Technology Fusion Model Bases in Jiangsu Province, which are Nanjing, Changzhou, and Wuxi. The objective of the final report of this project was to draw some conclusions about the industrial efficiency promotion of these three bases. During the research, more than 50 features were selected for the ranking and comparison. Lastly, Nanjing got the first place, while Wuxi and Changzhou got the second and third place, respectively.

3. **"Startup In Shanghai, 2016" Funded Project: Man-machine Interactive Smart Wheelchairs and Internet-based Health Big Data Platform**
   Principal Investigator, 2016.08--Now, RMB 200,000
   This project was granted by Shanghai Technology Innovation Center after a startup competition, where more than 10000 teams took part in the competition in Shanghai, only 1000 teams were granted. This project firstly started with the support of a wheelchair manufactory and an aging pension company. The wheelchair manufactory wanted to build a smart wheelchair, and the aging pension company wanted to build a health big data platform for the home-based elders. I combined these demands. A smart wheelchair engineering prototype was built, with hand-gesture intelligent control and a tablet-based health big data client platform. Moreover, servers for health big data platform were also constructed by my team. This project was implemented at the Research Center of Web Information and Social Management, Wuxi Research Institute of Applied Technologies, Tsinghua University, Wuxi, Jiangsu China.

   There is a long-term objective about the smart wheelchair, where the smart wheelchair will be made as a wheelchair robot. However, for a short-term objective, the smart wheelchair will be installed with an intelligent control system, so that it will fit the demands of the elders, who might not have the capacity to control a wheelchair by themselves in a conventional way. The hand-gesture intelligent control module is the first module we have installed onto the smart wheelchairs. This module was made for Amyotrophic Lateral Sclerosis (ALS) and Parkinson Patients. In China, the number of such people has exceeded over 2 million by the end of 2015. The hand-gesture intelligent control module was developed based on Leap Motion. A Leap Motion device collects hand gesture, and converses hand gestures into eight different signals by a fuzzy classifier. The results output from the classifier controls the speed and the direction of the wheels. Different speed and directions of the wheels convers eight different signals into eight different directions for the wheelchair movement. The

structure of the hand-gesture intelligent control module is shown in Figure 12, and Figure 13 shows the picture of the electric wheelchair with hand-gesture intelligent control module. Figures 14-16 show our smart wheelchair on the exhibition in Wuxi.

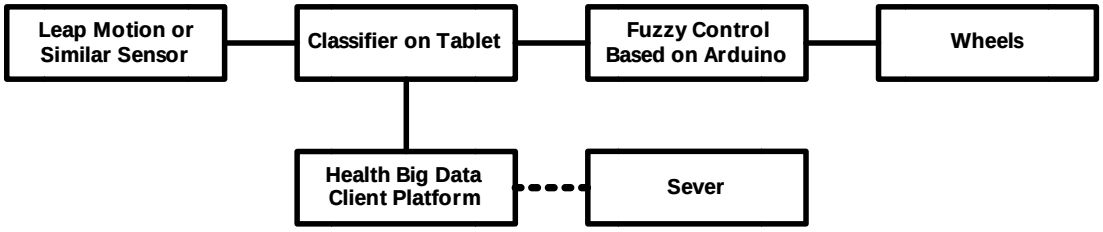


Figure 12. The Structure of The Smart Wheelchair

Figure 13. Electric Wheelchair with Hand-Gesture Intelligent Control Module

Figure 14. Smart Wheelchair on Exhibition

Figure 15. Smart Wheelchair Demonstration for Wuxi Deputy Mayor and Officials

Figure 16. Poster of Smart Wheelchair on Exhibition

The health big data client platform runs on the tablet of the smart wheelchair and connects to the server via Internet. This smart wheelchair is an intelligent hardware mechanism of the health platform. This health platform aims to provide a continuous healthcare service to millions of home-based elders in China. A Personal Health Record System including patient information, medicine record, treatment record, insurance record, community service and commercial record, and information of family relatives, were constructed in this platform. In the offline aspect, the community governments and the aging pension company supported this project. Health data was collected by smart medical devices, or submitted by volunteers, and then sent to the server directly

after the measurement. Experiments have been carried out simultaneously in about 20 communities in Wuxi with the supporting of the aging pension company. More than 4000 elders took part in this project. Now, more and more families are participating in this project, which will bring solutions to the aging society of China.

Figure 17 illustrates the working flow of health big data platform, where the blue lines are the data flows, the red lines are the service flows, the yellow lines are the order flows and the green lines show the cooperative flows. Figures 18 and 19 present the interfaces of PC and Android. Figure 20 shows the medical devices we used for aging health record measurement and data collection.

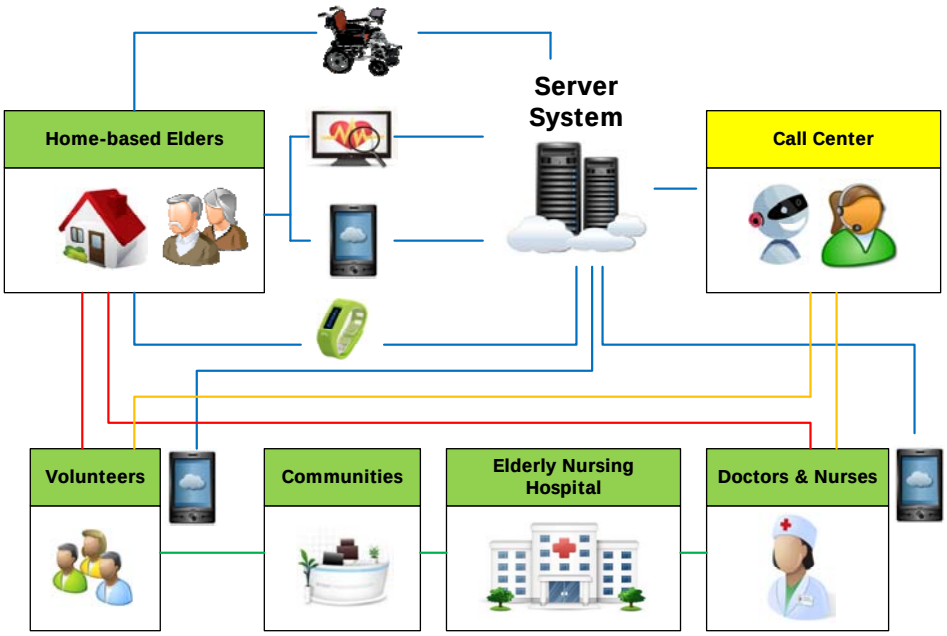
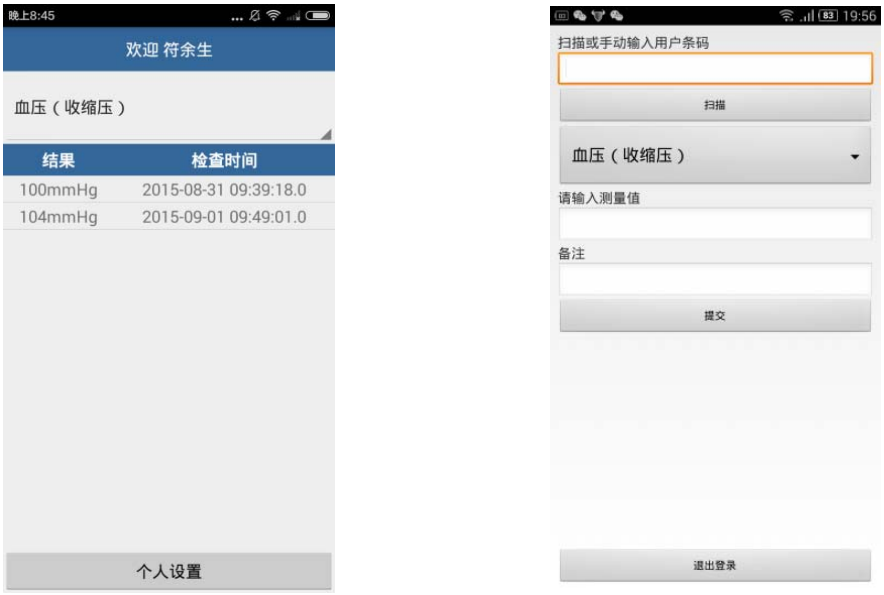


Figure 17. Working Flow Of Health Big Data Platform

Figure 18. The Interface Of PC



(a). User Client for Record View **(b). Volunteer Client for Record Submit**

Figure 19. The Interface Of Android

Figure 20. The Medical Devices for Aging Health Record Measurement and Collection

Current Research

My current research is relevant to my current research interests. Some of them are mainly based on projects supported by the government or industries. Now I prefer to concentrate

on industrial applications of my previous theory studies.

1. **Intelligent Control based on Hand Gesture and Its Application**
   This research is a further study of the project "Man-machine Interactive Smart Wheelchairs and Internet- based Health Big Data Platform". The intelligent control mechanism based on hand gesture is an independent system, which can be installed and used in many other scenarios, such as UAV Control, Smart Home Control, and Smart Vehicle Control. The hand gestures can be captured by a sensor, and then signals will be processed by an Arduino SCM. Lastly, they will be converted into directions by a classifier. The algorithms in the classifier can be made by Fuzzy Logic or Machine Learning algorithms.

2. **Film Box Office Prediction based on Social Media and Online Journalism for Film Making Investment**
   Film industry attracts a great number of investments every year. It can bring a vast amount of profit to the investors if the film gets a good box office. However, not all films can earn money. There is a high risk in film making investment. At least two ways can be used to avoid such a risk: investment portfolio and project selection. The former aims to put the fund into different film projects, so that negative influence will be reduced if one of these investments fails. This is an optimization problem. The latter depends on the film box office estimation approaches. Such an estimation will employ machine learning or statistical methods based on historical data, social media and online journalism. This is a regression problem. About ten different features have been selected for the film box office prediction, such as director, actors & actress, release date, theme, and marketing. All the information of these features can be collected from social media or online journalism via Internet. Then a computational model will be employed to estimate the final box office. Lastly, the optimal film projects will be selected for investment portfolio.

3. **Disease Prediction based on Health Big Data Analysis for the elders**
   So far, we still cannot predict whether or when a people will get a disease. These problems are very interesting. It is certain that a disease can be diagnosed by physical signs like blood pressure, pulse rate, and glycemic index. However, here is a question: Can these physical signs or features be employed for disease prediction? As we know, China has a very large population of the elders, who need more healthcare than others. However, the resource in China for these elders is limited, for example, human resources for aging nursing and aging nursing hospitals. If we can predict and alarm the elders and relatives before the disease comes, the benefits will be very huge. This is a decision support problem, including regression and classification. Apart from physical signs, more features about behaviors of the elders will be imported into the system, such as daily diet and amount of exercise. In addition, historical data will be used for comparison, so that the computational results can be more precise.

Future Work

After I close my current research, I will start new studies in the future. My future work will still focus on, but not be limited in, the area of Intelligent Information Processing, especially in the following aspects.

1. Machine Translation and Natural Language Processing

Machine Translation will break the barriers between different languages. Once the results of machine translation can be accepted by users, information will be easily shared cross languages. Natural Language Processing is very important in Machine Translation. Technologies will focus on Natural Language Understanding and Natural Language Generation. Machine Learning or Statistical approaches will be employed for Machine Translation. Moreover, metaphors may become a difficulty in this process.

2. Smart Chatting Robot for Aging Healthcare

Because of the upcoming aging society, smart machine assistant who can communicate with the elders will be in great demands. Smart chatting robots for aging healthcare will play important roles in the elder's future home-based life. Because of the busy work, children of the elders can hardly accompany with their parents. Although the elders are alone at home, they will not feel lonely any more if they have a smart chatting robot. The smart chatting robots for aging healthcare will help the elders in news reporting, weather forecasting, healthcare information searching, community services, and hospital reservation.