Knowledge mapping omni channel system for the diagnosis and the treatment of traditional Chinese medicines based on an identification analysis

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Abstract: In this study, centring on the bases of TCM diagnosis and treatment (e.g., Guangzhou, Shenzhen, Zhuhai, Foshan, Huizhou, Dongguan and Zhongshan), the digital control level of the whole life cycle of TCM diagnosis and treatment was significantly elevated. In addition, the online monitoring of diagnosis and treatment status and the tracing of the whole diagnosis and treatment process were optimized, as an attempt to achieve the safety and control of diagnosis and treatment, as well as to rapidly and efficiently research and develop TCM products. The research and development cycle of TCM products was shortened by employing the technology of identification analysis and the non-structured database of Neo 4. Moreover, the platform for R & D and health management of Chinese medicine was established and improved, feedback of the diagnosis and treatment effect data was given timely, and the R & D optimization of new Chinese medicine products was supported.

1 INTRODUCTION

The traceability of Traditional Chinese medicine (TCM) products lacks unified standards and information correlation means, thereby adversely affecting the information exchange and sharing between doctors and patients in the same industry [1-3]. Data islands are common, and the more complex management needs of TCM clinics is difficult to meet. For instance, in the TCM industry, there are a wide range of TCMs and various ways of diagnosis and treatment projects, the main bodies of TCM clinics are relatively independent, the information is out of touch, and the safety incidents of TCM occur frequently, thereby seriously threatening the health and life safety of consumers.

By uniquely identifying TCM diagnosis and treatment to accurately record the whole information of TCM, the information of cross subjects is exchanged via the analysis system, and of TCM diagnosis and treatment can undergo the forward, reverse or non-directional tracing, as an attempt to achieve the source inspection, the tracing and the responsibility [4-7]. The world is ushering into the era of big data [8-10], in which connectivity is an important feature of big data, and graph computing / network theory lays the basis of studying connectivity [11-13]. The challenge of big data analysis can be addressed by exploiting knowledge maps to calculate the graph [14-16] (Fig. 1).

Fig. 1. Graph calculation.

2 Architecture design

The forward monitoring of TCM products is designed from production / processing to after-sales status information, backward tracing from after-sales service to pre-production in the respective link of the product quality information map [17-19]. The one-stop Knowledge Computing Omni channel service is achieved for TCM library [20-22], the degrees of digitalization, informatization, standardization and standardization of

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TCM library data are improved, insights into TCM library data are gained, and service decision support is offered.

2.1. Design of knowledge map of TCM diagnosis experience

Knowledge mapping comprises things / concepts and their relationships, which can present a richer, more relevant and accurate context for machine learning, thereby increasing the accuracy of applications (e.g., case text mining and recommendation). Knowledge mapping offers more abundant and multi-level domain related knowledge. In addition, graph analysis is most suitable for behaviour prediction and introduction of TCM diagnosis and treatment dynamic groups / datasets (Fig. 2).

Fig. 2. Analysis method of knowledge map.

2.2 Analysis of identification of traditional Chinese medicine products

Given the existing situation that TCM diagnosis and treatment has not constructed knowledge maps, this study offered customers knowledge map identification and analysis service, so customers could automatically complete the construction of knowledge maps through a digital form. The identity analysis service has the functions of knowledge map creation, process management, TCM diagnosis and treatment identity map management, which covers the business of ontology creation, data source configuration, ontology selection, information extraction, knowledge mapping, knowledge fusion, etc. Moreover, identification analysis enables cross platform information sharing of diagnosis and treatment data, i.e., the core resource of TCM (Fig. 3).

Fig. 3. Identity resolution application.

2.3 Omni channel service decision making

Omni channel service is committed to improving patient experience, medical efficiency and service value, closed-loop service management, Omni channel patient interaction and efficient team cooperation. Moreover, it draws upon the cloud platform AI / IOT and other technologies developed by neo4j chart data to offer intelligent services and improve customer experience and service efficiency. A patient-centred, data-driven digital TCM service system is established (Fig. 4).

Fig. 4. Omni channel service solution.

3 Hypergraph computation

Path finding refers to one of the most basic and common techniques in graph computing.

$$D_{L/2} = \sqrt{\sum_i (h_1(i) - h_2(i))^2} \quad (1)$$

Since hyperedges are multidimensional, hypergraph computation covers a more generalized model as compared with attribute graphs. Besides, the two models should be isomorphic. Hypergraph calculation is conducted to form model graph and attribute graph to

express the same information. Some meta intents in TCM diagnosis and treatment knowledge map are captured, one link with another is effectively modified, and Dijkstra algorithm of breadth first search is improved (Fig. 5).

Fig. 5. Knowledge map hypergraph method.

1) Taking the contact circle as the start and end, the start circle is introduced to the completed contact circle set. Its value is marked as 0;

2) Starting from the initial contact circle, breadth first traverses the associated contact circle, and it subsequently records the path length from each contact circle;

3) The shortest path in the association circle is selected and marked as completed;

4) From the completed contact circle set, the nearest contact circle is accessed, the path length from the contact circle to the mentioned new contact circles is recorded, and the association degree is identified;

5) Steps 3 and 4 are repeated until all contact circles are associated.

In China, the frontier research on Hypergraph of TCM knowledge atlas remains blank. The level of foreign pharmaceutical industry is high, and the research on the application of single-to-single hypergraph technology has satisfied its industrial demand. In addition, the level of Chinese pharmaceutical industry is relatively low, and the research on many-to-many hypergraph calculation conforms to the reality of the

knowledge atlas of Chinese pharmaceutical industry. Currently, it has broad application prospects in China's pharmaceutical industry.

4 Conclusion

The application of knowledge mapping and identification analysis in product traceability turns out to be a typical case. In Zhongshan citizen youtang Medical Co., Ltd., the TCM products are coded by laser coding, and the original medical code is introduced to the identification prefix for mapping and association, which is bound with the order and production. After the inspection of TCM products is qualified, the detection information of TCM products is bound with the drug identification. When the TCM products are out of the warehouse, the order information is bound with the drug identification. By scanning the drug identification, medical patients can acquire the mentioned information to verify the authenticity of the products.

The enterprise plans to develop the intelligent Chinese medicine system of minyoutang based on big data, artificial intelligence and Internet of things, and deploy three intelligent IOT Chinese medicine configuration centers in Guangzhou, Zhongshan and Zhuhai. It has several automatic digital decoction equipment, and automatically receives the "electronic prescription" information of the hospital in real time. After the checking with the clinic doctors and nurses, the daily production capacity is expected to reach 30000 prescriptions. Combined with the Internet doctor app, online prescriptions are generated. Each prescription corresponds to an identity, and it is associated with the decocting process, logistics and valuable medicine decocting video. Patients are enabled to identify through the identity on the prescription.

The application effect refers to improving the monitoring ability of medical insurance monitoring and recall of problematic TCM products, helping medical institutions achieve management transparency and improve management efficiency, realizing service integration and improving the doctor-patient relationship, as well as promoting the construction and improvement of the quality traceability system in the pharmaceutical industry.

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