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RESEARCH ON DERMATOLOGY ONTOLOGY CONSTRUCTION FOR DIAGNOSIS AND TREATMENT

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Abstract. *With the rapid development of information technology in the medical field, the diagnosis and treatment of diseases is not only determined by the clinician's personal experience but also needs support of intelligent decision support systems as supporting modern technologies. Evidence-based medicine representatives have gradually become a research hotspot. At present, most of the medical knowledge models are relatively coarse-grained and do not build a knowledge model or ontology for a certain type of disease, and cannot effectively support the diagnosis and treatment of diseases. In view of this, this article describes the current state of the art, and proposes a method for the construction of dermatology ontology for diagnosis and treatment. By constructing the dermatology ontology, it is possible to improve the efficiency of the medical treatment of the doctor and the patient while accurately judging the diseases.*
Keywords: Dermatology, Diagnosis and treatment, Ontology

1. **Introduction.** Decision Support System (DSS) is a new type of management system that emerged in the late 1970s. It supports the decision-making of semi-structured decision-making problems in human-computer interaction. With the rapid development of information technology in the medical field, the diagnosis and treatment of diseases are not only determined by the clinician's personal experience but also needs support of intelligent decision support systems as supporting modern technologies. As a representative of supporting modern evidence-based medicine, Clinical Decision Support System (CDSS) has gradually become a research hotspot. The traditional centralized CDSS mainly consists of a medical knowledge base, a diagnosis and treatment decision model library, and a comprehensive database that forms a knowledge management environment. The system is composed of a rule analysis engine and a knowledge inference engine to support the operating environment. In CDSS, the most important part is the medical knowledge base. Due to the complexity of medical knowledge, most researchers focus on the description and representation of medical knowledge. At present, most of the medical knowledge models are relatively coarse-grained and do not build a knowledge model or ontology for a certain type of disease, and cannot effectively support the diagnosis and treatment of diseases. In view of this, this article describes the current research progress, proposes a method for the construction of dermatology ontology for diagnosis and treatment. By utilizing the ontology theory and technology to precisely describe the dermatology concepts, attributes and relations, a semantic network of dermatology is constructed and presented in a user-friendly system, which can help doctors to improve the efficiency in the diagnosis and treatment of dermatology diseases [1-3]. The rest of this paper is organized

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as follows. Section 2 introduces the related work. Section 3 describes the dermatology ontology construction process. Section 4 describes the implementation and applications. Finally, a conclusion and future work are given in Section 5.

2. **Related Work.** In the field of medical knowledge, since the development of the Arden Syntax, the earliest medical knowledge expression standard in the 1990s, more than ten medical knowledge models such as EON, PRODIGY, SAGE and GLIF had been publicly released. The ontology-based medical knowledge models include EON, PRODIGY and SAGE, are commonly used medical knowledge models for modeling medical knowledge at this stage. There is also some research in the field of medical metadata and ontology. Medical metadata is a structured data used in the medical field to describe medical words in a standardized way. It is applicable to the sorting, multiplexing, publishing, and query of metadata in the medical and health field. Medical ontology is a standardized tool used to describe various concepts and relations of biomedicine in the biomedical field and is a representation technology of medical knowledge. According to the different areas involved, it can be divided into (1) medical comprehensive metadata; (2) clinical disease term metadata; (3) medical term medical metadata; (4) laboratory and clinical observation metadata; (5) nursing medical metadata.

UMLS: Unified Medical Language System, was first developed by the National Library of Medicine in the United States in 1986. Its goal is to establish an integrated biomedical vocabulary that enables the semantic integration of a large number of biomedical resources. Currently, UMLS connects more than 60 controlled vocabularies in the biomedical field, covering a wide range of concepts in the clinical medicine and life sciences fields. UMLS includes three sources of knowledge: Meta thesaurus, Semantic Network, and SPECIALIST Lexicon [4].

MESH: a biomedical topic vocabulary prepared by the U.S. National Library of Medicine, covers 719,171 terms, 313,772 concepts, 83 sub-subject word concepts, and 177,000 entrance terms. According to the semantic types, MeSH is currently divided into 15 major categories such as A – ANATOMY, B – ORGANISMS, C – DISEASES, D – CHEMICALS ANDDRUGS [5,6].

In summary, most of the existing medical models are applied to the structural research of medical knowledge and the acquisition of medical knowledge based on semantics, but the scope of application is also relatively narrow, and it cannot support the underlying clinical diagnosis and treatment decision support system.

3. **Construction Process.**

3.1. **Dermatology classification structure construction.** By referring to dermatology subject vocabularies, encyclopedias, teaching materials and other materials, 21 dermatological-related conceptual classification structures were established, including diseases, anatomy, biological genetics and physiology and pathology immunology, pharmacology, skin histopathology, physical factors, chemical factors, social factors, epidemiology, routes of infection, symptoms, analytical diagnostic tests, chemicals and drugs, treatment techniques and equipment, organisms, seasons, population, geography, metabolic disorders and nutritional disorders, lesions, characteristics and types of skin erythema. There are totally 4516 concepts in this dermatology classification structure.

3.2. **Dermatology attributes and relations construction.** By referring to dermatology-related encyclopedias, teaching materials, and other materials, 21 dermatological related conceptual classification structures were described by attribute relations. And the description of disease attributes includes: alias, definition, English name, clinical manifestations, pathogenesis, complications, examination, treatment, etiology, skin lesion characteristics, related diseases, histopathology, drugs, diagnostic points, and so on. There

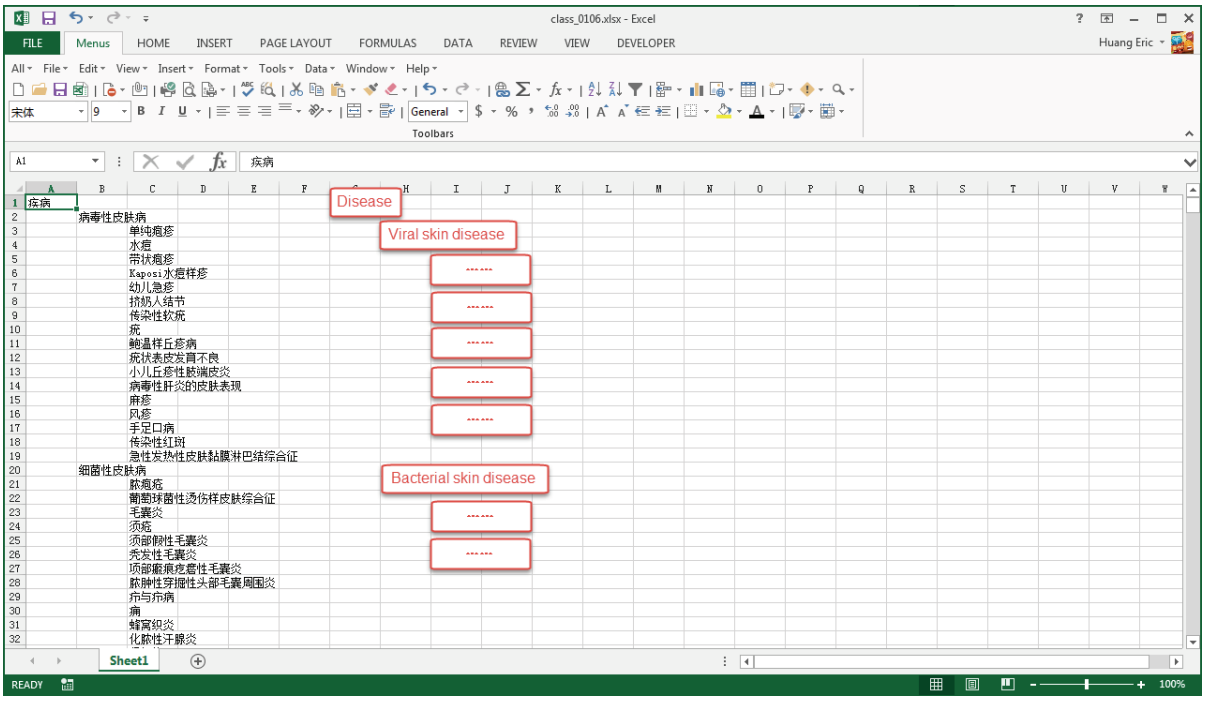

FIGURE 1. Dermatology classification structure construction

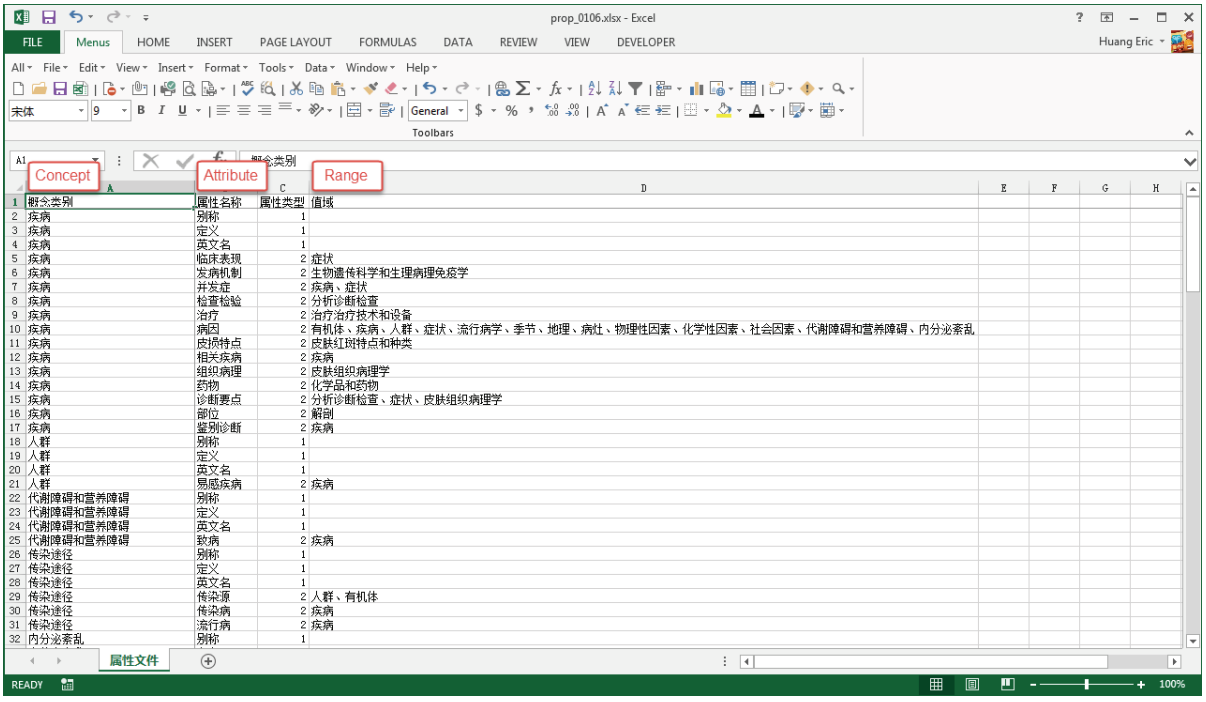

FIGURE 2. Dermatology attributes and relations construction

are totally 136 attributes to describe the dermatology concepts and relations between them.

3.3. **Dermatology data processing.** Some widely used in clinical practice books on dermatology are chosen as dermatological related linguistic materials, such as China Clinical Dermatology and Routine Medical Diagnosis and Treatment, Routine Diagnosis and Treatment of Department of Dermatology. Those materials are structured and processed to form a standardized XML document, which supports detailed analysis respectively in chapter, section, paragraph, and sentence levels according to semantic units.

3.4. **Dermatology ontology construction.** Based on our previous research results [7-9], these resources are uploaded and imported into the domain ontology construction platform as the raw materials, to automatically construct an ontology. The formed dermatology ontology is shown as Figure 3.

FIGURE 3. The formed dermatology ontology

4. **Applications.** The dermatology ontology offers a professional knowledge for diagnosis and treatment process of dermatosis which can help doctors obtain useful information accordingly, mutual relations and potential connections of a variety of information can help doctors to reduce the subjective bias and improve the level and accuracy of diagnosis and treatment of dermatosis. Based on the technologies and resources above, we design and develop the Dermatology Diagnosis and Treatment System. The main steps and features are shown as follows.

(1) Automatic screening. According to the basic information entered by the doctor, to draw some of the disease range, the left is the disease after screening related symptoms

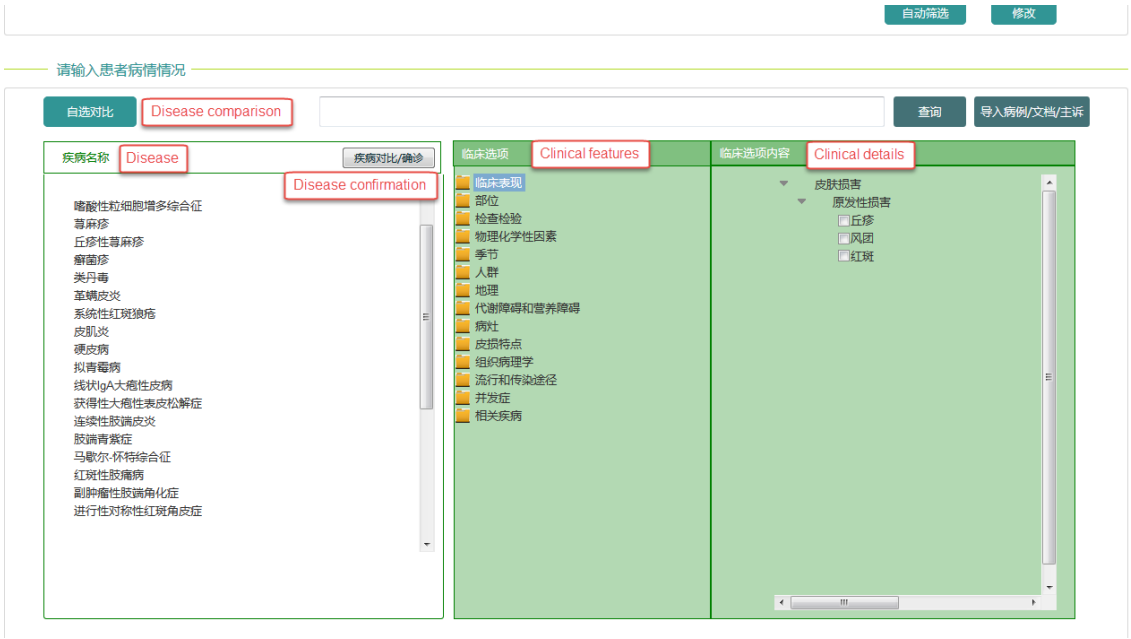

FIGURE 4. Automatic screening of disease

or performance, the right green area is the clinical option attributes of these diseases, according to the need, and click on the various options, the right side will show the specific content of this option.

(2) Disease Wikipedia. During the screening process, the range of diseases on the left side will gradually decrease. At this time, if necessary, doctors can click on the disease name to view the encyclopedia of the disease. Click on the name of the disease, the Wikipedia page comes out, and you can also search for encyclopedias of other content on the Wikipedia page.

FIGURE 5. Disease Wikipedia

(3) Diagnosis and comparison. After screening some conditions, several diseases remain. The doctor can check the diseases that they want to diagnose and compare to determine the next step.

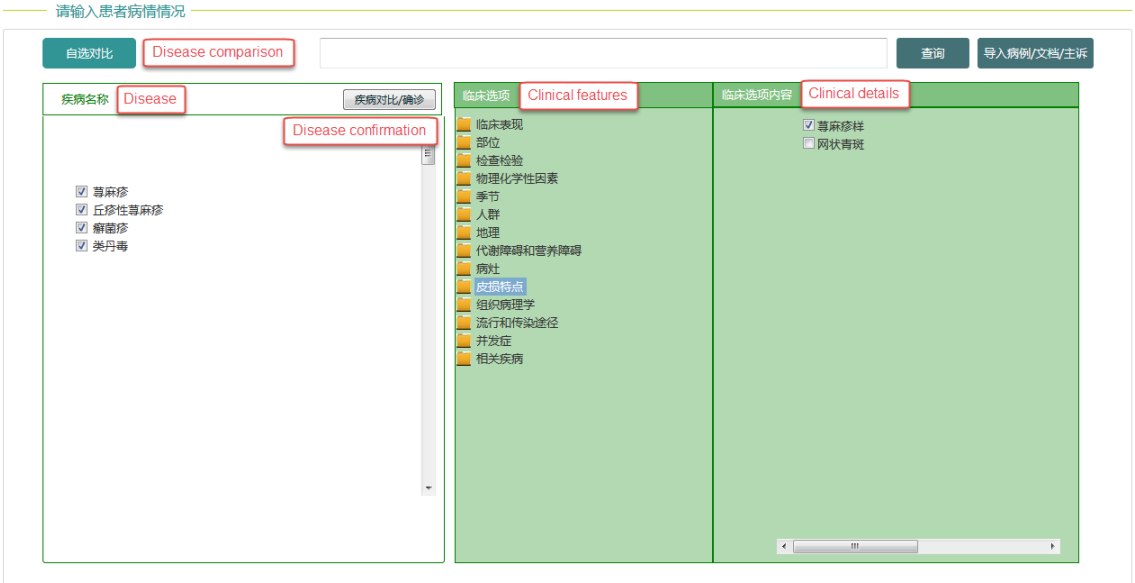

FIGURE 6. Diagnosis and comparison of diseases

(4) Diagnosis confirm. After comparing the content of these diseases, select the disease that meets the patient's condition and confirms the diagnosis.

FIGURE 7. Diagnosis confirm

5. **Conclusions.** In this paper, we describe the current state of the art, and propose a method for the construction of dermatology ontology for diagnosis and treatment. By utilizing the ontology theory and technology to precisely describe the dermatology concepts, attributes and relations, a semantic network of dermatology is constructed and presented in a user-friendly system. With the dermatology ontology, it can help doctors to improve the efficiency in the diagnosis and treatment of dermatology diseases. It is necessary to select the method suitable for the construction of the specific ontology according to the existing methods and applicable scopes. In the future, we intend to proceed along two lines in parallel: on the one hand, to integrate other dermatology materials such as medical records into the system; on the other hand, to broader its applications.

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