## 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 coarsegrained 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

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FIGURE 1. Dermatology classification structure construction

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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.

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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.

Concept classification structure		Attributes and realtions
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■ □   月17日  1527/1400 単 ■ □   传染途径 ■ □   化学性因素	相关疾病2	<b>疾病 0.14</b>
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<ul> <li>○ 使用</li> <li>○ 更用</li> <li>○ 真菌性皮肤病</li> <li>○ 物理性皮肤病</li> <li>○ 性伤描疾病</li> </ul>	鉴别诊断	们Yook Linder setf Land Dann <sup>+</sup> 水晶均均值用的最有機有限这些自然的自动的自动和自动和使用的最优的。我有能有有效此是,以我就是我们会出现外或且用有全量包括为利益。1 I Yook Linder setf Land Dann <sup>+</sup> 才像自然的有限的表情的表情,就是你是自己的有一点的不少,如此是不是不是不是不是不是不是不是不是不是不是不是不是 最终由此最高校最终接着到起的自己最终也发现我,本面完成的处生,表现为这就的面景性小小语,从一侧覆面积低作者状分布,某样
① 非感染性肉芽肿病                  ご                  ご                  ご             ・	鉴别诊断2	交击反应性反映病 0.07 物理性反映病 0.07 等所参 0.07 销格 0.07
<ul> <li>■ 二 灯斑鱗帯性皮肤病</li> <li>■ 二 灯斑鱗帯性皮肤病</li> <li>■ 二 内分泌、营养和代謝性疾病</li> </ul>	鉴别诊断3	
<ul> <li>□ 皮肤树屋器疾病</li> <li>□ 病毒性皮肤病</li> <li>□ 存染性红斑</li> </ul>	油疗	[Tbook_article_section_section_section_p_idProperties""15","book_article_section_section_p"12数基新出版確定,減起国神経公共,或規科経送至正侵協功能が其基本規約指行原则。 7) ['book_article_section_section_p_idProperties""15","book_article_section_section_p"11.為性期但反早後用模式因素意,可用说包括 30mg 口服 10%天成効素未転動後の同誌の方見用左
	治疗2	<b>亂丁胺 0.07 电疗 0.07 阿普洛布 0.14 炉封石 0.07 伐普洛布 0.07 炮逐消节剂 0.07 泛普洛布 0.07 氢氧激光 0.07 阿特琼蓝白 0.07</b>
<ul> <li>□ 急性发热性皮肤黏膜淋巴结综合征</li> <li>□ 手足口病</li> <li>□ 単均疱疹</li> </ul>	治疗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

自选对比 Disease compariso	on		查询	导入病例/文档/
免房名称 Disease           時間性近個胞谱多综合征           荨麻疹           丘疹性荨麻疹           癬菌疹           柴丹毒           革網皮炎           系統性虹球態度           皮加炎           硬皮病           災害病時           支援人均久大疱性皮病           茨場内           送休以今大疱性皮病           茨特特大疱性皮炎松麻症           运染性胶調素繁症           马歇尔怀特综合征           红斑性胶薄病           副評価性胶試病化症           进行性对称性紅斑角皮症	東京対比/除鈔 Disease confirmation E E	Clinical features           協作表現           部位           检查检验           物理化学性因素           季节           人群           地理           代謝博尋和當养障碍           病灶           皮損特点           成指有点           道织病理学           流行和传染途径           并发症           相关疾病	Chincal details ◆ 皮肤振客 ◆ 皮肤振客 ● 尿发性振客 ● 风間 ● 紅斑	

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.

			相关词	
日本 又名等現 点而命名的	上等床校 Papular ( 新修祥苔藓、婴儿苔藓、多见于婴幼儿; 疾病,实际上本病期为虫咬症。	UTICAFIA 及儿童,但成人亦可患此病。往往同一家庭中几人同时发病。春秋季发生较多。本病是一个以症状特	猩红热样红斑 多形性红斑 擦烂红斑	(0.95) (0.88) (0.81)
别称 丘	应样荨麻疹,荨麻疹性苔藓,婴儿苔 <b>苔</b>	I		
	1. 病因及发病机制	1. Etiology and pathogenesis		
日志	<ul> <li>2. 临床表现</li> <li>3. 诊断及鉴别诊断</li> </ul>	2. Clinical manifestation		
	4. 预防及治疗	3. Diagnosis and differential diagnosis		
		4. Prevention and treatment		
病因及发	病机制			
本病与] 个体素质对] 些物质过敏; 证实。因此	昆虫叮咬有关,如臭虫、跳蚤、虱、螨 昆虫叮咬反应也不同。Bazex及Rook等 的儿童产生本病。这是一种迟发性过敏 ,本病一般在7岁左右停止发病。	、蚊、狗疥虫、米恙虫、鸡刺皮螨、蠓虫类昆虫等可咬所致的过数反应。昆虫的种类皤地区而异。 均认为本病是由节肢动物类可咬脂引起的外母性过敏反应。节肢动物叮咬皮肤后注入喘液,使对这 反应,致数需10天左右,此时再受叮咬朋促使皮疹发生。反复叮咬可产生脱数作用,这已为实验所		

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.

自选对比 Disease	e comparison			查询 导入病例/文档/主》
<ul> <li>疾病名称</li> <li>⑦ 荨麻疹</li> <li>⑨ 丘疹性荨麻疹</li> <li>⑦ 承留旅</li> <li>⑦ 英円毒</li> </ul>		Cinical features           部位           管位           管理经常           物理化学性因素           季节           人群           地理           化謝障碍和营养障碍           病灶           道以時点           组织病理学           流行和传染途径           并发症           相关疾病	★ 國家建國內容 Clinical de 「	tails

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.

				返回上一	-步				
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Disease	英文名称	别名	病因	发病机制	好发人群	年龄	性别	家族史	更多条目>>
	(一)病因 荨麻疹病	因复杂,约3/4的患者	音不能找到原因,ナ	尤其是慢性荨麻疹。				*	
Urticaria	<ol> <li>1.食物及食物添加剂</li> <li>加入的分表 调味日</li> </ol>	」主要是动物蛋白性 「 「 「 「 」 の の 、 、 、 、 、 、 、 、 、 、 、 、 、 、 、 、 、	食物,如鱼、虾、蟹 5.56 均量66 (甲4	璧、肉类、蛋(或已变 a	(质)等;植物性食物 (化物等中的干燥者)	财加茄子、竹笋、菠菜 Mactioner	素、苹果及李子等蔬菜	和水果。食物中 🗉	
荨麻疹	加入的巨繁、调味品、防腐剂、酵母、水物酸、柠檬酸、偶氮样出现或体和受易营酸们化物每中的大流或合成物质。 2 [16]为物 向抗常论 为物由西国 如果 直菌两子 左小 田縣 无燥风 董商轮 除色劑 气体感见 补闭份生营商店 日边比重素带伴呱呱道在针								🔲 确诊
	3. 應染 各种急慢性感染因素均可引起本病,包括:①细菌感染,如急性扁桃体炎、咽炎、脓疱病、疗、胆囊炎、胰尾炎、胰腺炎、鼻窦炎等。有报道幽门螺杆								■排除
	苗可问接引起自身抗体的产生而与慢性荨麻疹有一定关系。②病毒,如病毒性肝炎的前驱期或黄疸期多见。柯萨苔病毒感染与传染性单核细胞增多症同荨麻疹的								
Papular urticaria	1118 大学年后日时的学校、创新生活、创作世界、剧情、教学校、学校、教学校、教学校、教学校、教学校、教学校、教学校、教学校、教学校、								
斤疹性荨麻疹	「「かっ」とのエリックスティンは美工、「和美工、「和美工、」、「お」、ショルス、「ショルス」、「キョンス」、キュンス」、美工・ション、「キュンス」の「シュンス」の「シュンス」の「シュンス」の「シュンス」の「シュンス」の「シュンス」の「シュンス」の「シュンス」の「シューンス」の							- 9HIS	
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Sputum rash	是由于原发真菌感染炸	は(头癬、足癬等)和	释放的真菌抗原经1	血流带至皮肤					□确诊
癣菌疹									THE BA
								.4	■排际
Erysipelas	人类可因接触带菌的表	动物或其制品而感染	故本病主要见于《	至营家畜、鱼类、禽鸟	的人或屠宰工人、制	革工人及兽医等,主	E要经外伤的皮肤感染	致病。有时发生于	🔲 确诊
类丹毒	洗鱼、切肉时,手被刺	則伤或刀切伤引起感夠	è.						■排除

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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