Medical ontology: Siddha System of Medicine

Abstract
Examines the range and nature of concepts and conceptual relations in the domain of Siddha medicine—a holistic system of medicine that originated in India and also practiced in other parts of the world. While his medical system has developed extensively and the consumer base grown widely, its representation in the Knowledge organization systems has been inadequate. Discusses Siddha ontology, a knowledge base built to support semantic information retrieval.

1. Introduction
In the trend of globalization and worldwide integration, information transfer and use, capturing and sharing knowledge assets for enhancement and sustainability has become the need of the day. Knowledge management and specifically knowledge organization systems (KOS) have been created to facilitate this process. KOS, includes knowledge structures such as taxonomies, subject headings, controlled vocabulary, and ontologies. In the medical domain, the Medical Subject Heading (MESH), used for indexing biomedical literature and the Unified Medical Language System (UMLS) are examples of KOS.

Despite the advances in healthcare technology in conventional medicine (Allopathy) the use of Complementary and Alternative Medicine (CAM) has increased considerably in the past years (Iyer and D’Ambrosio 2013). The World Health Organization estimates that approximately 80% of the world’s population relies on traditional systems of medicines for primary health care, defining these systems as those in which plants form the dominant component over other natural resources (Mukherjee and Wahile 2006). Siddha medicine is a holistic medicine that originated in India and is being practiced in many parts of the world.

Information systems have, for long, employed traditional knowledge organization systems (KOS) such as classification schemes, thesauri, etc. for knowledge representation. The range of conceptual relations these can represent is largely limited to hierarchical and associative relations. Knowledge available in many of the domains is so complex that effective retrieval and knowledge discovery require more powerful tools and techniques of knowledge representation than what traditional KOS can support. The use of ontologies to overcome the limitations of keywords-based Boolean search has been projected as one of the key requirements of Semantic Web. Ontologies can represent more complex relations in a more precise and specific manner (compared to mere RTs in Thesauri). More importantly, Ontologies support inferencing and thus facilitate improved retrieval. Ontologies are projected as knowledge bases which can
be exploited to support semantic searches.

The Siddha system of medicine has not been adequately represented in any traditional KOS. In this paper an attempt has been made to examine the range and nature of concepts and conceptual relations in the domain of Siddha medicine and model these in an ontology.

2. Siddha System of Medicine

This is one of the oldest systems of holistic medicine that emphasizes both prevention and treatment of diseases. The fundamental principle of Siddha, as of Ayurveda, is geared towards maintaining equilibrium of three humors, or the metabolic agents in the body, namely, Vata (air), Pitta (fire) and Kapha humor (earth and water). The normal ratio between the three humors is 4:2:1 respectively. A disequilibrium between the humors is the underlying cause of disease. Amongst other factors, stress, environment, comprising of climate, diet, physical activities trigger the imbalance. Healthy living consisting of a disciplined regimen along with proper diet and medicines are recommended to restore body’s equilibrium. The government of India regulates the medical practice, standardizing and testing drugs, supporting clinical investigation of herbs, establishing Siddha research centers and Siddha medical colleges.

Originally, Siddhars (founding fathers) codified their “findings on the characteristics of plants, metals, minerals and animal products and their knowledge of the properties of drugs, its purification, processing, fixing dosage, toxicity, antidote and clinical application, were preserved in the form of verses for the use of the posterity” (National Institute of Siddha). Subsequently, the oral literature was transcribed on palm leaf manuscripts that continue to serve as a repository of Siddha knowledge complementing the substantial publications, journals, books and digital information.

3. Diverse user categories

One of the authors (Iyer) conducted extensive interviews with the Siddha practitioners and educators in India regarding the principles and practice, communication patterns and knowledge structures. Their input informs the ontology that is reported in this paper. There are diverse categories of users seeking and utilizing information and the information sources range from palm-leaf manuscripts to digital sources.

a) Practitioners: Formally educated physicians in Siddha Medical Colleges
b) Medical College students, researchers and professors
c) Vaidyars: Practitioners who typically have inherited their knowledge from their forefathers /Gurus. They apprenticed with a teacher in a Gurukula system (residence with the teacher). The apprenticeship involved a highly disciplined way of life, learning, reciting Siddha verses, observation, and mentorship. In essence, this facilitates a complete and total immersion. The teacher gave
individual attention to each of the students that resulted in a strong teacher-student bond. The students not only to gain knowledge and skills but also attitudes, professionalism and considerable practical clinical experience. One of the aspects examined during the interviews by Iyer was whether the two seemingly disparate groups of vaidyars and the formally educated practitioners professionally interacted/ networked. The vaidyars by and large focused on the specific areas of expertise, often as that of their forefathers/teachers. The professional schools tap this vast resource. The interesting aspect is that though a dichotomy exists, there is mutual respect and acknowledgement that allows collaboration and consultation. This is rather unique to this system. Interestingly, the national level research councils also maintain considerable connection with the vaidyars.

To sum up there are distinct categories of users that need to be served. Their backgrounds, education and language may be very different and so also their modes of communication and access to information. The use of technology for interaction is not as much as one would expect from professional groups.

4. Siddha concepts and categorization

The following sections presents the description and classification/categorization of the various components of the domain that form the basis of this ontology:

a) Disease: During the onset of a disease a single humor gets aggravated from its state of equilibrium. Diseases are fundamentally classified according to the three humors of the body. Thus there are Vata correlated diseases, Pitta correlated ones and so on. Symptoms, etiological and other factors are also used to further categorize.

b) Treatment: Siddha system uses vegetables, animal and mineral products in the preparation of drugs. Examples of the categories of medicine are: Kudineer churanchuram--decoction powder; Thailam--medicated oil; Parpam--prepared by the process of calcination; Legiyams and Rasayanams--Contains herbal powder; Chunnam--alkaline in nature.

Being a holistic system of medicine the treatment techniques also includes lifestyle modifications, massage, meditation, breathing techniques, and diet, as a regimen for healing. The major categories of techniques are: Yogasanam--yoga postures; Varmam--manipulating vital energy points; Tokkanum--massage technique; Unavu ozhukam--diet regulations.
5. Diet in Siddha

Regulating diet and correcting lifestyle activities is emphasized for preventing and curing diseases. Based on the body constitution and seasonal variations, diets are prescribed to increase or decrease the three dosha (humors). Broadly, grains (wheat, rice and millet), fruits (banana) and dairy products increase Kapha. Spices (pepper, chili) increase Pitta. Staple food and legumes increase Vata. The Siddha literature provides specific details of the kind of food that regulates and normalizes each of the doshas.

a) Spices are correlated with doshas. Spices are rich in antioxidants and low in calories. Siddha recommends the use of eight spices namely: turmeric, cumin seeds, pepper, cardamom, dried ginger, fenugreek, asafetida, and garlic. Specific spices that aid healing of specific ailments are also indicated. For example: Curcuma longa (Siddha name, Manjal) possesses anti-inflammatory properties and is effective for healing wounds, common cold etc. Fenugreek (Siddha name, Venthiyam) stimulates insulin release and decreases blood glucose level.

b) During treatment specific diets are prescribed based on the disease, potency of medicine, period of administering drugs, climatic/ environmental changes etc. For example compatible diet after medicated oil bath is: tender lentils, certain types of dried fruits, tender mango, gooseberry and certain type of leaves (Mutthulakshmi and Vijaykumar 2009).

c) The combination of spices and ingredients to use, the type of utensils for cooking, menu combinations that help alleviate the impact of individual doshas are recommended. Details of the number of meals, quantity, exercise regimen, seasons and climate also are factored in the choices of food, spices, herbs etc. The underlying purpose is to improve digestion, absorption, and to ensure that the value of nutrition is not diminished.

6. Information resources

There is voluminous literature in the field, consisting of books, journals, conference proceedings, CDs and palm leaf manuscripts that are housed in Siddha libraries. The Palm leaf manuscripts are central and unique to this domain. Codes, symbols and poetic verses are used to express ideas. Therefore reading, writing and deciphering the manuscripts is a very specialized skill and requires scholarship and training.

There are thousands of manuscripts held by Siddha families. Individual vaidyars prepare medicines in accordance with the instructions in their manuscript collection. The formulas are kept very private and guarded as a secret family legacy. Hence, certain vaidyars are reputed for their effective medicines for certain diseases. The Government of India has several initiatives to locate, collect, digitize and preserve this invaluable treasure.
7. Siddha ontology

This section briefly presents the Siddha ontology. Protégé version 5.2.0 is used for developing the ontology.

The Principal Classes and Object Properties:

The major classes (and subclasses) in the Siddha Ontology (see Figure 1 and 2) developed for the present study are:

- Disorders: the set of subclasses that includes various health problems, diseases affecting the human body and mind. Again, while many of the concepts are common to other systems of medicine, there are some that are unique to Siddha. The Siddha system of medicine is based on the premise that all health problems are directly related to tridoshas. Thus, disorders are broadly viewed as vata disorders, pitta disorders and kapha disorders.
- Symptoms: set of classes that includes both physical and psychological manifestations when there is disequilibrium in the tridoshas. Again, these could be classified into vata disorder symptoms, pitta disorder symptoms, and so on.
- Medicinal Plants: Medicines (drugs) in the Siddha system are mostly plant-based. In this ontology, for representing the subclasses of medicinal plants both the common names (mostly Tamil names) and botanical names are used. These plants also have therapeutic value.
- Siddha Medicines: Drugs made of herbs / plants etc. prescribed for treatment of various disorders.
- Therapy: The major curative and preventive measures prescribed in Siddha system.
- Institutions: that teach, practice and / or conduct research in Siddha system of medicine including hospitals.
- People: Siddhars (who developed the system of Medicine), Vaidyars, who practice the system as a family vocation, and authors of publications constitute this class.
- Adverse Effects: Some of the medicines when administered may have certain undesirable effects. For some of these classes a few instances have been added purely for the purposes of illustration.
- Documents: include works (classics by Siddhars), journals, scholarly papers, manuscripts, etc. One way of classification (subclasses) could be Texts and Media.
Figure 1: Major classes of the ontology

Figure 2: The Class ‘disorders’ and its subclasses

The Principal Object Properties that are used in the Ontology to relate individuals are shown in Figure 3:
Searching the ontology

It has already been mentioned that an ontology is a knowledge base and is built to support semantic information retrieval. An entire information corpus (not merely documents) can be fully represented in an ontology supported knowledge base. The search of such a knowledge base results in retrieving ontology entities. While this work is still in progress to be able to exploit the full capabilities of an ontology-driven knowledge base, the domain ontology populated with many classes, subclasses and instances is adequate for testing purposes. Some typical results using search queries involving regions of the ontology that are complete to a higher degree than others are presented below. The following figures (Figures 4 & 5) present the results of a couple of searches carried out for purposes of demonstration.

Query 1: Figure 4 presents the results for the query “Symptoms of Vata Disorder”.
Figure 4: Query 1 – Symptoms of Vata Disorder

Query 2: Figure 5 presents the results for the query “Institutions of Siddha Medicine”

Figure 5: Query 2 – Institutions of Siddha Medicine
The value and utility of semantic retrieval as compared to keyword-based searching is clearly evident. A demonstration of the degree of enhancement in retrieval is dependent largely on the completeness and quality of the domain ontology. For example, if the knowledge base is complete with documents on prescribed therapy for treatment of a particular disorder in different systems of medicine, it is possible to query the system to retrieve values from structured data.

8. Conclusion

Since the original texts are written in Tamil, that too in the form of poetic verses, kural, nool, padal, it poses a language barrier to users. The treatises that are in English also tend to use the Tamil medical terminology. Hence it is important to use Tamil terms with English/ botanical/ scientific equivalents while representing concepts in the Siddha ontology. This will help to universalize the concepts, to preserve cultural sensitivity and aid better communication. This is true of names of diseases, spices, herbs, medicinal plants, food ingredients, medicines and treatment, all of which are expressed using Tamil vocabulary. In addition, employing annotations liberally to explain the abstract and unfamiliar concepts will help the users.

An ontology-driven knowledge base can perform complex queries on structured data and it is important to build such knowledge bases. An issue encountered in the present context is that some of the concepts in the domain are unique to the culture in which the system developed. Exact equivalent labels, for example, in English for some of the concepts may not exist. Further experimentation, larger knowledge base and corpus of documents are needed to improve the ontology. This work is in progress.

References


