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Review Article

Recommender system introduction for requests of cancer world

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ABSTRACT

Awareness of cancer patients and their families, health care providers, and specialized cancer centers is achieved through access to up-to-date information about various items. Today, intelligent information technology systems have an important role in the awareness of people. Therefore, a type of technology is required that is capable of learning people's needs, interests and suggesting appropriate information accordingly. The emergence of information technology systems, like recommender systems, is a step towards selecting appropriate information. With modeling the preferences, interests, needs, requests, and behaviors of the users, recommender systems seek to predict the future preferences, needs, and behaviors of the users to recommend appropriate and helpful services accordingly. Recommender systems can be a suitable tool for the information management of cancer-related screenings, diagnoses, treatments, operations, and rehabilitation programs. Access to treatment and health recommendations from valid sources is an important component of the natural processes of human decision making. The aim of this collection is to introduce recommender systems to use in cancer-related issues.

Keywords: Cancer, Health care, Recommender system

INTRODUCTION

There are several pains in cancer patients.[1,2] Attention should be paid to different pains resulting from cancer to enhance the quality of life of cancer patients.[3,4] Cancer patients undergo different treatment options which some of them may have adverse effects. Consultation with health care providers is an obvious need of cancer patients and their families.[5] On the other hand, using the experiences of other patients who had or have cancer can at least lift the spirit of cancer patients.[5,6] Even people who do not suffer from cancer but have a cancer patient in their families should adopt a healthy lifestyle to prevent cancer. Furthermore, cancer patients and their family members should be familiar with the method of cancer management.[5] A healthy lifestyle and early detection of cancer can effectively decrease its mortality.[7]

As part of the society, cancer patients demand certain up-to-date information about their disease.[8-10] Treatment may be facilitated if educational materials are available to patients and they use them.[11,12] Moreover, health care providers should receive continuous education on the newest methods of prevention, detection, surgery, treatment, and postoperative care of different types of cancer. In this regard, specialized cancer centers should have access to the newest sub-specialty facilities and equipment for the provision of optimal services. Awareness of cancer patients and their families, health

care providers, and specialized cancer centers is achieved through access to up-to-date information.[10,13]

Today, intelligent information technology systems have an important role in the awareness of the patients, their families, and health care providers according to certain conditions of special patients.[14,15] Therefore, a type of technology is required that is capable of learning people's needs and interests and suggesting appropriate information accordingly.[16] The emergence of information technology systems, like recommender systems, is a step towards selecting and refining appropriate information.[17-19] The aim of this collection is to introduce a recommender system to use in cancer-related issues.

RECOMMENDER SYSTEMS

Recommender systems emerged in the mid 1990s as an independent research field.[18] They are appropriate assistants when people face a great deal of information and need to select the required information for decision making.[20-24]

Recommender systems have been defined in different ways

- Computer programs that offer recommendations for special users which they may like or benefit from.[25]
- Strong tools that support the users and provide them with useful recommendations which are related to different decision-making processes.[26]
- A type of information system that analyzes the needs of the users and suggests items accordingly.[27]
- A refiner of invisible information that predicts the needs and interests of the users and provides suitable recommendations.[28]
- A subgroup of information refinement systems whose aim is to predict the interests or provides ranking for a certain item.[29,30]
- Software techniques and tools that provide a collection of suitable recommendations for users according to their preferences. These preferences are based on clicking on a certain item, duration of surfing, etc. Recommender systems try to offer the best, most effective, and most suitable recommendations based on techniques, algorithms, and data mining methods, considering the confidentiality and privacy of the clients. The recommendations made by a recommender system are known as "items".[31]
- Recommender systems are intelligent tools for data retrieval that help the clients with discovering their favorite products or items in a larger collection of items. With modeling the preferences, interests, needs, requests, and behaviors of the users, recommender systems seek to predict the future preferences, needs, and behaviors of the users to recommend appropriate and helpful services accordingly.[16,32-34]

TYPES OF RECOMMENDER SYSTEMS BASED ON THEIR TECHNIQUES

Recommender systems can be categorized based on their techniques and approaches. The most famous types of recommender systems include content-based, collaborative, knowledge-based, and hybrid systems.

- Content-based recommender systems: In this method, when users work with the system, a record of their activities is saved in their user profile. Then, the system reviews its knowledge repositories to find items that are similar to the items available in the user profile and offers recommendations to the user accordingly.
- Collaborative filtering recommender systems: In this method, the system offers recommendations based on the interests, needs, and behaviors of other users that are similar to the specific user's interests, needs, and recommendations. These systems are divided into memory-based, model-driven, user-based, and item-based systems.
- Knowledge-based recommender systems: These systems offer recommendations based on a perception of needs, interests, and behaviors of the specific user and the features of the items intended for the specific user. Knowledge-based systems benefit from different methods of knowledge analysis, including genetic and fuzzy logic algorithms, neural networks, etc.
- Hybrid recommender systems: These systems use a combination of the aforementioned methods to offer recommendations.[16,35-37]

Other types of recommender systems include community-based, demographics-based, and utility-based recommender systems [38]that are all classified according to input and background data and the algorithms employed to generate recommendations.[16,37]

SOME APPLICATIONS OF RECOMMENDER SYSTEMS IN THE FIELD OF HEALTH

Recommender systems can provide physicians with good recommendations using the physical examination history of the patients.[39] These systems can offer recommendations with the assistance of diagnoses, interventions, and nursing outcomes.[40] They can offer health insurance plans considering the users' priorities and criteria.[41] They are capable of recommending physical activity programs with regards to the users' conditions.[42] They can also introduce physicians and hospitals according to the conditions of the patients.[43] These systems can present the articles related to cancer and its management to patients.[10] They offer appropriate recommendations for lifestyle modification.[44] Recommender systems offer suitable recommendations to physicians for decision-making through analysis of diagnostic images.[45] They offer proper nutrition

considering the patients' conditions.[46,47] Information refining systems shorten the research duration for health care providers, enhancing the quality and recentness of the research.[33]

WEB-BASED RECOMMENDER SYSTEMS

Currently, the Internet and consequently web tools are used to obtain the latest information, including health information.[28, 48,49] However, the lack of accuracy of all the information available on the Internet is not a secret. People can have access to any information at any place using a variety of smart phones and computers. One-third of Americans seeks patients with similar health conditions on the Internet to discuss their health status with them, and 36% of the Internet users consider the information and opinions of social networks users before making a medical decision.[50] In some studies, the majority of the patients stated that they used the Internet sources to become more aware of their disease and these resources affected their perception of the disease and also their decision about treatment.[51,52] Since some Internet sources are not comprehensible to patients and require specialized knowledge, and also because some sources are not valid.[51]. Establishment of systems supervised by valid people or organizations is a step toward improving the level of knowledge and awareness in these patients and saving their time and expenditure.[53,54]

The availability of a valid website where cancer patients can find answers to their questions is very important.[55] On the other hand, health care providers for cancer patients can obtain valuable up-to-date information through web-based information technologies.[56-59] Web-based recommender systems are one of the information resources management tools, especially health information, available on the web.[44] A web-based recommender system is a web-based software that offers web pages based on the interests and needs of the users.[18,60-66] When a recommender system is placed on a website or a social network, it helps the users to refine a huge amount of information and recommends appropriate information according to the needs of the users; also, it provides the possibility of predicting the future requests of the users.[63,66,67] Web-based recommender systems search the web using data mining techniques and evaluate it in terms of content, structure, and utility, obtain the data patterns, and make recommendations and predictions with the help of their refiner techniques.[68-70]

SOME CHALLENGES OF RECOMMENDER SYSTEMS

Some studies have reported some challenges of recommender systems that are of course dependent on the techniques used in the recommender system. Some of these challenges include cold start, Data sparsity, scalability, and Synonymy problems.[71]

- Cold start problem: It occurs when a new user or item is entered into the system but the system cannot make useful recommendations due to lack of sufficient data on the new user or item. This problem is mostly observed in collaborative recommender systems and can be managed through combining this method with content-based techniques.[71,72]
- Data sparsity: It occurs when most users do not rate all items in a recommender system; as a result, the ratings are available sporadically. This problem can be overcome through clustering of items and users.[71,73]
- Scalability: It is seen when the number of users or items increases markedly in the system. However, dimensionality reduction techniques can be used to address this problem.[71,74]
- Synonymy: It is expected when items with different names are identical or very similar. The use of techniques such as automatic term expansion, construction of a thesaurus, singular value decomposition, especially latent semantic indexing is effective in overcoming this problem.[71,75]

CONCLUSION

Different information technologies, regardless of the context in which they are going to be used, have emerged to help the science of medicine. Recommender systems in the area of cancer can help the patients and their families, and health care providers and organizations to find and refine the required information in order to provide them with the information that they must really have, of course if the systems are probably designed and implemented. Recommender systems can be a suitable tool for the information management of cancer-related screenings, diagnoses, treatments, operations, and rehabilitation programs. Access to treatment and health recommendations from valid sources is an important component of the natural processes of human decision making.

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