Utilizing Collaborative Filtering to Recommend Opportunities for Positive Affect in daily life

Panote Siriaraya
Kyoto Institute of Technology
spanote@kit.ac.jp

Kenta Suzuki
Kyoto Sangyo University
g1644655@cc.kyoto-su.ac.jp

Shinsuke Nakajima
Kyoto Sangyo University
nakajima@cc.kyoto-su.ac.jp

ABSTRACT

In this position paper, we discuss the potential use of Recommender Systems to support interventions used in mental health care. As an example, we highlight an ongoing project which aims to develop a mobile application to increase positive affect and psychological well-being based on the "Three-good-things" exercise. In our system, users are asked to take photos of situations or activities which they felt satisfied about or were grateful for during each day. Afterwards, they are asked to reflect upon the activities and write short messages to describe their experiences. Collaborative Filtering is used to enhance the existing exercise by providing recommendations of nearby activities and locations which have the potential to increase positive affect for users based on their past experiences. This helps further highlight opportunities for users to experience small moments of happiness and gratitude in daily life.

CCS CONCEPTS

• **Human-centered computing** → *Collaborative filtering*; • **Applied computing** → *Health care information systems*;

KEYWORDS

Mental Healthcare; Open Data; Collaborative Filtering

1 INTRODUCTION

Recent years have seen increasing interest in the use of digital interventions in Mental Health care. Such technologies allow treatments to be delivered directly to users who can access them at a time of their convenience, offering greater flexibility and control over the therapeutic process and helping reduce the cost of mental health services. This has led to a number of online, mobile and even gamified therapies to be developed and used to treat a variety of mental health conditions such as depression and anxiety. However, it is challenging to create digital interventions which are engaging enough for users in the long term and practical enough to be integrated effectively into clinical practice [1].

Our own prior experiences of developing Gamified Digital therapies have highlighted some of these challenges [7]. In particular, one of the main difficulties which we encountered was in providing content which matches the characteristics and interests of each individual user of our digital therapy. For example, when developing the Ready-Set-Goals, a mobile application designed to encourage goal setting for clients undergoing Cognitive Behavioural Therapy (CBT), users found the pre-set goals provided by the application to not be flexible enough to meet their interests and their specific situations. When allowed to set open goals based on different life areas (work, education etc.) however, users found it too vague and it was difficult for them to come up with meaningful and suitable goals for the therapy [7]. To address this issue, we would need to develop a system which is able to suggest appropriate goals for users based on their individual characteristics, real-life situation (time, location etc.) and therapeutic aims. Similar issues have also been encountered in our development of digital interventions for other CBTs. Recommender systems could play a vital role in addressing such issues and overall, we believe that there is much potential for such systems in the domain of Mental healthcare.

While several studies have examined the use of Recommender Systems in health care, such studies tend to focus on recommending items such as medicine, health information or treatments based on the health profile of the patient [6]. However, few studies have examined the use of Recommender systems within mental health treatments. Therefore, in our research, we are interested in investigating whether such systems could be used to enhance interventions and exercises aimed at improving psychological well-being. Overall, our project aims to: (1) develop novel recommendation algorithms that could be integrated into existing CBT exercises to provide therapeutic content that are relevant to the personal context of each user (2) contribute practical knowledge regarding the effective implementation of such systems in a therapeutic setting, in particular to determine how user acceptance would be effected when recommender systems are integrated with different aspects of the therapy and (3) provide empirical evidence regarding the effectiveness of such systems through user experiments that compare the system with traditional therapeutic approaches.

2 RECOMMENDING OPPORTUNITIES FOR POSITIVE AFFECT IN DAILY LIFE

An example of one of the systems in our project is a mobile application that is being developed based on the "three-good-things" exercise originally proposed by Seligman [3]. The exercise involves participants keeping a record of three things that went well for them each day of which they were happy about. By reflecting on these activities, participants are able to experience more thankfulness and appreciation in daily life and this has been shown to
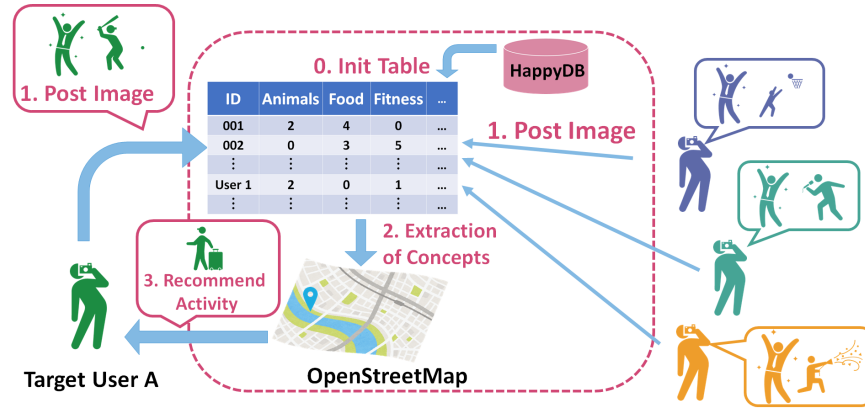
Figure 1: The overview of the proposed system

help increase emotional well-being, happiness, and resilience [4]. To further enhance the original exercise, our system plans to use collaborative filtering techniques to highlight latent opportunities for users to experience positive affect in daily life (activities which could provide feelings of gratefulness, happiness and satisfaction etc.) based on their past records. The aim is to encourage users to become more aware of previously unrecognized opportunities which could provide them with experiences of positive affect.

3 DEVELOPMENT OF THE SYSTEM

Figure 1 shows an overview of the proposed system. In our system (step 1) users first take photos of situations or activities which they felt happy or were satisfied about each day using a mobile device. During the night, they are asked to reflect on the photos and write short sentences describing their positive experiences. These activities would be recorded and presented to users in the form of a "image diary of satisfied life moments". The images and text in the diary is then analyzed and the features which represent the concepts that provided participants with satisfaction and happiness are extracted (using keyword/concept extraction techniques for text data and image detection techniques for image data). This data is then used to generate the user-item matrix (i.e. the HappyRec table), with the row representing a user and the columns corresponding to the different Positive Affect concepts. The cold start problem is addressed using data from the HappyDB (Asai et al.[2]), which is a corpus of 100,000 crowd-sourced happy moments (step 0). The happy moments recorded by users in the HappyDB would be used to initiate the user-item matrix.

To determine which concepts have the potential to provide experiences of positive affect for the user, we plan to utilize collaborative filtering techniques on the HappyRec Table. We would experiment with different techniques such as Matrix Factorization and Tensor Factorization to determine which concepts have the highest chance of providing positive experiences based on similarities with other users. This is based on the rationale that users would be interested in activities that have been carried out by other users with similar positive affect profiles. The concepts with the highest scores would then be used to identify potential opportunities for positive affect (step 2). Data from OpenStreetMap would then be used to determine which locations near to the users are related the concepts that have

been identified as having potential to provide positive experiences. Data about the nearby Points of Interests would be extracted from OpenStreetMap (for example, the tags which describes the characteristics of the locations such as parks, trees, shrine). A similar technique which we previously used in [5] would be used to match the concept tag words with different POI locations. Users would be alerted to the presence of such locations and the potential activities which could be carried out when they move near there.

4 CONCLUSION

In this paper, we discuss the potential use of Recommender Systems to support Mental Healthcare. As an example, we describe an ongoing project which utilizes collaborative filtering to recommend opportunities for users to experience positive affect in daily life. This system is used as part of a mobile application which we hope to develop and use to improve well-being and happiness for general users and those with low self-esteem.

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