KNOWLEDGE BASED ARCHITECTURE FOR MENTAL HEALTH CARE SYSTEM

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Abstract

It is important for experts to understand patient emotional state and personality traits to suggest intervention materials for them. Different patients might have the same emotional state, but different personality; hence a tool that can help match intervention materials with the user emotional state and personality traits is needed. Intervention materials that best suit for user’s personality is important as it will encourage them to follow the recommended materials. Personalization can be identified using the emotional states and personality traits. In mental health care, identifying emotional state, and matching intervention material based on personality traits, is critical for patient as it may affect their mental health condition progress and their willingness to follow the recommended materials. Therefore, it is crucial for users to be able to locate intervention material that best matches their personality traits. The objective of this paper is to develop a tool that can help retrieve intervention material based on personalization. By using a knowledge-based method, this tool will be able to help user match intervention materials that best suits their emotional state and personality. The architecture and components of the tool are discussed.

Key Terms: Knowledge based, Architecture, Mental Health Care, Personality

1. Introduction

The numbers of mental health patients are increasing as years passed. Mental disorder such as depression, anxiety and stress are an increasing problem in our society. 2018 theme for World Mental Health Day is “Young people and mental health in a changing world”. According to WHO, half of all mental illness begins by the age of 14, but most of the cases go
undetected and untreated. Meanwhile, in Malaysia, National Health and morbidity Survey 2015 stated that every 3 from 10 adults aged 16 and above have mental illness. This finding shows mental illness not only affects adults but it also has impact to youngster as early as 14. To solve the problems and improve the quality of mental health care in Malaysia, MOH focus on elements, which are fundamentally crucial for quality healthcare, which are appropriate, accessible, safe, responsive, patient-centered, effective and affordable.

However, most intervention materials for mental illness only focus on the patient’s emotional state. The intervention material provided might not suited certain patients hence, may cause the slower patient’s progress as a result. Habibi et al. (2013) findings show that there is a significant and positive relationship between personality traits and dimensions of mental health tests. Thus, this study aims is to introduced a system that not only take the patients emotional state into account but also focus on the patients personality traits when providing intervention materials for the patients.

Currently, there are no tools that can assist patient to get suitable intervention material based on the patient’s emotional state and personality traits. To assist the patients finding suitable intervention material, a knowledge-based recommender system is developed. Personalization can be identified using both mental test and personality test.

2. Literature Review

Intervention materials for mental illness are normally given to the user without taking into account the user's personality traits. Examples of the intervention materials are, yoga, hiking and games. Each personality may have different preference and liking. Each material provided may affect the user willingness or desire to follow the recommended materials. Suitable intervention materials recommendation plays important role; because it increase the user willingness to follow the materials suggested and effectively improve the user emotional state.

With increasing access to the Internet, the amount of information is growing exponentially; thus leading to information overload problems. For this reason, users are faced with difficulties of obtaining suitable intervention material. This is largely because users are unaware of their own personality traits. To eliminate this problem, intervention materials are matched depending the users emotional state and personality traits.

To evaluate the user's emotional state, the Depression Anxiety Stress Scale (DASS) is used. However, since the system will be a web-based system, the DASS 21-item version will be adopted. Based on the previous study, DASS 21-item also have similar consistency, excellent convergent validity and also good discriminative validity. Overall DASS 21-item works as well as other commonly used measures (Gloster et al., 2008). DASS 21-item assessment is used in the system to evaluate the user condition which are, depression, anxiety or stress. The level of each user's condition also can be determined.

Personalization can be applied via personality traits. In this study, the TIPI (Ten Item Personality Measure) by Muck et al., (2007) is used, because it uses five-factor model (FFM) or also known as Big Five. Big Five is one of the predominant models of personality in trait psychology to date. Basically TIPI is the short version of Big Five, which only have 10 questions in the assessment. The benefits of using this assessment are the short time to complete the questionnaire, cost effective and verified good as the Big Five measure (Muck et al., 2007). The traits evaluate in the assessment are extraversion, emotional state, openness, agreeableness and conscientiousness.

More alternative should be developed or introduced to cater to these people especially youngster and young adults. To reach out to more people, mobile mental health treatment
applications are introduced. These applications are regarded as a promising solution to meet increasing demands in mental health care division.

1) Mental Health Care

Another solution to cater for the demand for mental health treatment can be online treatment (Becker, 2016; White et al., 2001). Computer-based cognitive behavior therapy programs have proven clinically effective to treat variety of mental disorder (Becker, 2016; Cuijpers et al., 2009; Andersson & Cuijpers, 2009; Olatunji et al., 2010). Another advantage of using online treatment is its time and cost effective. In this personalize system, intervention materials are selected based on the user's emotional state and personality traits. Each material is matched to the results of both DASS 21 and TIPI assessments.

2) Recommender system

One of the recommendation systems purpose is to deal with information overload (Konstan & Riedl, 2012). Information system filtering works by generating the result depending on the user preferences and interest or by monitoring the user action towards the recommended results or items (Isinkaye et al., 2015). According to Isinkaye et al. (2015), collaborative filtering technique was the most mature and the most commonly implemented. However, for this system we use knowledge based filtering (KB). KB filtering use knowledge about users and products to pursue a knowledge-based approach to generate recommendations and reasoning about what products meets the user’s requirements (Bobadilla et al., 2013; Burke 2000). KB also works best to solve the cold start problem (Bobadilla et al., 2013) which a problem that faced by a lot of recommender system.

3. Methodology

The methodology of this research study consists of four phases (as shown in Figure 1):

1) Identifying Mental Test

DASS 21-item (Gloster et al., 2008) is used because it is verified to accurately evaluate the user’s emotional state. It is also have the short version, which made it easier for the user to answer without having to rush to complete the assessment. DASS 21 able to evaluate the user depression, anxiety and stress level. The levels for each category are normal, mild, moderate, severe and extremely severe.

2) Identifying Personality Traits Model

The TIPI (Muck et al., 2007) was used because of it is the short version from the Big Five model which both are verified to be able to determine the user's personality. The TIPI consists of extraversion, emotional state, openness, agreeableness and conscientiousness.

3) Mapping Intervention material onto the Emotional State and Personality Traits
The materials provided by the experts and mapped by the experts. Extensive research was done to map the material accordingly. First, the materials were map to the right emotional state condition, and then only the materials were mapped to the personality traits.

4) Designing and Developing the Tool

The system was designed and developed using a web base system. Figure 2 shows the architecture of the system. The architecture has five components, which are Input, Output, Database and Knowledge based. Each component is discussed in the next section.

![Figure 2](image)

5) Evaluating the Tool

The evaluation will be using Technology Acceptance Model (TAM) and Precision and Recall.

4. 2Heal

The system named 2Heal. The modules available in Figure 2 are discus below:

1) Input Module

The module requires the user to provide their basic information such as their name and email. Then the user will need to take the assessments, which are DASS 21 and TIPI. All the user information is stored in their user profile. Information from the assessments is needed to provide best results for them.
Figure 3: User registration

Figure 4: User login

Figure 5: DASS 21-item assessment
2) Process Module

This module map and match the intervention material for the user based on their results from both DASS 21 and TIPI assessments. The system uses the knowledge from the user (assessments results) and generates the intervention materials accordingly. To get the user’s feedback, this system used the user rating and user behavior technique. The user behavior was based on the items clicked by the user.

3) Database Module

There are two database used in this system. The first database is the user profile, which contains the user’s information and assessments results. Another database contain the intervention materials.

4) Output Module

Assessments results and intervention materials that matched the user’s assessment results. The user also can take the assessments more than one time to see their mental health progress.
5. Conclusion

In order to provide intervention materials for user who may or may not have mental disorder, the user personality traits should be taken in consideration as well as the material provided may not suitable for certain user. The implication of the wrong material being used to people with mental disorder may affect their mental health progress and may give negative impact in their daily life. In the future, the knowledge-based system can be integrated to enhance the system capability and improve the recommender results.

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Reference


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