Movie Recommender System with Perceptual Engineering in Chatbot

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Abstract- This study proposed Movie Recommender System (MRS) with a Perceptual Engineering (PE) in Chatbot. We call this system as MRS-PE that could reflect users’ preferences and achieve their expected looking movie results. To display effect of our MRS-PE system, we insert the system into LINE that is a social Chatbot system. To complete these building processes, we divided the system into four parts: (1) Web Crawler; (2) Decision of Perceptions; (3) Building MRS with PE and (4) Building Chatbot. The Yahoo Movie website was selected as a database for demonstrating our MRS-PE system in Chatbot. The users can check out movie Chatbot to view the proposed movie results based on user’s preferences before going to the movie theater. After receiving a recommended movie, users can also determine which movie theater to go and purchase online tickets first. The results show that people would like to use our movie Chatbot before going to movie theater because save their purchase time and reduces searching movie time.

Keywords –Web Crawler, Recommender System, Kansei Engineering, Chatbot, Natural Language Analysis

I. INTRODUCTION

With the rapid development of communication software, there is a dialogue between the robot and the user on the communication software. That “robot conversation” plays an important role in human software communication. Chatbot can be used to perform simple operations or questions and answers, and complex systems with appropriate algorithms. Chatbot is used in e-commerce systems where 24-hour customer service can be created. It can also be used to deal with large and repetitive tedious problems, for example, to receive delivery orders from fast food or beverage outlets. The application of this chat application greatly reduces the cost of hiring customer service staff and makes the estimation of the workforce more rational.

The background of a conversation robot is also controlled by the program, causing the user to communicate with a conversation robot. In the next command, the conversation robot will only reply to fixed text, and incorrect text input will only get an error message. Message error tolerance rate is almost zero. It makes users feel no sense of chat with machines and will simply stop using Chatbot after multiple messages. Therefore, special algorithms are also needed to help Chatbot in evaluating user responses.

Nowadays, artificial intelligence has been widely utilized in various application from many application fields due to its capability to imitate human-like thinking. Chatbot is a kind of conversation machine to present the artificial intelligence technology, combined with machine learning, intelligent sensing technology. It causes chatbot no longer only have a cold reply but more like chatting with real people temperature. This also contributed to the chatbot becoming a hot topic in the major industries.

Its applications have spanned medical drugs, advertising, decision making, e-commerce, financial transactions and more. Today's chatbot process data, but they can't load the data types derived from such huge data. Because big data is scientific in its view, big data draws conclusions that are possible answers, not scientific ones. The design of the perceptual engineering we will use in this study depends more on Perceptual engineering techniques for analytical research.

There were numerous researches work which were concerned about the Perceptual engineering which is a technology that considering human’s perceptions in the process [8]. (see References [7], [12-13], and [15-18]), but they still have some deficiencies. For example, the traditional Perceptual image spends a lot of time and manpower when gathering data; the systems generally include only product image survey and lack of Perceptual semantic works from product retrieval module for designers. Moreover, the systems are inconvenient for designers to search the matching products by inputting correct Perceptual semantic words. Those systems are not common for a variety of products and they are only for one type of products such as modeling, color, material, etc. (see References [1-2], [4], [11] and [19]).

Due to the development of the Internet, people's dependence on search engines has increased. It is often seen on social platforms. Many users have entered keywords that are not accurate enough so that the search results are not as
expected. Or the results of the search are not in line with the user preferences. Therefore, a system that can correctly cater to the user's preferences is required.

In view of those considerations, this research topic will be based on the building perceptual engineering in Chatbot. First, the algorithm of Perceptual Engineering (PE) is designed. Second, the designed PE is employed into the Recommender System and hence building in LINE chatbot application.

Using this, an independent database of individual users will be established based on PE algorithm. Finally, the user's needs and ideas are inferred from the results of the data analysis, and then a recommender system for the user is made. Based on these preferences, the user's interests is calculated in order to deliver the correct information and achieve the best results. We provide a LINE Chatbot prototype of the Movie Recommender System with Perceptual Engineering system (hereafter, we call this system as MRS-PE system).

The structure of this paper is organized as follows: Section 1 gives introduction of the study. Section 2 describes preliminary reviews of Perceptual engineering and statistical analysis. Section 3 explains for establishing PE algorithm. Section 4 explains an architecture of MRS-PE system in Chatbot and a prototype results Section 5 gives conclusions and future work.

II. LITERATURE REVIEW

In order to introduce the building of Perceptual Engineering technology, we first introduce the Perceptual engineering which could extract people’s perceptions and hence we could define the PE parameters for our MRS-PE system.

2.1 Extract Perceptual Factors

In a Perceptual Engineering system, the decision in the perceptions are to identify the stage in which a particular field is being investigated using a Perceptual methodology. Because the Perceptual Engineering experience is unique with different products, a specific concentration area is necessary in the process of Perceptual engineering research. Domain decisions can be segmented with market analysis techniques or through targeted consumers [10].

In addition, the decision is necessary to deal with the Perceptual engineering based on existing products or to start designing a new concept of a product from scratch. Different methods can be applied, and none can be classified as better than the other. As a mere method of experience, this field can be determined to improve the existing condition based on the presence of flexibility.

In this paper, we used the Perceptual engineering (PE) “type I” [3] which is used in the form of Perceptual semantic words to distinguish emotional appeal and movie category. We give the flowchart with statistical analysis through PE Type I in Fig.1 and explanations of the process following the Figure1. We also give the clearly explanted processes of extracting perceptual factors as follows:

2.1.1 Identification of perceptual factors

First of all, perceptual expression pattern is in the form of adjectives or nouns. This is known as Perceptual words, which is a necessary condition. Usually, the number of Perceptual words originally prepared will be very large, and this reduction can be performed qualitatively or quantitatively.

2.1.2 Measurement by perceptual

Perceptual measurement is the process of capturing the consumer's Kansei. Because Perceptual is subjective, vague and informally organized, it is impossible to measure it directly. Therefore, we need to come up with an indirect measurement method to use the alternative approach [6] Perceptual measures the measures and psychological
measures that are classified into physiology. Physical measures aim to capture consumer behavior, response and physical expression patterns. This can be done by electroencephalography (EEG) analysis of EEG, Electromyography (EMG) muscle load measurement, used to measure Kansei eye movements and other physiological ergonomic indicators, when a consumer uses or When looking at this product. Examples of such measurements can be used to find the degree of evoked in their hearts [14], and the response to robot feedback [5]. Psychological measures are coordinated with human mental states (such as consumer behavior, actions, and impressions). This can be done using a self-reporting system, such as different emotional scales measurements, different scales of semantics or freely labeled systems. Such measures are popular in the implementation of its simple sensible engineering.

2.1.3 Analysis of perceptual
By the results of the first two identifications and measurements, we can calculate a relationship coefficient between each individual and other individual, through which the recommendation system can be operated. We usually use a factor analysis (Factor Analysis, abbreviated as FA) for inductive analysis. FA is a statistical data reduction technique that used to be used to observe correlation variability in random variables or to observe small changes in random variables relative to those. FA can usually reduce the data level of different attributes to some important degree. This reduction is necessary because the level of any attribute is affected by the results of other attributes. The FA is often used to explore the Perceptual concept in the field of investigation and the psychological structure of Kansei. Such a result usually reinforces Kansei, which describes consumers in a field, and then decides on the new concept of Perceptual products.

2.2 Recommender System
The recommendation system is a system for filtering information to predict the user's rating or preference for the item. There are two ways to generate a list of recommendations, content-based recommendations and collaborative filtering. Content-based recommendations use the characteristics of items to recommend items with similar characteristics, while collaborative filtering uses the past behavior of users to guess future behaviors. These two methods are often combined to achieve the purpose of improving recommendation accuracy.

With the rapid development of the Internet, people rely on the Internet to obtain all kinds of information, and then the amount of information is gradually increasing, and it has reached the level of information overloading, making it more and more difficult for users to get real on the Internet. The information you need. The recommendation system came into being. The filtering or feature retrieval method was used to retrieve a user’s real information from a large amount of data, so that the user can easily obtain the required information.

III. PERCEPTUAL ENGINEERING FUNCTION

After we extracted the Perceptual factors, we need to give a score for the features that enable us to distinguish which factors are the most infection for users to choose the movie which they want to see. We decide the scores of perceptual engineering (PE) algorithm based on two factors. One is evaluation sentences from users’ comments. The other factor is decided from similar analysis of user’s want to seeing movie with those similar category movie list. We list the mathematical definition in the following.

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Definition 1 Scores of Perceptual Engineering Algorithm
Let \( x_i \) is denoted as user \( i \), and \( x_i \) is the evaluations of the movies from other users, for \( i = 1, 2, 3, \ldots \). We denote the \( f(x_i) \) as the feature of movie categories and \( g(x_i) \) as the feature of evaluation statement which are extracted by similar analysis. To decide the decision boundary, we give score functions for \( f(x_i) \) and \( g(x_i) \), separately, as follows:

\[
\text{Score}_1(x_i) = \mathbf{W}^T f(x_i) = \sum_{j=0}^{m-1} W_j f_j(x_i) = W_0 f_0(x_i) + W_1 f_1(x_i) + \cdots + W_{m-1} f_{m-1}(x_i)
\]

and

\[
\text{Score}_2(x_i) = \mathbf{W}^T g(x_i) = \sum_{k=0}^{n-1} W_k g_k(x_i) = W_0 g_0(x_i) + W_1 g_1(x_i) + \cdots + W_{n-1} g_{n-1}(x_i)
\]
where $W$ is the effect factor (coefficients) of feature $f(x_i)$ and $W$ is the effect factors of feature $g(x_i)$, i.e. $W_j$ is the weight value of feature $f_j(x_i)$ and $W_k$ is the weight value of feature $g_k(x_i)$, for $j = 0, 1, 2, ..., m - 1$ and $k = 0, 1, 2, ..., n - 1$.

We give the Definition of PE function in the following that combine two scores which mentioning in Definition 1.

Definition 2 Index of Perceptual Engineering Function

The Perceptual Engineering (PE function) is defined by an estimated function which is denoted as $PE$ function and given as follows:

$$PE(y = +1 \lor X, W) = \frac{1}{1 + e^{-Score_1(x)}} + \text{sign}(Score_2(x)),$$

where the values of $Score_1$ and $Score_2$ are calculated by using formulas in Definition 1, $X$ is a two-dimensional vector and denoted as $X = [x, y]$. $W$ is also a two-dimensional vector which is indicated the best solution of likelihood function $I(W)$ and denoted as $I(W) = [I(W), I(W)]$.

Note that training a good classifier means learning the best coefficients in Machine Learning. We need to maximize the quality metric (likelihood $I(W)$ and $I(W)$) over all possible $W_0, W_1, ..., W_{m-1}$ and $W_0, W_1, ..., W_{n-1}$. [8]

The concept of Definition 1 and Definition 2 comes from the Lin, et al.’s paper [8]. PE functions is combined with two functions which calculate weight values for evaluating users’ perceptions. One of the functions is calculated by using logistic function which is in order to make decision in the values between 0 and 1 that will be closer users’ perceptions. The other function is calculated by using sign function that will be given positive (+1) and negative (-1) evaluations only.

The concept of PE function comes from the definition of combining two factors into one decision making formula which defined in Lin, et al.’s paper [9]. They also give a serious proof to show that it is more significant to use exponential function in making decision.

To evaluate our $PE$ function, we calculate the accuracy by using following function. [8]

$$Accuracy(PE, PE) = \frac{1}{q} \sum_{i=0}^{q-1} 1(PE = PE),$$

where $q = m + n$, $\forall m, n \in R$, and $1(x)$ is the indicator function.

The procedure of training a good classifier for MRS-PE algorithm is given in Figure. 2.

![Procedure of Training Classifier by PE Function](image)

In the following section, we give an architecture of MRS-PE Algorithm in Chatbot and a prototype result of LINE Chatbot.
IV. AN ARCHITECTURE OF MOVIE RECOMMENDER SYSTEM WITH PERCEPTUAL ENGINEERING IN CHATBOT

4.1 MRS-PE Algorithm in Chatbot

The architecture of MRS-PE algorithm in Chatbot is given in the Figure 3.

![Architecture of MRS-PE System in Chatbot](image)

The architecture of MRS-PE algorithm contains four important topics that include web crawler, data processing, recommended system and Chatbot System.

A. Web Crawler
   i. Data capture: Grab recent film data from major movie data websites.
   ii. Data standardization: Filter and standardize the captured data into the format we need.
   iii. Data Storage: Store processed data as a file.

B. Decision of Perceptions
   i. Data Reading: Read the results of the crawl by the web crawler.
   ii. Data Analysis: Analyze and classify data and label according to the content of the data.
   iii. Generate Features: Generate features based on the analyzed tags.

C. Movie Recommended system
   i. Read Features: Read the features generated by the functions in the data section.
   ii. Read User Preferences: Read past data from users in the system, i.e. user preferences.
   iii. Recommended results: Capture the matching movies from the database based on the interaction results of the features and preferences as a result of the recommendation.

D. Chatbot
   i. Receive Messages: Receive messages using the Message API provided by Telegram.
   ii. Send Messages: Use the API to return the corresponding message, which is the recommendation result or the dialogue process.
   iii. Insert Natural Language (NL) Analysis: The user's language is analyzed by NL analysis to guess the user's preferences.

4.2 A Prototype Results of LINE Chatbot

As shown in Figure 4., with Morgan Freeman as an example, there is a user who has the characteristics of "like Morgan Ferryman" and "like comedy". When the user enters "I want to see the latest movie". At that time, because
there was no clear time relationship, the system went to find the latest movie starring Morgan Freeman, and found the "Just Getting Started" to meet the conditions and recommended it to the user. When the user enter "Want to Watch Comedy" again, the user will also find the same movie. Since the previous result has already been recommended, it is speculated that the user may not like "Going in Style", so the system will recommend another one. When the user enters "Want to see Morgan Freeman’s movie," the comedy is selected from all of Morgan Freeman's movies based on the user's characteristics. Then based on the film's IMDb score or within the system. Recommended times to recommend movies to users, here is recommended "Bruce Almighty".

![Diagram](image)

**Figure 4.** Result of Recommender System for Morgan Freeman

We give a prototype result of Line Chatbot conversation in the following Figure 5.

![Chatbot Conversations](image)

**Figure 5.** A Prototype Result of Line Chatbot

V. CONCLUSIONS AND FUTURE WORKS

The potential of the recommendation system is endless. A prototype Chatbot of movie recommender system in this paper presented with some explanation on its implementation. We hope to deepen the extension in the future and promote it into a recommendation system for music and even online programs. In the function of the Telegram, API is much more than that we only use the basic text transcribing function. In the future, we may be able to import the positioning function, directly open the navigation to the nearest studio, or directly connect with the cinema booking system. The studio's little helper turned into a full-scale movie chat robot. The potential of the recommendation system is endless.
VI. ACKNOWLEDGEMENT

The authors express their appreciation to the Feng Chia University. This research work also supported by Ministry of Education, R.O.C., under the grants of TEEP@AsiaPlus.

VII. REFERENCES


