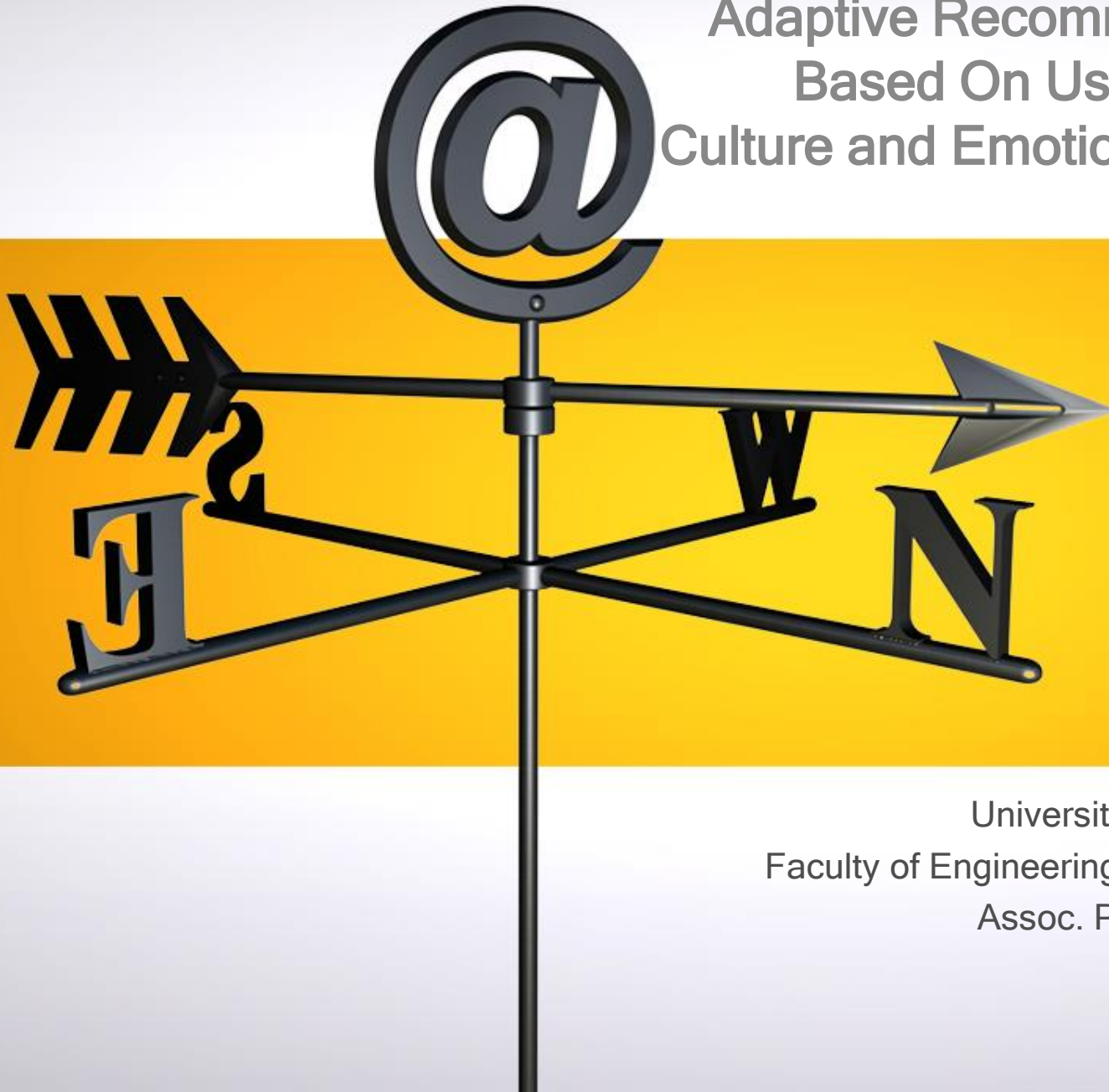


Adaptive Recommender System Based On Users' Interaction, Culture and Emotional Intelligence



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Introduction

What is Recommender System?

- Recommender Systems (RS) generate a list of items (or people) to be recommended to the users. These systems predict the rating of the item which the user would give.
- Recommender Systems (RS) was being discussed in Data Mining and Information Filtering (Information Retrieval) areas, but it has been chosen as a separate research area in 1990s and it is becoming very popular.



Introduction

Why is Recommender System important?

- Internet users are facing with a huge load of information/items to choose from, and a proper selection is impossible and time consuming through the normal search process.
- People normally trust the recommendations in the daily life, and the reputation of the people is related to how strong and correct the recommendations are.
- Most of the big and popular companies such as Amazon.com, NetFlix, Launch.com, Google, YouTube and Facebook are using the Recommender Systems to increase the corporate sales.
- NetFlix Grand Prize (1 Million US Dollars)



Problem Statement

What are the problems in the current Recommender Systems?

- High False Positive Rate (Which would cause user angeriness)
- Rely on explicit knowledge
- Limited to methods or current situation
- Limited to few parameters (such as geographical location)
- Considering outdated items
- Lack of diverse recommendation
- Obvious and true fact recommendations
- Ratings changes
- Existing systems are too rigid
- Lack of psychology-based methods
- Lack of cultural analysis on people from different countries



Platform

Recommender Systems Platform

- Online advertising system (e-marketing) is the target platform of this research to present the proper advertisements to the right users.
- Users are willing to view the relevant advertisements due to their needs and they might be angry by watching and facing the irrelevant ads (false positive).



Objectives

- To find out a user observation approach based on users' interaction with the system by using Mouse, Keyboard and Touch Screen monitors to detect users' emotions.
- To apply the multiple emotional intelligence parameters of the users to enhance consistency of rating prediction.
- To provide a method based on cultural features which is adaptable with people from different parts of the world (Malaysia - Germany) for an efficient prediction.
- To decrease computational cost and increase the efficiency (prediction accuracy) by employing less methods.
- To apply a personalized fuzzy cultural/emotional intelligence and cognitive model on recommender systems to provide flexible, diverse and surprising recommendations among the people of different countries.



Past Related Research

- Previously, in July 2012, a research related to the emotional intelligence as “**Intelligent Human Emotions Recognition System in Human Computer Interaction**” in Universiti Kebangsaan Malaysia (UKM) was done to fulfill a master’s thesis research. Some fundamental and basic parts of studies related to the emotional intelligence have been done so far and the result showed that different cultures have different meaning of emotions.
- This research is used as a base and structure of the further works on recommender systems. And this proposal is intending to extend the previous research on an applied research area as Recommender Systems



Methodology

Concentrations:

- Analysis of human-computer interaction features such as mouse movements, keyboard keystroke dynamics, and touch-screen interactions.
- Analysis of users' cultural backgrounds.
- Analysis of users' emotional states (Emotional Intelligence)



Image Source: Cheese Project, MIT University



Methodology

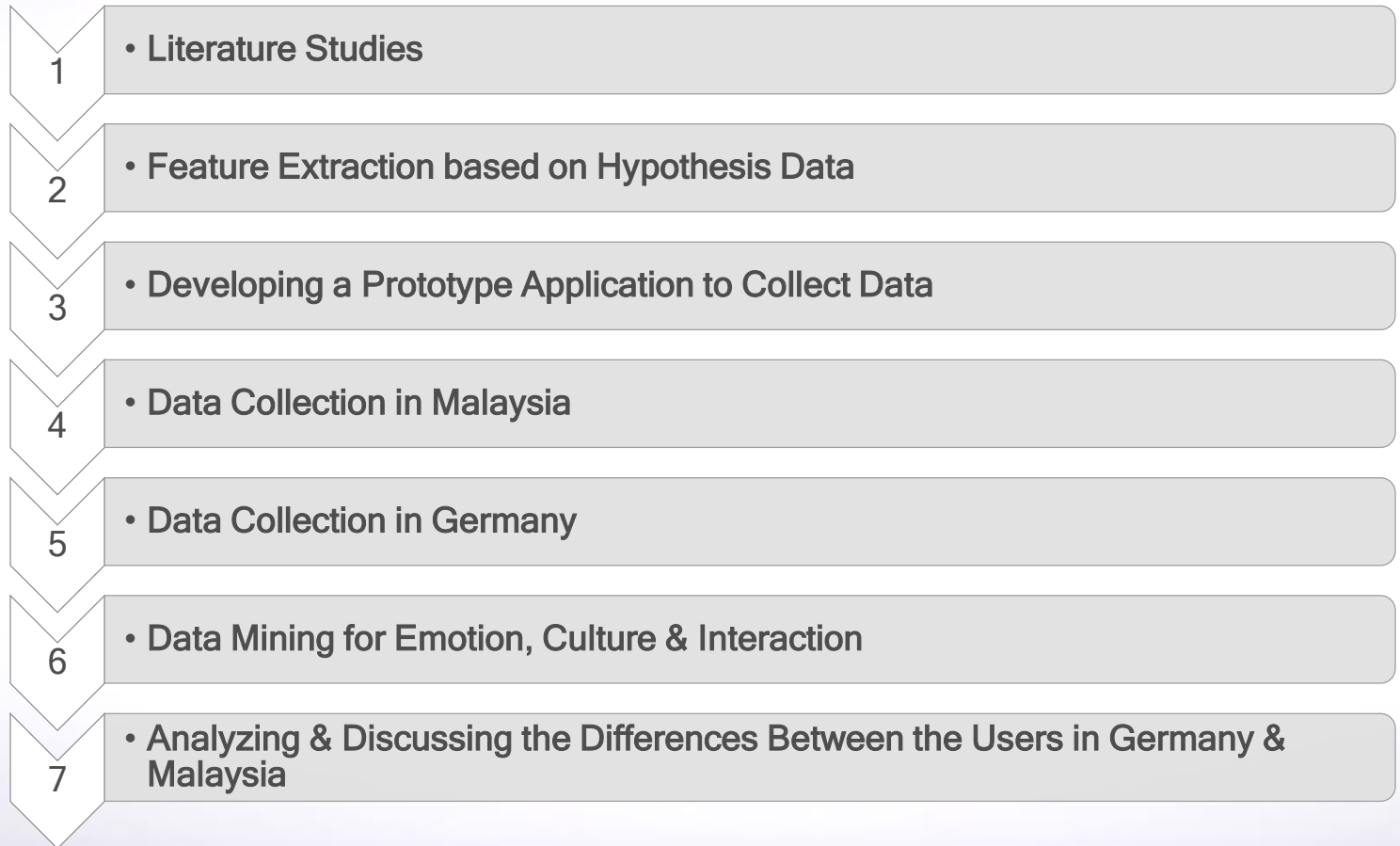
Framework (Prototype / Survey):

- The prototype application would record the human-computer interaction as keyboard keystroke dynamics, mouse movements and finger touches on touch screen monitors as well as recording the page/window information that the user is interacting with such as words, titles, images, captions and so on. These collected data would be analyzed on the further processing.
- The survey is trying to make a framework on the research hypothesis on emotions and emotional intelligence on users and cultural differences based of fuzzy analysis.



Methodology

Research Phases



Required Software & Hardware

SOFTWARE

- Big Data Analysis / Data Mining Software (RapidMiner)
- EEG monitoring software
- MathWorks Matlab
- MS SQL Server (Data Mining / Data Warehousing)
- MS Visual Studio .NET (Prototype Developemet)

HARDWARE

- Fast processing computer to analyze the results
- Web Server to test the designed framework & prototype
- Electroencephalogram (EEG) to capture human scalp voltage differences

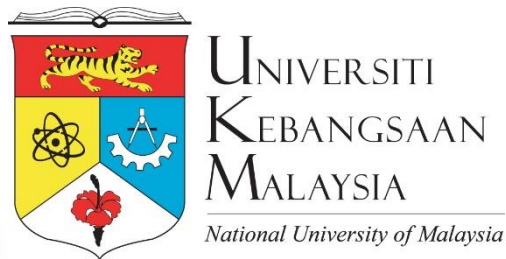


Methodology

Target Countries:

(Collaboration between UKM - UDE)

- Malaysia
- Germany



Methodology

MALAYSIA:

- Malaysia is multi-ethnic country. It is consist of Malay, Chinese, Indian and some other minor ethnics. It makes it the best option in Asia to study on different ethnics in one place.
- Malaysia has various religions and cultures, as Islam, Buddhism, Christianity and Hindi as the most popular religions. These are the most important and frequent religions in the Asia which all can be studied in one place.
- Beside the multi-ethnic part, there are lots of temporary immigrants as students and employees from all around the world in Malaysia.
- Malaysia is one of the rapidly developing countries in the region, and it is targeting the online market, and e-commerce. There are lots of international companies which are targeting Malaysia as gate to the Asian market.



Methodology

GERMANY:

- Germany is one of the largest countries in Europe with a population of more than 70 million inhabitants.
- Germany is a developed country and very strong fundamental structures in e-commerce.
- Germany is located in the heart of Europe and there are lots of people from European countries who are living and working in Germany.
- There are some potential applicable Recommender Systems in Germany, which can be used to run the prototype application.



Project Schedule

This research project is expected to finish in 2 years with all 7 stages mentioned in the previous slide.



Applications

- E-Commerce (Online Shopping)
- E-Marketing (Online Marketing)
- Financial Departments (e.g. Stock Markets)
- Business Forecast
- E-Learning
- E-Assessment
- Digital Library
- Navigation
- etc.



Benefits

- To enlighten development of efficient and effective recommendation systems with a user context
- The idea of application of user interaction, culture and emotion is quite new and innovative
- To provide more adoptable recommendations with changing environments or products, new and divers, accurate
- Applicable in real word according to the Malaysian and European residents
- To maintain cultural values which worth for each country (e.g. Islamic culture in Malaysia)
- Employment of these features along with intelligent technologies brings efficiency to existing systems and address the current problems and fulfill desired characteristics of recommenders from the user aspect



Risks

- To fail to fully achieve the objective of “To decrease computational cost and increase the efficiency (prediction accuracy) by employing less methods” since utilizing few numbers of methods may decrease the prediction accuracy
- As emotions are cognitive and very hard to detect, it may not provide completely accurate detection
- The survey and the performance of final developed system will be assessed in 2 countries with vary culture and attitude, but still it may have different result for other countries with similar or different culture and attitude
- The estimated time may increase due to the access difficulties to the technical infra-structure to collect and test the recommender system



Contributions

The concentrations of this project are the novel contributions in their kinds as according to the literature and current Recommender Systems in e-commerce, there is no similar system available:

- Integration of human-computer interaction features such as mouse movements, keyboard keystroke dynamics, and touch-screen interactions
- Integration of users' cultural backgrounds (Malaysia - Germany) in Recommender Systems
- Integration of users' emotional states (Emotional Intelligence) in Recommender Systems
- The hypothesis and assumptions based on the literature says that the above integrations should result a more reliable recommender system in e-commerce solutions.



References

- Del Missier, F., & Ricci, F. (2003). *Understanding recommender systems: Experimental evaluation challenges*. Paper presented at the Proceedings of the Second Workshop on Empirical Evaluation of Adaptive Systems, held at the 9th International Conference.
- Fang, B., Liao, S., Xu, K., Cheng, H., Zhu, C., & Chen, H. (2012). A novel mobile recommender system for indoor shopping. *Expert Systems with Applications*, 39(15), 11992-12000. doi: 10.1016/j.eswa.2012.03.038
- Happel, H. J., & Maalej, W. (2008). *Potentials and challenges of recommendation systems for software development*. Paper presented at the Proceedings of the 2008 international workshop on Recommendation systems for software engineering.
- Hussein, T. (2010). Context-aware Recommendations.
- Konstan, J. A., & Riedl, J. (2012). Deconstructing Recommender Systems. Retrieved 06/12/2012, from <http://spectrum.ieee.org/computing/software/deconstructing-recommender-systems>
- Levandoski, J. J., Sarwat, M., Eldawy, A., & Mokbel, M. F. (2012). *Lars: A location-aware recommender system*. Paper presented at the Data Engineering (ICDE), 2012 IEEE 28th International Conference on.
- Lewis, M., Haviland-Jones, J. M., & Barrett, L. F. (2010). The Cultural Psychology of the Emotions - Ancient and Renewed. In J. H. Richard A. Shweder, Randall Horton, Craig Joseph (Ed.), *Handbook of Emotions* (3rd ed., pp. 19): The Guilford Press.
- Nunes, M. A. S. N. (2010). Towards to Psychological-based Recommenders Systems: A survey on Recommender Systems. *Scientia Plena*, 6(8).
- Park, D. H., Kim, H. K., Choi, I. Y., & Kim, J. K. (2012). A literature review and classification of recommender systems research. *Expert Systems with Applications*, 39(11), 10059-10072. doi: 10.1016/j.eswa.2012.02.038
- Rajaraman, A., & Ullman, J. (2011). *Recommendation Systems Mining of Massive Datasets*: Cambridge University Press.
- Ricci, F., Rokach, L., & Shapira, B. (2011). Introduction to recommender systems handbook *Recommender Systems Handbook* (pp. 1-35).
- Robillard, M., Walker, R., & Zimmermann, T. (2010). Recommendation systems for software engineering. *Software, IEEE*, 27(4), 80-86. doi: 10.1109/MS.2009.161
- Shani, G., Brafman, R. I., & Heckerman, D. (2002). *An MDP-based recommender system*. Paper presented at the Proceedings of the Eighteenth conference on Uncertainty in artificial intelligence.
- Shani, G., & Gunawardana, A. (2011). Evaluating recommendation systems *Recommender Systems Handbook* (pp. 257-297): Springer US.
- Strickroth, S., & Pinkwart, N. (2012). *High quality recommendations for small communities: the case of a regional parent network*. Paper presented at the Proceedings of the sixth ACM conference on Recommender systems, Dublin, Ireland.
- Tkalcic, M., Košir, A., & Tasic, J. (2011). *Affective recommender systems: the role of emotions in recommender systems*. Paper presented at the Proceedings of the RecSys 2011 Workshop on Human Decision Making in Recommender Systems. Decisions@RecSys11.
- Ullah, F., Sarwar, G., Lee, S. C., Park, Y. K., Moon, K. D., & Kim, J. T. (2012). *Hybrid recommender system with temporal information*. Paper presented at the Information Networking (ICOIN), 2012 International Conference on.
- Xu, B., Bu, J., Chen, C., & Cai, D. (2012). *An exploration of improving collaborative recommender systems via user-item subgroups*. Paper presented at the Proceedings of the 21st international conference on World Wide Web.



Q&A

Thank you for your attention.

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