Project Plan

HKUCS Graduate Admission Data Analysis: A Multimedia Mining Approach

Song YiTing, Wang Michelle Yih-chyan

Supervisor: Dr. Reynold Cheng

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1 Introduction

The Computer Science Department of the University of Hong Kong (HKUCS) receives hundreds of applications for graduate programs every year, including both MPhil and PhD. Because of a great amount of applications and limited number of admission officers, it is difficult and time-consuming to filter out suitable candidates and make admission decisions manually. In addition, the Department has to take the probability of applicants rejecting the offer into account. Consequently, it is crucial to provide insights and key attributes of the admission patterns to help admission officers admit the best students available.

Previously, a web-based admission analysis system had been developed to focus on parameter data of applicants, such as CGPA, English skills and their research interests. To obtain a deeper understanding of the admission criteria, the project aims at analyzing multimedia data format, such as interview videos, teacher's comments and resume contents. By using data mining tools and multimedia analyzing techniques, this project is expected to provide a more thorough analysis on the admission patterns, to suggest appropriate students teachers according to their research interests as well as to predict the result of prospective students.

2 Related Studies

Nowadays, computer-based learning systems contain a wide range of data. Not only parameter data, but also multimedia data, such as video and audio, are available in the system. As a result, educational data mining are able to take one step further to make use of the learning systems to identify certain patterns among the collected data. For example, some studies used models to carry out data analysis tasks, such as classification, regression and density estimation. Even relationship mining, such as correlation mining and sequential pattern mining, can be applied as well. [1]

Scarano et al. developed speech recognition methods and apparatus for audio data analysis and data mining. The application is able to search the spoken words as an

organized data format. Also, it can organize the data with an SQL-like interface for processing, searching and combining with other traditional data formats. [2] Works on the educational data mining have constructed raw data bases, which is suitable for storing the data to be mined. With statistical and clustering processes, recent studies have developed a realistic pattern of educational data mining approaches. [3]

3 Prerequisites

- Database system and access: application data of graduate admission based in MySQL database management system
- Scikitlearn [4] : machine learning library for the Python programming language
- D3.js [5] : JavaScript library for producing dynamic, interactive data visualizations in web browsers using SVG, HTML5, and CSS standards
- OpenCV[6] : a library mainly aimed at real-time computer vision
- Caffe [7] : a deep learning framework made with expression, speed, and modularity in mind
- Python speech features library [8] : for extracting MFCC features from audio files

4 Methodology

During HKUCS admission process, each candidate is required to attend an interview with admission officers. In previous works [9], only numerical and boolean types of admission data (parameter data) have been processed and analyzed. In order to obtain a more complete picture of the underlying admission patterns, it is necessary to examine multimedia data as well. The interview videos are the main data source of this project. The performance of each and every candidate in their interview will be examined and analyzed for making implications of the admission strategies of HKUCS.

Since the video contains broad range of information, it is important to extract certain types of information separately before further analyzing the data. Therefore, the project focuses on two types of information: facial expression and speech analysis.

For facial expression, HappyNet [10], a facial expression recognition tool, will be used to extract the facial expressions of the interviewee. They will first cut the video into a series of photos. Each photo will be scanned to see whether there are any recognizable emotions. Then, the percentage of each facial expression in the video will be collected for further analysis.

On the other hand, concerning speech recognition, the project will focus on speech accent, speech tone, and content of speech. With a trained neural network, accent classifier is able to distinguish and classify the accents of English speakers from different geographic and linguistic backgrounds. [11] Also, Conceptor will be used to detect the emotions and tone in a speech using deep neural network and extreme learning machine. [12] [13] In order to attain the speech content, Tensorflow, a speech recognition package, will be implemented. The processed data will be stored into the database as parameter data.

After extracting the two types of data mentioned above, the web tool developed by previous students, Wu You and Xu Fang Yuan, will facilitate data processing, data mining and classification. [9]

5 Deliverable

The project will be presented as a web tool integrated into the admission system for the HKUCS graduate program. The web tool is connected to a database containing analyzed information and displays the information by a user-friendly interface. The details of the project can be found in the project website: http://i.cs.hku.hk/fyp/2017/fyp17013/

6 Challenges and Mitigation

There are two potential challenges for the project. The first one is the conversion and extraction of multimedia data. Since multimedia data contains a great deal of information, it is essential to evaluate the information extracted in order to achieve a higher relevance to admission strategies. Also, after deciding what perspectives of multimedia data should be used, how they can be culled is of great importance. The tools chosen must be able to efficiently extract information and parameterize it for integration with the existing system.

The other challenge is the choice of the models. With the addition of the parameterization of the multimedia data, the models chosen for data mining should be re-evaluated. Each model will be implemented iteratively. After each iteration, the model will be evaluated based on whether it improve the mining result.

7 Schedule

Date	Task
September	• A detailed project scheme • Project Web Page

October to November	• Data extraction from multimedia data format
	  - Facial expressions in interview videos
	  - Recognized speech in interview videos
	• Parameterized result of the multimedia data format

December to January	• Integration of the parameterized multimedia data to existing database system • A prototype of a basic data analysis tool with a designated data mining algorithm • A prototype of a basic visualization tool
January	• First presentation • Interim report

February to March	• Integration of the web tool into the updated system
	• A web application with functions on the integrated database
	  - Smart filtering
	  - Intelligent matching
	  - Result prediction

April	• Project testing and evaluation • Final report • Project presentation
May	Project exhibition

8 Work Division

Task	Teammate
Multimedia data extraction and parameterization	Wang, Michelle Yih-chyan (speech) Song Yi Ting (facial expression)
Database integration	Wang, Michelle Yih-chyan
Data analysis	Wang, Michelle Yih-chyan
Web tool	Song Yi Ting
Outcome Prediction	Song Yi Ting

9 Conclusion

The project targets at the development of a finer data mining toolbox integrated with multimedia and other information. Hence, it is able to assist admission officers to analyze these data and to discover the crucial parts of admission strategies of HKUCS graduate programs. What's more, with the functionalities provided by the web tool, the department members would be able to have a deeper understanding of many aspects of the candidates and receive useful suggestions based on the well-founded data mining methods. We hope the project could be later adapted for candidates selection from other departments at HKU, or to be extended to a part of company hiring process.

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