AI Learning Warning System

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Background

Learning warning system or early warning system is a concept about predicting students' academic performance in several type of educational organizations or schools. The purpose of this system is to provide a data of significant problems in education field. One of the most common problem is a failure and drop out. By obtaining this data organization can analyse effectiveness of their teaching system and may apply some changes for further improvements.

The prediction of academic performance is one of the most popular subjects in a fields of educational data mining and learning analytics.[1] Academic performance can be defined as the score obtain by the students during or in the end of the learning activity. Those scores could belong to a short or long term learning activities such as lesson, an academic term, or to a complete educational process, i.e., GPA [2]

Introduction

Our research is designed to discuss similarities between student's learning characteristics, behaviours, educational performances and make predictions about their department ranking, final GPA, graduation status during and after finishing four academic years or eight semesters, by using their historical educational data.

Methodology

All data used in this research belong to the undergraduate students of Industrial Engineering and Management departemt of Yuan Ze University. Historical data of the students who admitted from 102 to 106 academic years have been collected. The range was chosen specifically from 102 and 106 academic years because our model requires training, to do so we need to have final results or outcomes. Genders, both male and female are collected without any filtering. In the end our data contained: student ID, gender, admission pipeline, grades of vacation course during 1st to 3rd year, entry year, graduation year, class PR, graduation status, grades of required courses provided by IEM department for eight semesters and 4 academic years.

After collecting the data, data processing techniques are applied which are: data filtering, merging, transformation, and normalizing. After applying each technique the representation data of each students were created as picture below.
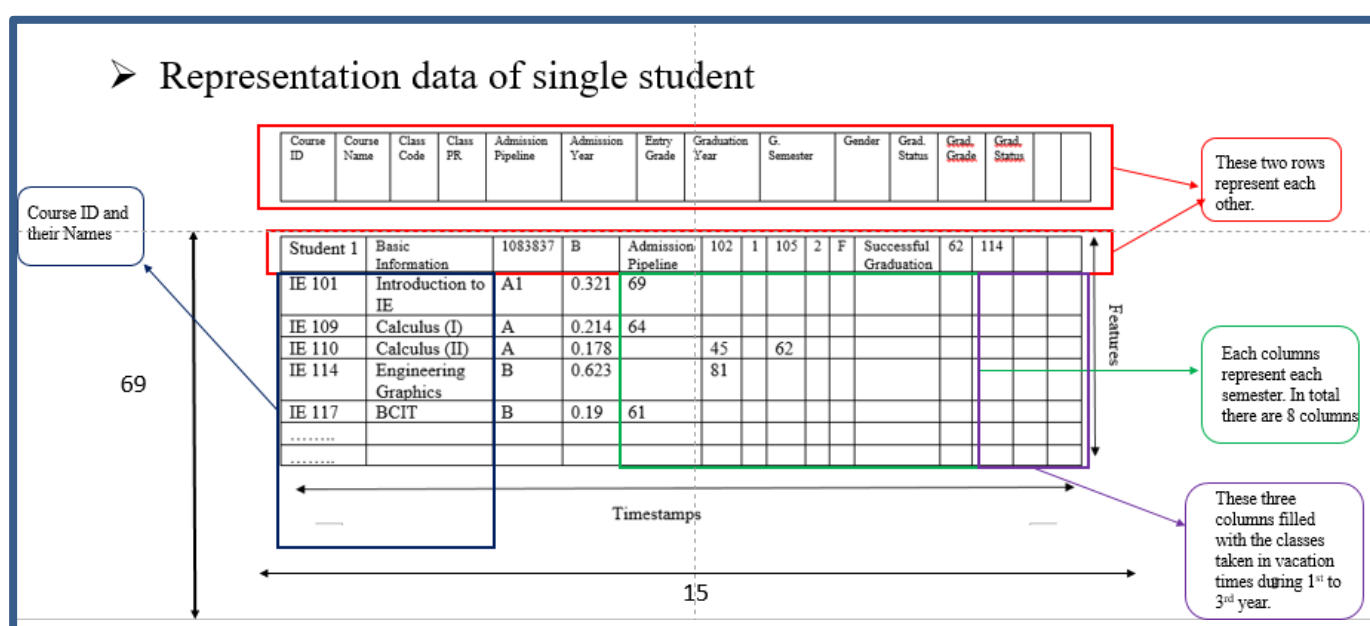
This research mainly focused on applying Convolutional Neural Network model to train and test students' data. Sumit Saha (2018) Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and able to differentiate one from another. [3]

As mentioned before Convolutional Neural Network is a classification model which is applied to classify images. It detects significant features about images according to their pixel numbers. Every image has three planes with which can be divided into three colour panels which are Red, Green, Blue. It receives images and divides in three layers with three different layers, in each layer it has small pixels which has numbers from 0 to 255. It detects numbers which describe colour of the pixels, and by using certain amount of filters it learns and classifies images into several classes.

In this research area we decided to apply CNN because student data we have is mostly created or contains by numbers so we easily can put them in a matrix form and train it as a single layer image.

There can be a question which why CNN is used in this research while ANN (Artificial Neural Network) is also being suitable for the structure of the representative data of students. Here are some statements collected from researches which made on comparing ANN and CNN.

CNN are resistant to errors while ANNs are not. This is because they can work in complex settings where there is high tolerance for errors. Besides, ANN are known to be more vulnerable when it comes to computations with significant uncertainties. CNNs are faster than ANNs when it comes to dealing with large amounts of data.

Now that everything is set up next task will be training the model and make predictions. In this research we mainly focused predicting students graduation status after each semesters of academic years. In the end we compare use charts to analyze and compare the results after each semester.

Results

It has been mentioned that a CNN is a classification model which detects the significant features of images according to their color numbers. To be able to train our data in this model first we need to categorize our classes and convert them into numbers as 0,1,2,… etc.
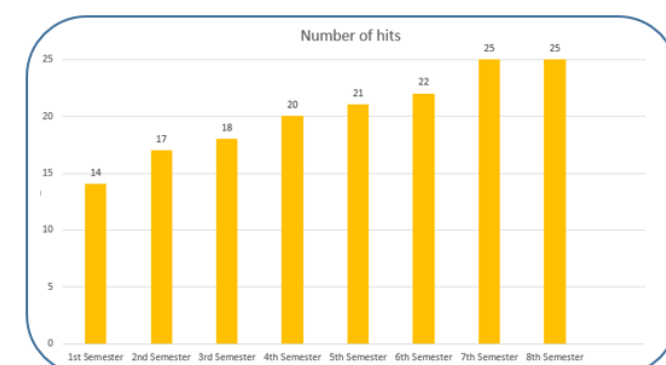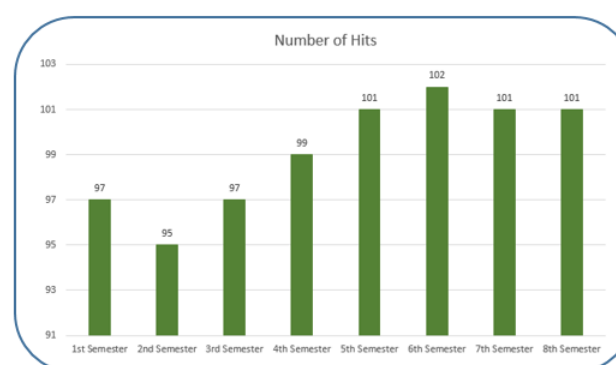
Graduation Status

	Status
0	Successful Graduation
1	Unsuccessful Graduation

Successful Graduation	Unsuccessful Graduation
On time graduation	Delay Graduation
	Drop out
	Quit School
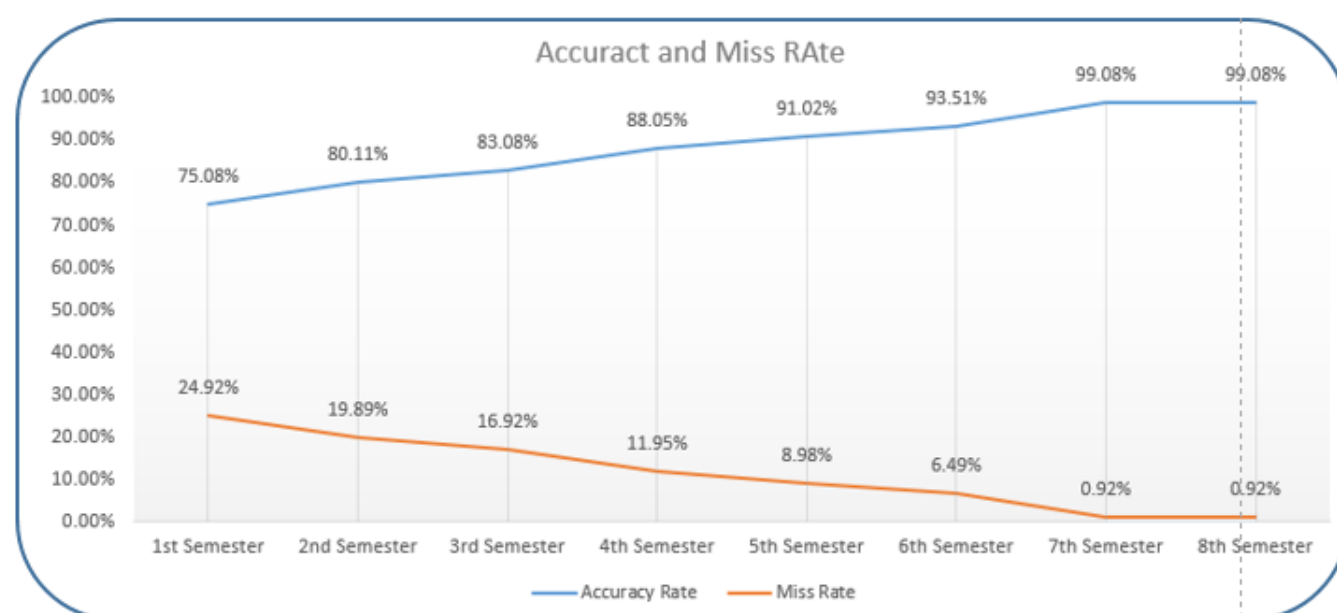
✓ Number of hits of successful graduation. Total number of data is 103

✓ Number of hits of unsuccessful graduation. Total number of data is 25

Conclusion

The prediction of successful or unsuccessful graduation can be used in various ways. One of the most common used way is to analyze students' educational behavior. It is very useful to know in what aspects students face difficulties. By finding those data or information the educational system can be adjusted to teach in more effective way.

Another significant contribution of this research is to let students' know or be aware of unexpected risk of failures and motivate them to study harder in order to graduate successfully.

The future research direction of this study is train the model in different conditions such as in different test size or different randomized form in order to get more specific accuracy rate and make our claim of success even stronger.

In the future there are going to be added more data such as grades of elective courses to make our data even more complete. After adding more data other features is planning to be predicted such as department PR and others.

References

[1] Chatti, M. A., Dyckhoff, A. L., Schroeder, U., & Thüs, H. (2012). A reference model for learning analytics. *International Journal of Technology Enhanced Learning*, 4(5), 318–331.
[2] Peña-Ayala, A. (2014). Educational data mining: A survey and a data mining-based analysis of recent works. *Expert Systems with Applications, 41*(4, part 1), 1432-1462.
[3] Sumit Saha (2018) A-comprehensive-guide-to-convolutional-neural-networks-the-eli5-way-3bd2b1164a53