Differentiating Computer Science Courses in Undergraduate and Graduate Level

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Introduction

We have BS and MS programs in Computer Science. As some graduate students come to MS programs without prior computer science background, they need to take certain pre-requisites before they take the master level courses. Meanwhile, we offer the same courses to both programs, most likely these courses are elective courses which are developed based on the current market need, such as Data Mining and Big Data, Computer Vision, Machine Learning, Artificial Intelligence, undergraduate/graduate Capstone Project to prepare students for their future career interests.

Therefore, we need to adjust the contents and assignments to differentiate the undergraduate and graduate levels, so that students could benefit the most from each course. As an example, the curriculum for Data Mining and Big Data course is shown in the middle.

The same is done for CS 470 Introduction to Artificial Intelligence and CS 665 Advanced Artificial Intelligence. CS 460 Undergraduate Capstone Project and CS 699 Graduate Capstone Project. Since many undergraduate students are interested in research in Computer Science and pursuing graduate degree, we give the undergraduate students a choice for their term project: programming project or survey research paper.

An Example

	Undergraduate Level	Graduate Level
Course Number	CS 430	CS 675
Course Title	Intro to Data Mining and Big Data	Advanced Data Mining
Textbook	Introduction to Data Mining, ISBN: 0133128903	Data Mining: Concepts and Techniques, ISBN: 9780123814791 & Research Papers from ACM and IEEE Resources
Course Contents	- Intro to Data Mining - Data - Classification: Basics - Classification: Alternatives - Association Analysis: Basics - Association: Advanced - Cluster Analysis: Basics - Cluster Analysis: Additional - Anomaly Detection - Big Data and Related Technics	- Introduction - Getting to Know Your Data - Data Warehousing and OLAP - Pattern Mining: Basics and Advanced - Classification: Basics and Advanced - Cluster Analysis: Basics and Advanced - Outlier Detection - Data Mining Trends and Research Frontiers
Project Assignment	Choose one of assigned Data Mining Projects and Implement it: - Data mining for weather prediction and climate change studies - Web Mining Techniques - Mining of government data for getting valuable information	N/A
Research Assignment	N/A	Writing a 10-12-page research paper: - Survey current research work on one of the selected data mining areas - Present the challenging issues of the current research - Present possible ideas/solutions to tackle one of the challenging issues
Quizzes/Exams	Weekly Quiz, Midterm and Final Exam	Chapter Quiz, Midterm and Final Exam, Research Presentation

Conclusions

Although both levels of each course are overlapped in certain contents, the two major differences are as follows:

Pace and Depth of the Contents

The teaching pace and depth varies between two levels, as we teach more materials and present current research work for each topic on the graduate level, and for the undergraduate level, we start from the basics, and gradually move to the existing algorithms to solve the problem.

Assessment

For the undergraduate level, we normally give a project and students are required to implement it based on the given algorithm(s). For undergraduate students, we give an alternative: a programming or research paper. Also, weekly quiz and midterm/final exam are required to enhance the learning outcome of the basics. For the graduate level, a research paper is required and plays an important role in the final assessment. Students need to read assigned papers and perform a survey, analysis, and investigation of the possible solutions to the current challenging issue(s). A term paper/project and its presentation, quizzes after each chapter, online and in-class discussions, midterm and final exams serve as the base for the final grade. This research work serves as a direction for undergraduate students to pursue a graduate degree and for graduate student to study further.

Our future work will be focusing on other aspects of learning outcome comparisons; and integrating students' job placement into consideration.