The Impact of UVA's Machine Learning Class (CS 4774) on Students: How its Benefits can be Augmented

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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ABSTRACT

UVA's Machine Learning course (CS4774), is very beneficial to computer science students. However, it could become a more useful experience if it were more engaging for students. To this end, I propose more professor-class interaction, additional in-class activities beyond quizzes, and in-person demonstrations. Anticipated outcomes of this class include a better understanding of the way machines learn to make once-human jobs easier. For the future, this class should focus on its strongest components like its hands-on homework and in-class examples so it can educate students even more effectively.

1. INTRODUCTION

The world of computer science has been struck by the innovations of machine learning. This has led to machine learning classes being implemented into CS curriculums at universities nationwide. At the University of Virginia, the machine learning class is an elective called CS4774. However, as with any class, the teachings are not perfect and there are flaws worth fixing so that students are better equipped to meet the real-world requirements of the machine learning world.

For example, many students complain of lectures being dry. Some professors do not add a lot of material to the slides, which can be read by students in a fraction of the time required for a lecture. However, students appreciate that the class is mostly project-based with no exams. This way, they show their knowledge through application rather than memorization.

2. RELATED WORKS

I consulted current students taking CS4774 to discuss their experiences in the course and how to improve it. Students mentioned that they did not understand the course material and felt a disconnect between in-person lectures and homework. While they stated that quizzes reflected the lecture material more closely, they also felt confused as to how to answer questions as they had not been able to digest lecture material (Ahmed, 2023).The input of current students weighed heavily into my proposal, as I proposed changes directly from their suggestions.

Additionally, I viewed the most recent syllabi from machine learning classes at UVA and other institutions with a highly regarded CS degree. The classes include CS4641 at the Georgia Institute of Technology, COS324 at Princeton University, and CS446 at the University of Illinois Urbana-Champaign. At Georgia Tech, the course emphasizes the mathematical aspect of machine learning and graded class attendance At Princeton, also highly mathematical, there is much more weight on exams than project-based

learning (Princeton, 2019). Finally, at University of Illinois Urbana-Champaign, there is an option between choosing to take the class as 3 credits or 4 credits, with the difference being that the 3-credit class lets one drop a homework grade (University of Illinois, 2023). I compared and contrasted how these other institutions teach to see what can and cannot be changed. Even though students complained of too much math in lecture, I realized this was not changeable as it was a core component of the course.

I also consulted Course Forum reviews of the class. While there are no reviews on the website for the most recent semester, there are reviews for a previous professor. They stated mainly that he was a good lecturer and the class covered important topics in the realm of machine learning. On average, much time was dedicated to programming and the class was considered reasonably hard, but highly recommended to CS majors (University of Virginia, 2022). Seeing how a different professor at UVA taught this course was integral to my proposal, as it involved using some successful strategies in previous semesters of CS 4774.

3. PROPOSED DESIGN

To propose a solution to the current problems in the CS 4774 class, one must look at the class's current structure and weaknesses and challenges.

3.1 Overview of Current Class Structure

Currently, the class follows a lecture-based structure. The class is slated to have ten quizzes, each providing 1% of the final grade. The five homework assignments are each worth 14% of the final grade, and the final project is 20% of the final grade.

3.2 Weaknesses to Improve

To understand the weaknesses to be improved, I looked at online reviews and did online interviews to learn about student needs and class limitations.

3.2.1 Student Needs

Through using various studies and interviewing students, I found that their needs pertain not only to learning the course material, but also to enjoying the class. Many students thought the class would involve hands-on activities beyond simple mathematics. For example, they believed they would be able to make real-life applications like ChatGPT or their own AI software.

3.2.2 Class Limitations

Course content aside, students cited various weaknesses in the class. They believed the class lecture content was dry and they could not absorb much of the material. Some students also cited a disconnect between the lecture material and the homework assignments due to the lack of hands-on activity.

3.3 Changes

To propose the most effective changes, I derived specifications from my research of student needs. I then discussed challenges to these proposed specifications and solutions to the challenges.

3.3.1 Specifications

To propose changes effectively, certain specifications should be put in place. From interviewing students, I learned that recommended specifications included more hands-on practices in class and more live programming. Another suggestion was more student-teacher interactions where the professor would ask if people had questions or would ask questions for volunteers to answer.

3.3.2 Challenges

There may be challenges to these proposed changes that affect their implementation. For example, live programming may be time-consuming for both the professor and the class. Additionally, live code may not always perform as planned. Student-teacher interaction may backfire if students in class are not already engaged to a degree. Some students may naturally not be inclined to speak up due to fear of being wrong.

3.3.3 Solutions

For live programming, the professor can have a quantity of the code written and tested to mitigate any possible mishaps during class. Moreover, the professor can begin the class with easier, more general questions related to machine learning as a discipline, or students' life experiences rather than specific course material. As the class time progresses and the students build knowledge and confidence, the questions may become more rigorous.

4. ANTICIPATED OUTCOMES

If the proposed design were to be implemented, there are various anticipated outcomes. For instance, students would better absorb the lecture material. This would manifest into higher quiz results and better performance on homework assignments. Beyond higher grades, there would be increased ability of students to teach machine learning concepts to other students and apply these concepts to the real world.

5. CONCLUSION

This project is a review of one specific computer science class at UVA. It gives a case study of the limitations of the teaching in the discipline, but also the strengths and how to improve learning in the course. With an emphasis on student testimonies, it gives an analysis of how to cater these classes for the primary consumer. Through completing this project, I learned how to give interviews and a new perspective on how to improve the CS teaching field as a whole.

6. FUTURE WORK

The insights gained from this project are fundamental to improving the machine learning class. In a broader sense, the lessons learned on students' learning can be applied to similar classes. In CS in general, there is work to be done in terms of pedagogy for the next generation of computer science students. With more case studies of CS courses like this one, there will be an improvement upon the overall pedagogy.

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