Detecting computing-enabled interdisciplinary domains using the MIDFIELD data set

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I. Merged draft

The computing domain has historically engaged with other branches of study to create new interdisciplinary programs. These specialized programs offer both a targeted approach for solving complex issues as well as acting as a point of attraction for students to enroll is one university over another. The curriculum of these interdisciplinary programs often include courses from their respective "parent" fields. For example, bioinformatics curriculum can include courses from both computer science departments as well as biology departments.

The Multiple-Institution Database for Investigating Engineering Longitudinal Development (MIDFIELD) project has collected complete course records of every student's path towards degree for eighteen Universities across the United States of America. This data allows us to construct sets of courses that students chose to complete to fulfill their institution's requirements for graduation. We interpret this set of courses as representing the knowledge, skills, and abilities (KSAs) of the students who graduate with a given degree, which we use as our theoretical framework.

This work analyses the robust MIDFIELD data set in order to identify overlaps between interdisciplinary degree course requirements and their "parent" degree course requirements. The set of courses that are shared between curricula can indicate to curriculum designers both the set of courses that other institutions have deemed sufficiently relevant to include, and also the courses that have been offered through other departments.

This study helps lay groundwork for promoting interdisciplinary majors between computing and other STEM fields. Research has demonstrated how a diverse team of computing-enabled professionals contributes significantly to solving complex problems. Implementing interdisciplinary majors can make computer science programs more attractive to students with marginalized identities who seek to bridge the gap between their lived experiences and the fundamentals of computer science. As such, this study aims to identify fundamental computer science courses that other programs can use and extend to create interdisciplinary majors.

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II. Tim's Draft

A major contribution of the computing sciences historically has been to enable other branches of science the knowledge and skills to further their own endeavors with the use of computation.

This has led to the creation of several interdisciplinary fields such as bioinformatics, computational chemistry, and computational physics. These specialized fields offer both a targeted approach towards furthering our collective knowledge as well as acting as a point of attraction for students to enroll is one university over another.

The curriculum of these interdisciplinary programs often include courses from their respective "parent" fields. For example, bioinformatics curriculum can include courses from both computer science departments as well as biology departments. The number of courses that are specific to the "child" field need not be as large as the number of courses offered by the "parent" field(s).

The MIDFIELD project provides a robust and detailed data set of the courses that students have taken as they complete their degrees. This project uses the MIDFIELD data set to determine the courses that students have taken on their paths to degree completion. The dataset has course information dating back to 19XX, and can therefore reveal interdisciplinary degree creation and growth over time.

Curriculum analysis is suited for quantitatve methods of analysis due to the size and quantifiability of the courses that comprise a curriculum.

This work presents a quantitative analysis of overlapping courses that students have taken as they completed computer science and related interdisciplinary undergraduate degrees. Detecting the course overlaps from a large dataset such as MIDFILED gives insights into the core courses that universities have required students to complete. The overlap between computer science and interdisciplinary courses can be used by curriculm designers to determine which courses would most quickly develop new interdisciplinary programs. For example, if a large portion of a desired but not yet implemented program is already offered by a university, then this study can identify which courses are highly critical to the creation of the new program.

III. Randi Draft

A. Problem statement

Degree programs for computer science students are often rigid, giving students few choices in courses, course sequences, and time to graduation. Courses within these degree programs have historically been accessible only to computer science majors. In recent years [maybe], universities have begun to shift particular computing courses to intersect with those in other departments which rely on computational methods, such as biology (bioinformatics) and genetics (genomics).

B. Importance of interdisciplinary

Interdisciplinary degree programs such as these allow for a diversity of entrance pathways for students from non-traditional backgrounds. These differing entrance pathways can promote inclusivity, allowing students multiple routes to graduation not outlined in a rigid degree pathway. While the importance of interdisciplinary fields and programs are well-known, the extent to which courses overlap between degree programs has not been investigated.

C. Theoretical Framework

D. Gap the work fills

Our work seeks to better understand the flexibility of these courses and their utilization within and between different degree programs through the following research questions:

E. RQs and hypotheses

RQ1: What are the most overlapping degree programs in the computing disciplines? RQ2: What are the most frequent courses to migrate between within computing disciplines?

F. Methods

This project uses data from [x] institutions retrieved from the MIDFIELD (Multi-Institutional Database for Investigating Engineering Longitudinal Development). Using techniques from Boolean algebra and descriptive statistics, we identified undergraduate degree programs with the highest and lowest percentages of overlap with computer science curriculums. We then used course data within the degree programs to determine the levels of course overlap between degree programs.

G. Results

Our findings show [x] degree programs as having large (x) percentages of overlap with computer science programs. [go into courses that make up these programs and their overlap]

H. Discussions

I. Impacts

Results from this project indicate specific degrees and courses which allow students easy entry points to an interdisciplinary degree pathway.

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