Dissertation Defense
Doctor of Philosophy in Information Science

"Explainable Course Recommendation: Connecting College Education to Future Careers Through Skills" by Hung K. Chau

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Committee:

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Abstract:
Academic choice and exploration are essential aspects of undergraduate education in the United States, allowing students to select courses with minimal restrictions. However, students often face challenges navigating the complex academic landscape due to limited information, guidance, and an abundance of choices. Time constraints from the academic calendar and high demand for popular courses make a thorough evaluation of options difficult. Although academic institutions provide career guidance counselors or advisers, the number of advisers is still limited. Course recommendation systems aim to offer personalized suggestions based on students' academic backgrounds, preferences, skills, and career goals. However, there is a lack of research on students' perception of recommendations and the provision of explanations to help them evaluate course relevance. Moreover, the majority of course recommender systems concentrate only on the context of learning in high education. Despite the importance of career goals, none have attempted to establish a connection between learning and work by incorporating job information into course recommendation and explanation.

I first investigate different methods for recommending courses in higher education using natural language processing and deep learning. I find that a simple word2vec approach to course-to-course articulation, DescVec, performs as well as the course2vec machine translation model. However, the course2vec model is shown to contain novel useful information in addition to what is found in the course description. The concatenated course2vec and DescVec model performs best. I also explore how the O*NET Detailed Work Activity (DWA) could frame the knowledge offered in a course, field-of-study (FOS), and university. By representing syllabi based on their relationships with DWAs, I can model a FOS and university in terms of their relationship to each DWA through the associated syllabi. This framework allows me to explain differences in taught skills within and between college majors that correspond to earnings differences of recent graduates. The results offer a novel approach that connects college education to future work. In addition to the DWA taxonomy, I propose a method to automatically extract concepts from course descriptions using deep learning without requiring manually labeled data for model training. The expert evaluation validates the quality of the extracted concepts, indicating the potential for practical applications of the concept extraction model in the field of education. Finally, I develop a career-oriented course recommender and conduct a user study at the University of Pittsburgh. Both DWA and Concept systems show promising results, with students finding the recommendations valuable and expressing interest in enrolling in the courses. The explanation also has a positive effect on the recommendation, with many users agreeing that it helps them determine their interest in the recommended courses. I further investigate the impact of skill-based explanation on a serendipitous course recommendation system. I use the AskOski system powered by an adaptation of BERT4Rec, a state-of-the-art deep neural network model for top N recommendation. I conduct a user study at the University of California, Berkeley. The results demonstrate that augmenting serendipitous course recommendations with explanations achieves some positive effects.