Edu-ACoCM: Automatic Co-existing Concept Mining from Educational Content

Maitri Maulik Jhaveri, Gujarat University, Ahmedabad, India
Jyoti Pareek, Gujarat University, Ahmedabad, India
https://orcid.org/0000-0002-6825-4803

ABSTRACT

Online learning repositories are the heart of learning content management systems. This article proposes a model that utilizes the educational content of learning repositories, to create and display multiple learning paths to the students. When a student specifies a topic to study, the model creates the learning paths in form of a tree, with student specified learning concepts as the root node and its co-existing concepts as the child nodes. The model also proposes to automatically extract three co-existing concepts: prerequisites, subsequent topics and features. Use of pattern-based mining and a rule-based classification approach is proposed for the extraction of co-existing concepts. Automatically extracted results are checked for meaningfulness and usefulness against expert generated results. Evaluation of the authors’ model on various learning materials shows the appropriate generation of learning paths depicting the co-exiting concepts. The average F1 score obtained for automatic prerequisite extraction is 78%, automatic subsequent topic extraction is 83% and automatic feature extraction is 88%.

KEYWORDS

Concept Map, Features, Knowledge Representation, Learning Material Repositories, Learning Path, Natural Language Processing, Prerequisites, Rule-Based Mining, Subsequent Topics

DOI: 10.4018/IJTESSS.2019010102
INTRODUCTION

The traditional colleges and libraries are being supported by learning management systems and online learning material repositories. Students themselves choose the subject of study, corresponding learning material and the studying path. In such a scenario where there is no physical tutor, the learning management system can help the student in choosing an appropriate topic to study, learning materials and learning path. After an extensive study of learning materials on different subjects the authors have identified that, each learning concept possess different roles when used in different context. Figure 1 shows the classification of learning concepts based on their significant role in a learning material.

The concepts listed in Figure 1 co-exist with each other in a learning material. The presence of co-existing concepts in a learning material can be identified using content specific patterns. Separate patterns exist for the occurrences of definitions, prerequisites, subsequent topics, features and comparable concepts. The learning concepts, its co-existing concepts and patterns to identify co-existing concepts can be found in the same sentence or consecutive sentences. This paper proposes the application of Rule based algorithms on these patterns to automatically identify and extract definition concepts, prerequisites, features, subsequent topics and comparative concepts.

Definitions of Co-existing Concepts

Prerequisite

A concept is learned through statements in which it is defined, implemented or used. Such statements are usually assertive in nature. Hence it is important to know beforehand the technical words used in these statements. Such concepts which are required to be known beforehand are called prerequisites. The nature of prerequisites can be compulsory or optional. For example, ‘stack’ is a compulsory prerequisite for defining and implementing ‘recursion’, whereas ‘recursion’ is an optional prerequisite for defining and implementing ‘Fibonacci series’. The method used for identifying optional prerequisite is to check if the relationship involves words such as can/may/ could and methods used to identify compulsory prerequisites is to check if it involves words such as is/are. Prerequisites for a given concept can be found in:

- Concept definition/implementation statement.
- Textual content when the concept is a title or heading.
- Statements following the definition where the concept is highly theoretical.
- Code snippets corresponding to the concept.

This work shows the prerequisite identification in the first two areas. Table 1 and 2 list the corresponding templates and patterns identified by the authors.
The Rhetoric of Fear: Voices and Stories Told of Faculty Who Engage in Online Teaching
www.igi-global.com/chapter/the-rhetoric-of-fear/181380?camid=4v1a