Concept Representation Prototype using Fuzzy Cognitive Maps

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1 Summary

These past two days I was given the task of reading some research papers[1][2][3][4] [5][6][7][8][9] and finding examples of domain knowledge concepts and concept representation methods used in e-learning environments. I was also given the task of coding a prototype of domain concept representation using Fuzzy Cognitive Maps.

2 Fuzzy Cognitive Maps

Fuzzy Cognitive Maps (or FCM) can be used to represent the dependencies between domain concepts.[1]

![Figure 1: Domain Concept Representation using FCM][1]

3 Prototype Model

In the paper[1], the authors used experts from the domain of computer programming to get dependency values between more than 30 concepts in computer programming. I have used six of those concepts in my prototype as the dependency values between them have been determined by experts.
I have used a 2D array to store this dependency matrix for these six concepts. The prototype allows the user to:

1. Read the material of a concept.
2. Take the quiz of the material.
3. Check his/her progress on various concepts. (This uses the student model designed by the team)

After the student takes the quiz, his/her knowledge level (KL) of the current concept as well as all depended concepts gets updated using the dependency matrix.

\[
KL_j(t + 1) = KL_j(t) + KL_j(t) \times W_{ij} \times p_i
\]

where \( W_{ij} \) is the dependency of \( C_j \) on \( C_i \) and \( p_i = KL_i(t + 1) - KL_i(t) / KL_i(t) \) is the fractional change in the knowledge level of Concept i.

Currently prototype has been built in Eclipse IDE using Java with all data stored in files. The whole model can be shifted to a database based system with all concept and student data stored in a database. This prototype is just to demonstrate an implementation of FCM model and related algorithms for transformation of knowledge levels and student states.

**References**

REFERENCES


