A new personalized learning path recommendation method with Ant Colony Optimization

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Outline

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Motivation

• The educational community has always been interested in having a true personalized learning system

• Such a system can adapt itself when providing learning support to different learners based on their characteristics and needs
Motivation

An ideal e-learning system should include:

• Adaptive content aggregation
• **Adaptive navigation**
• Adaptive presentation
• Adaptive collaboration
Problem Definition

• Content Planning, Learning Path (LP), and Learning Objects (LO).

• Content network can be represented as a graph indicating all possible paths that a learner can take to achieve his learning goal.
Background

• Conventional Intelligent Tutoring Systems (ITS)
  – Use rule-based system to find the suitable path

• Data Mining approaches
  – Induce the path that most ex-learners had taken

• Two issues to consider:
  – Select a set of ex-learners with the same characteristics as the new learner
  – Consider the ex-learners’ learning performances
Ant Colony Optimization (ACO)

- A probabilistic technique to solve computational problems that can be modeled to find suitable paths through graphs [1]
Ant Colony Optimization (ACO)

Short Video:
Ant Colony Optimization (ACO)

• Learners are modeled as ants
• Nodes are LOs
• Edges are possible pedagogical sequence
• Weights on edges are the pheromones
• Pheromones are calculated based on:
  – Ex-learners’ paths and performances
  – Learner’s prior knowledge
  – Learner’s learning styles
Summary of Related Work

• Hung and Hung 2009 [2]
  – Familiar degree of concepts of learners calculated based on an initial test result
  – Mined fuzzy association rules from the familiar degree
  – Constructed concept map as LP using the mined rules
• Wong and Looi 2012 [3]
• Kurilovas et. al. 2013 [4]
Summary of Related Work

• Kardan et. al. 2014 [5]
  – Familiar degree of concepts of learners calculated based on an initial test result
    • Relation between questions and concepts
    • Learner’s score for the questions
  – Use K-Mean to cluster similar students based on the Familiar degree of concepts
  – Used ACO to construct LP
  – Used familiar degree to calculate pheromone
Weaknesses

• Ignore learners gradual improvements (static path)

• Ignore true personalization in favor of group adaptation
Proposed algorithm

• Generate familiar degree after an initial test.
• Update familiar degree after each step based on learners performance on reassessment results.
• Use K-mean to cluster learners with updated familiarity degree.
• After each step, the ACO is used to dynamically select new learning objects for the rest of the course.
• The learning path may change after each step due to improvement of the learner’s knowledge.
• Use the updated familiar degree for the pheromone calculation.
Conclusion

• Designing a dynamic ACO algorithm for selecting the best learning path in content planning problem

Future Work:
• Applying more accurate clustering method
• Parallelization of the algorithm to speed up the process
References


Thank you!

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