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E-learning personalization in programming tutoring system

Content

- Area of research
- Mag
- Recommender systems
- Protus
- Current efforts
- Future work

Area of research

- E-Learning systems
- Adaptive and intelligent web-based educational systems
- Main objective was to implement programming tutoring system that adapt and personalize learning to the needs of each learner

Mag system

Mag system

- *Mag* is a tutoring system designed to help learners in learning programming languages in different courses
- The first completely proposed and tested version was for introductory Java programming course

Mag system

- Preliminary design of the *Mag* system was based on next system requirements:
 - separated user interfaces for learners and their mentors
 - easy-to-access tutorials for learners
 - various examples for every particular lesson
 - different personalized tests for every particular lesson
 - online programming, compiling and running
 - summaries and reports about learner's work
 - functionalities for easy monitoring of learner's work
 - easy adding of new lessons, examples, and tests
 - communication between learners and mentors.

Mag system

- Two main roles exist in the system, intended for two types of users:
 - learners - they are taking the Java programming course and will be using the system in order to gain certain knowledge and
 - mentors - their role is to be the lesson and learner database administrator, to track progress of learners learning and to help them with their assignments
- Therefore, two separated user interfaces are provided for :
 - learner (learner) and
 - instructor (learner's mentor)

Application for administrators

Options for creating new tutorials, examples, tests and lessons

Tabs with numerous reports

List of students

Mag's user interface

List of lessons' titles that allows student to skip one

Student can communicate with administrator (mentor) with messages

Source code area

Results of parsing are displayed in form of short messages and hints

Student can skip the current question

Recommender systems in e-learning

Recommender systems

- Recommender systems use the opinions of a community of users to help individuals in that community more effectively identify content of interest
 - E.g. music, books and movies
 - In eCommerce recommend *items*
 - In eLearning recommend *content - learning objects*
 - In search and navigation recommend *links*
- Help customers/users make *decisions*

RS in an online learning environment

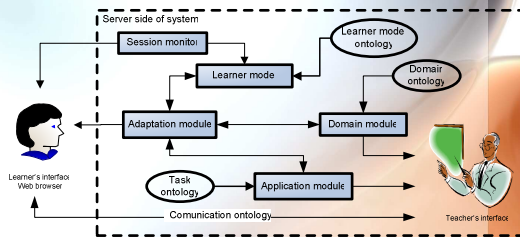
- Discovering useful knowledge – improving instructional/learning performance
- Recommending learning objects that learners should study next
- Providing recommendation about learning objects offered that contribute to the learner's progress towards particular goals
- Research was done concerning the different Cognitive Styles of Learning (CSL) students may have

RS in an online learning environment

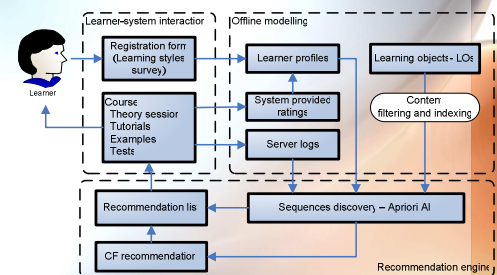
- Different techniques was implemented to adapt content delivery to individual learners according to their:
 - learning characteristics,
 - preferences,
 - styles and
 - goals
- We designed a recommender system for an adaptive and intelligent web-based programming tutoring system – *Protus* (PROgramming TUting System)
- System recommends items to an active user

Protus PROgramming TUting System

Protus system architecture



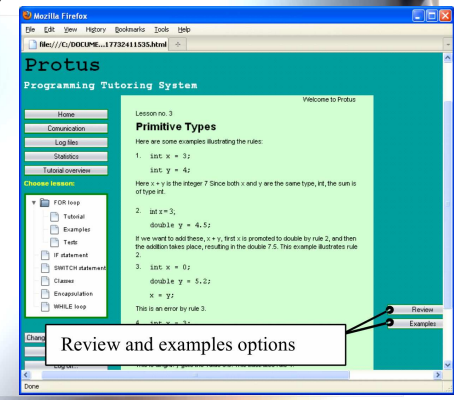
The recommendation component

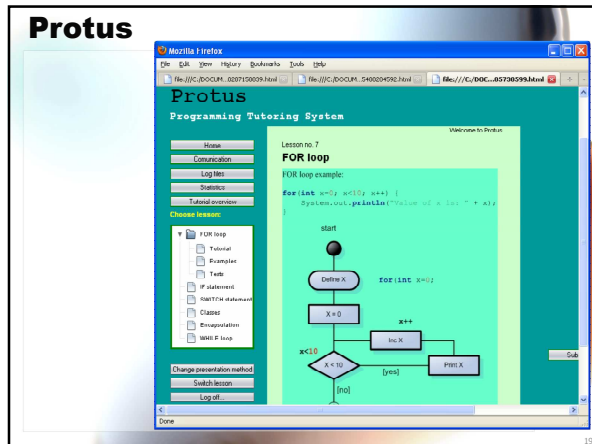


The recommendation component

- The proposed recommender system:
 1. Learning Style identification
 - ⊗ Information Processing: Active and Reflective learners,
 - ⊗ Information Perception: Sensing and Intuitive learners,
 - ⊗ Information Reception: Visual and Verbal learners,
 - ⊗ Information Understanding: Sequential and Global learners.
 2. Mining the frequent sequences in the server logs by AprioriAll algorithm
 3. Recommendation list (CF) - according to the ratings of these frequent sequences, provided by the *Protus* system.
 - ⊗ two learners are similar - if they are evaluated by the system with the same ratings for similar navigational sequence

Protus





- ### Current efforts
- Semantic web
 - The main objective of the Semantic Web is to describe Web resources in a way that allows machines to understand and process them
 - Ontologies allow specifying formally and explicitly the concepts that appear in a concrete domain, their properties and their relationships
 - *Ontologies* require a rule system to derive/use further information that cannot be captured by them

- ### Current efforts
- Educational ontologies for different purposes was designed for:
 - presenting a domain (*domain ontology*)
 - building learner model (*learner model ontology*),
 - presenting of activities in the system (*task ontology*)
 - specifying pedagogical actions and behaviors (*teaching strategy ontology*)
 - defining the semantics of message content languages (*communication ontology*) and
 - specifying behaviors and techniques at the learner interface level (*interface ontology*)
 - We exploit:
 - OWL – Ontology Web Language

- ### Current efforts
- Adaptation rules in Protus can be categorized as
 - Learner modeling rules
 - Adaptation rules (Altering Pattern Navigation)
 - Recommendation rules
 - We exploit:
 - SWRL - Semantic Web Rule Language

- ### Future challenges
- Using Tag-Based Recommender Systems in e-Learning Environments
 - Additional programming courses
 - We plan to incorporate additional courses from other domains

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