Intelligent Tutoring System

Course Description

Intelligent Tutoring System (ITS) is focused towards providing individualized learning experience to the students through application of artificial intelligence techniques. This course covers different topics that relate to student and teacher modelling, development of adaptive systems using core AI techniques like knowledge representation, Bayesian belief networks, cognitive modelling.

Course Objective

Upon completion of the course the students will be able to

- identify and describe different components in ITS architecture
- identify parameters and strategies to evaluate ITSs
- describe and compare different approaches to student modelling
- describe and compare different approaches to teaching knowledge modelling
- explain and compare different cognitive modelling approaches towards ITS development
- classify different types of ITSs
- analyse the features and working principles of different types of ITSs

Course Content

- **Introduction(4):**Foundation of the field, computers in education, ITS architecture and design principles, evaluation.
- **Knowledge Representation (5):** Student model (modelling skill, procedure, affect, complex problems, bug library, planning and plan recognition), Features of teaching knowledge, learning theory based teaching model (Socratic learning theory, cognitive learning theory, constructivist theory, situated learning), animated pedagogical agent
- **Cognitive Modelling and ITS (9):** ACT-R and Cognitive tutor, Constraint-based modelling, Knowledge tracing, Example-tracing
- **Analysis of ITS systems (8)**: Cognitive Tutor (Carnegie learning), Model tracing tutor (ANDES), Constraint-based Tutor (SQL-Tutor), Inquiry-based Tutor (Rashi, Crystal Island), Dialog-based Tutor (AutoTutor, Why2-Atlas)

Books

1. Building Intelligent Interactive Tutors: Student-centered strategies for revolutionizing e-learning, Beverly Park Woolf
2. Student Modelling: The Key to Individualized Knowledge-Based Instruction, Jim E. Greer and Gordon I. McCalla, Springer

References

1. Intelligent Tutoring Systems: An Overview, Hyacinth S. Nwana, Artificial Intelligence Review, (1990) 4, 251-277
2. Theoretical Foundations for Intelligent Tutoring Systems, John Self, Journal of Artificial Intelligence in Education, 1990, 1(4), 3-14
3. (1990), 42(1), 7-49
4. The Construction and Application of Student Models in Intelligent Tutoring Systems, Journal of Computer and Systems Sciences, 1994, 32(1).
5. Cognitive Mastery Learning in the ACT Programming Tutor, Albert Corbett, AAAI Technical Report, 2000
6. Cognitive Tutors: Lessons Learned, Anderson et al., Journal of the Learning Sciences, 1996, 4 (2)
7. Instructional Interventions in Computer Based Tutoring: Differential Impact on Learning Time and Impact, Albert Corbett and Holly Trask, Proceedings of ACM CHI'2000
8. Fifteen years of constraint-based tutors: what we have achieved and where we are going, User Modelling and User-Adapted Interaction, 2012, 22(1-2), 39-72,
9. Using Bayesian Networks to Manage Uncertainty in Student Modelling, Conati C., Gertner A., VanLehn K. User Modelling and User-Adapted Interaction. (2002) 12(4)
10. A New Paradigm for Intelligent Tutoring Systems: Example-Tracing Tutors, Aleven et al., International Journal of Artificial Intelligence in Education 19 (2009) 105-154
11. The Behavior of Tutoring Systems, Kurt VanLehn, International Journal of Artificial Intelligence in Education, 2006, 16