Improving Student’s Programming Ability Using Peer Learning Agent

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Abstract: This paper analyzes the performance of a peer-learning agent system based on pair programming in programming courses. A peer learning agent system is used to improve students’ performance in learning programming language. This system is based on the role of a peer-learning agent from pedagogical and technical aspects and simulates the “tutor” and “tutee”. The peer-learning agent uses Bayesian network to develop a model for determining students’ programming ability. The developed agent system is demonstrated to have positive effects on knowledge retention and transfer in a programming course, with a greater influence on transfer than on retention. The Peer Learning Agent with a teaching and learning strategy is more effective in helping learners to attain programming skills.

Key words: Intelligent tutoring systems · Learning systems · Programming education

INTRODUCTION

The importance of programming courses is increased in this computer world. But many of the students do not have any interest to study these courses. The number of students has decreased to learn programming courses because they perceive computer programming courses as being difficult. Some researchers offered two methods to learn programming. One of the methods is pedagogical aspect to improve students’ programming ability. Pair Programming is the collaborative learning because in which two people are working together for achieving common goal. This learning has proven beneficial to students in programming courses [1].

The other method is technical aspect to get programming skills. Intelligent Tutoring System based on one-on-one tutoring used to teach programming concepts and analyze the cognitive ability through the use of the Adaptive Control of Thought Rational Theory of human cognition.

In Peer learning agent system student act as a tutor and tutee. Here the roles of agent and student will change frequently for each topic [2]. By switching their roles students experienced with “learning by doing” and “learning by teaching” interacted with the peer agent as with a tutor and tutee and attempted to enhance their learning through use of peer agent. Through this peer learning agent system we can easily improve the students' Programming ability, knowledge retention and transfer capacity.

Existing System: Agent based learning system is the Existing system today. In this system the content will be displayed by the agent from the database. The students will learn the content and attend the test [3]. This process will be continued until all the topics covered by the student.

Proposed System: We develop a peer learning agent system for reducing the difficult of studying programming courses. In this system peer agent and student, both are act as tutor and tutee. After studying the programming course content, the student and the peer agent will enter into role [4]. First, the agent send algorithm to the student. The student sends the coding according to the algorithm. Then agent debugs the errors by sending the delayed feedback. After finishing the first topic, the role will change for next topic. In which agent will send the coding according to the algorithm sent by the student. The peer agent evaluates the student and teaches the next topic according to their level of knowledge [5]. Through this role changing, we can easily improve the students’ programming ability.

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Literature Survey: Bagley C.A et al. [6] describes Collaborative learning as a situation in which two or more people learn or attempt to learn something together. He describes that it encourages students to share experiences and learn from others [5]. Usually there is no sufficient time for true collaboration to occur. In this system we cannot gather in same place. Instructor may not be able to monitor groups effectively.

Han K. et al. [7] describes Pair programming that requires two programmers working together at one computer. It improves the quality of the code and reduces the development time, because there are two roles for peers in this system. One will write the coding and another one correct the code. He recognizes that Knowledge transfer between partners is enhanced by switching partners. If a student pair has radically different schedules it will be difficult for them to practice pair programming. Pair programming is affected by a peer’s programming ability.

Hanks B.F. et al. [8] describes that Distributed pair programming, is pair programming where the two programmers are in different locations, working via remote pair programming. People need not to be located in same place. Remote pairing introduces difficulties not present in face-to-face pairing, such as extra delays for coordination, depending on the weight age of the work and loss of non-verbal communication resulting in confusion and conflicts over such things as who "has the keyboard".

Butz C.J. et al. [9] describes that An Intelligent Tutoring System is any computer that provides direct customized instructions or feedback to students. The intelligent tutoring system provides personalized learning content and knowledge using artificial intelligence methods. Here no intervention of human beings. It implements the theory of learning by doing only.

Woods P. et al. [10] describes that rapid prototyping adaptive intelligent tutoring system(RAPITS) is an intelligent programming tutor that teaches Pascal looping concepts. Different teaching styles may be used both for different domain areas and for different students. Systems must allow flexibility in teaching styles as well as in domain material. The student will learn the concept of the particular domain only.

In our project we develop a peer learning agent system. Here we encourage the student to get the full knowledge about the particular topic. The peer learning agent uses the pair programming strategy for teaching. Using Bayesian Network we evaluate the student’s level of knowledge by calculating the probability of their test performance. So that, this system can be very effective.

System Architecture: The Fig. 1 shows the System architecture of our project. Group of students are taken as input. Students are divided into two groups. One is experimental group and another one is control group. Control group learned with the agent based learning system which is a traditional learning method without teaching and learning strategy. Experimental group learned with peer-learning agent system which provides not only learning content and coding practice, but also a teaching and learning strategy.

Peer learning agent explains the learning content to the student. When the student act as driver and the agent act as a navigator, the agent provide the algorithm and the student write the code according to the algorithm. Peer learning agent verifies the code and provides the compiled result with error type and number. Using that delayed feedback, the student debugs the program and produces the correct program [11].

Peer learning agent uses the Bayesian network to quantify the student’s level of the knowledge. For the next topic, peer learning agent will explain the learning content according to the student’s level of knowledge. Then roles will be changed between the agent and Student. That means the student act as navigator and agent act as a driver.

Here student will provide the algorithm and agent will write the code. Student checks the code and finishes by rewriting the errors. The student and agent change the roles alternatively until all the topics learned by the student. The students who learned in experimental group by peer learning agent gain more knowledge than control group students.

Implementation

Bayesian Network Construction: Bayesian Network is constructed using the following procedure.

Step 1: Initiate a graph G (V, E) where V= {all the nodes of a data set}, E= { }. Initiate two empty ordered set S, R.

Step 2: For each pair of nodes (v, v) compute mutual information. For the pairs of nodes that have mutual information greater than a certain small value sort them by their mutual information from large to small and put them into an ordered set S. Step 3: Get the first two pairs of nodes in S and remove them from S [12]. Add the corresponding arcs to E. (the direction of the arcs in this algorithm is determined by the previously available nodes ordering).
**Step 4:** Get the first pair of nodes remained in S and remove it from S. If there is no open path between the two nodes (these two nodes are d-separated given empty set), add the corresponding arc to E; Otherwise, add the pair of nodes to the end of an ordered set R.

**Step 5:** Repeat step 4 until S is empty.

**Step 6:** Get the first pair of nodes in R and remove it from R [13].

**Step 7:** Find a block set that blocks each open path between these two nodes by a set of minimum number of nodes. (This procedure find _block_set (current graph, node1, node2) is given at the end of this subsection). Conduct a CI test. If these two nodes are still dependent on each other given the block set, connect them by an arc. Step 8: go to step 6 until R is empty [14-18].

**CONCLUSION**

Peer learning agent allowed students to learn programming courses together with the agent. Peer learning agent determines the students’ programming ability using the Bayesian Network. According to the students’ level of knowledge in previous topic, the next topic will be taught by the agent. Students’ knowledge retention and transfer are improved through the use of pair programming strategies. The roles of the tutor and tutee are changed for every topic regularly. The use of intelligent and pedagogical methods with a peer learning agent promotes meaningful learning as a cognitive tool.

**REFERENCES**


