Computer recognises students’ difficulties in programming at Aalto University in 2020

Artturi Tilanterä will present their master’s thesis on Computer Science, called *Automatic advice for algorithm simulation exercises*, on 9 March 2020. The thesis was completed for Aalto University. It improves computer-assisted teaching of programming. The thesis delivers a computer software which recognises all the students’ mistakes in the *Build-heap* exercise and makes automatic advice possible.

When a student solves a puzzle-like exercise on a computer, a computer software watches how they work. The computer recognises the student’s difficulty and gives them an advice how to improve – just like a patient music teacher. Piece by piece, the student will learn how the computer would solve the puzzle.

To achieve this, Tilanterä reviewed students’ solution attempts to a puzzle called *Build-heap*. Tilanterä managed to guess students’ thoughts and wrote a computer program which detects different types of thinking. It turned out that 52% of the solutions were correct, 17% had systematic mistakes, and the rest 31% had a logical explanation. Many students solved the puzzle in a wrong order: they mixed left and right, or up and down. Some students understood what a solved puzzle looks like, but did not achieve it systematically.

This kind of computer-aided teaching has been used at Aalto University and its predecessor, Helsinki University of Technology, since early 2000s. Currently, the puzzle shows an image and the student clicks parts of it in a certain order to solve the puzzle. A correct solution follows a set of given rules, and the computer decides whether the student’s solution was correct. Students like the exercises, because they allow individual practise at students’ own pace, instant feedback, and a possibility to retry one exercise many times.

The puzzles and their solution strategies are called *algorithms*. Computing students must know different algorithms to become skilled engineers which make computers solve new problems efficiently.

Students’ difficulties and misunderstandings regarding algorithms have been studied earlier. The new thesis confirms earlier theories and presents new ones. Still no finished product has been made before. “I would be happy to see the software helping students already at the Autumn”, says Tilanterä.

Contact:

Artturi Tilanterä
Master’s candidate
artturi.tilantera@aalto.fi