Program synthesis in the visual programming environment Algot

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Algot [1] is a visual programming environment which supports direct manipulation on the program state. It was designed with three complementary goals in mind; first, to assess student proficiency in algorithmic and procedural thinking; second, to serve as an exploration tool, for example in problem-solving-before-instruction (PS-1) activities; and third, to aid educators in creating instructional materials on algorithms and data structures.

This thesis project is on extending the capabilities of the system by adding support for user-defined functions via the programming-by-example paradigm. This means that by constructing one or more examples, the user should be able to define functions on subsets of the system's variables and data structures.

As a delimitation, the focus of the work should be on supporting simple operations, in particular those that are commonly used by programming novices. Additional complexity can be supported if there is enough time. To implement the feature, various options can be explored, such as using rule-based systems, or supervised or oracle-based learning [2].

The project will be divided in three parts: planning, implementation and small-scale evaluation. For the first part, it should be determined which features should be supported and how they are to be implemented, even though this plan can be changed later. For the last part, either a small theoretical or empirical evaluation would suffice.

The thesis work will conclude with a report and a presentation.

[1] Thorgeirsson, S., & Su, Z. (2021, October). Algot: An Educational Programming Language with Human-Intuitive Visual Syntax. In *2021 IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC)* (pp. 1-5). IEEE.

[2] Jha, S., Gulwani, S., Seshia, S. A., & Tiwari, A. (2010, May). Oracle-guided component-based program synthesis. In *2010 ACM/IEEE 32nd International Conference on Software Engineering* (Vol. 1, pp. 215-224). IEEE.