

The paper "Extracting Features for Computational Thinking from Block-Based Code" by Param Damle et al. presents a novel approach to support undertrained instructors in introductory computer science classes by developing an automated evaluator (autograder) for Snap!, a block-based programming language. The autograder focuses on assessing the computational thinking (CT) elements in the structure of students' submissions rather than their accuracy or runtime. The authors propose an evaluation method that uses XML tree representations of Snap! programs to capture CT elements like abstraction and iteration. This approach aims to provide personalized feedback to students, enhancing their learning experience and understanding of programming concepts.

The authors designed a course centered around Computational Thinking using Snap!, involving personalized instructor feedback on code submissions. The autograder uses a clustering model to group similar programs based on structural features extracted from the XML representation of the code. These features include tree-based metrics like average and maximum depth of nodes and a custom convolution method to measure repetition. The effectiveness of different clustering algorithms, such as K-means, DBSCAN, Gaussian Mixture Models, and hierarchical clustering, was evaluated to determine the best method for grouping student submissions.

Experimental results showed that the Gaussian and hierarchical clustering models were more effective in grouping similar submissions, with a focus on features like repetition and unique children per parent node. The study highlights the potential of the autograder to scale and provide personalized CT feedback in larger classrooms, though it notes limitations such as the lack of personalized coding solutions and the inability to appreciate multimedia outputs. The authors plan to further develop and tune the autograder to optimize its feature extraction and clustering capabilities, aiming to generalize the model for broader applications in educational settings.