BioScratch: Merging Computer Science and Biology in Software Tools for High School Education

Candice Schumann, Abhay Yadav, Ruichi Yu, Alejandro Flores Velazco

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Overview

Biological disciplines play a significant role for the protection and welfare of all living species. Hence, basic knowledge about the diversity of life forms, as well as their conservation and exploitation, is of great importance. In fact, during the last century, biology has become a fundamental part of the curriculum in high schools. With the rise of technology, modern high school teachers are exploiting multimedia resources to convey knowledge to students. Combining different sources, high school teachers can integrate text, graphics, animation, sound, and video, not only to illustrate concepts and knowledge vividly, but also to encourage students to work in groups, express their knowledge in multiple ways, solve problems, revise their own work, and construct knowledge [1, 4]. This project aims at merging advanced technologies in computer science and biology in software tools to help high school education: the idea is to teach computational thinking through the field of high school biology. The research will focus on teaching biology teachers how to teach computational biology methods (e.g., DNA string matching and alignment, building phylogenetic trees, etc.) through interactive visualizations and programming tools. Previous work has focused on teaching computational thinking through high school algebra classes [5]. Leveraging tools such as Scratch, will provide a fun and educational outlet to teach computational biology methods [3]. The reasoning behind this project is to provide an extra outlet to increase knowledge of applications of computational thinking and get more people (including minorities) interested in STEM fields [2].

Intellectual Merit

The proposed research explores how the merging of advanced software tools and traditional curricula can help in fundamental education. To build software tools that can help high school teachers convey knowledge better, the project will leverage the achievements from pedagogy, educational psychology, information visualization and software design, and advance those fields via multidisciplinary collaboration. For example, applying visualization techniques for illustrating biological concepts and algorithms not only helps students absorb knowledge better, but also boost research on pedagogy and educational psychology by analyzing the influence of different visualization strategies to successful knowledge conveyance.

Broader Impacts

The project will help increase public scientific literacy, both in Biology and Computer Science, since it will encourage teaching basic computational biological processes using software tools in an interactive, fun and simpler way. This also would be a wonderful platform to disseminate the state of art results in biology. We also think that it will encourage networking and partnership among biologists and computer scientists. Hopefully this work will provide another opportunity to increase interest in STEM and computational thinking.
References


