Algaeorithm

Technology-Focused Content for Algae Experimentation and Education

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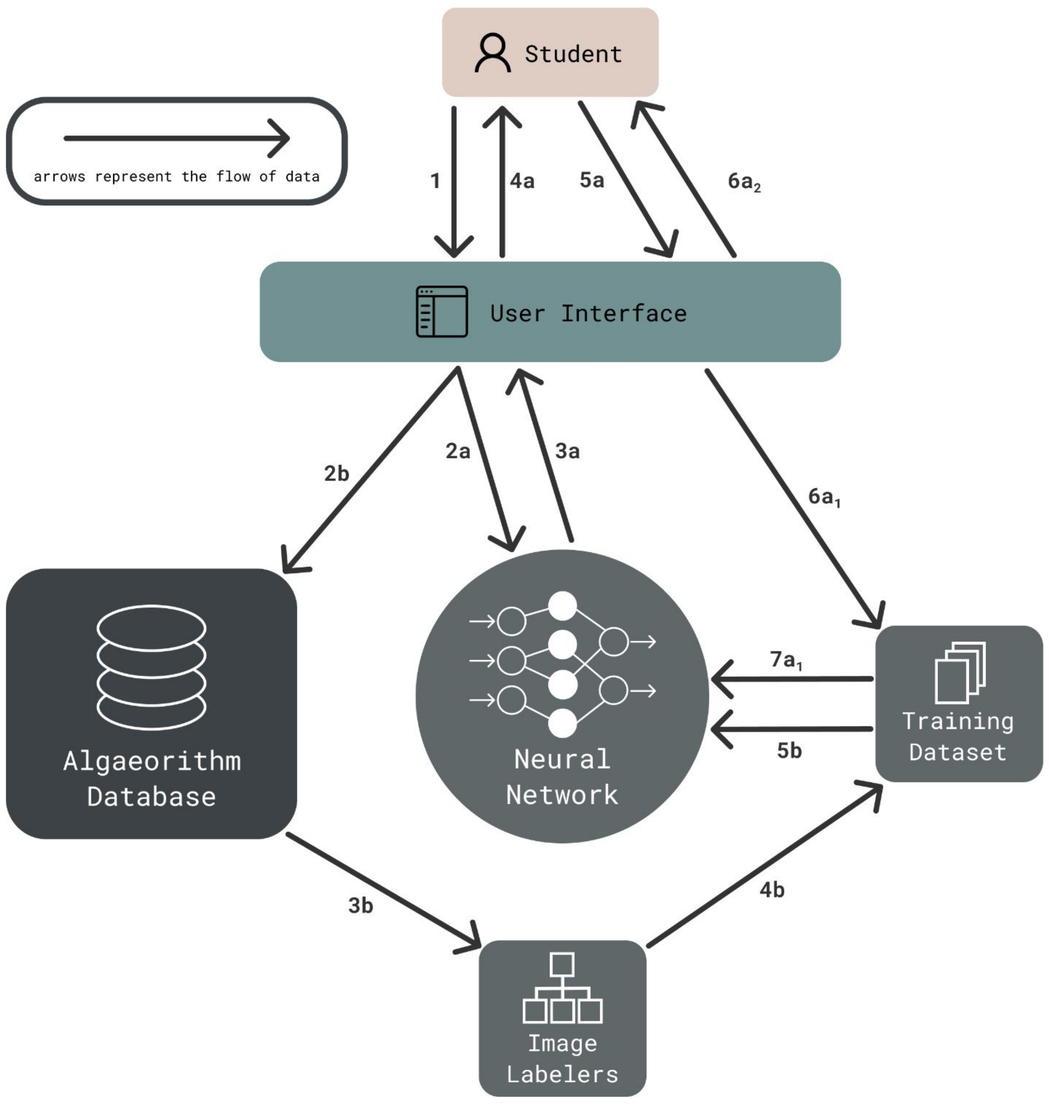
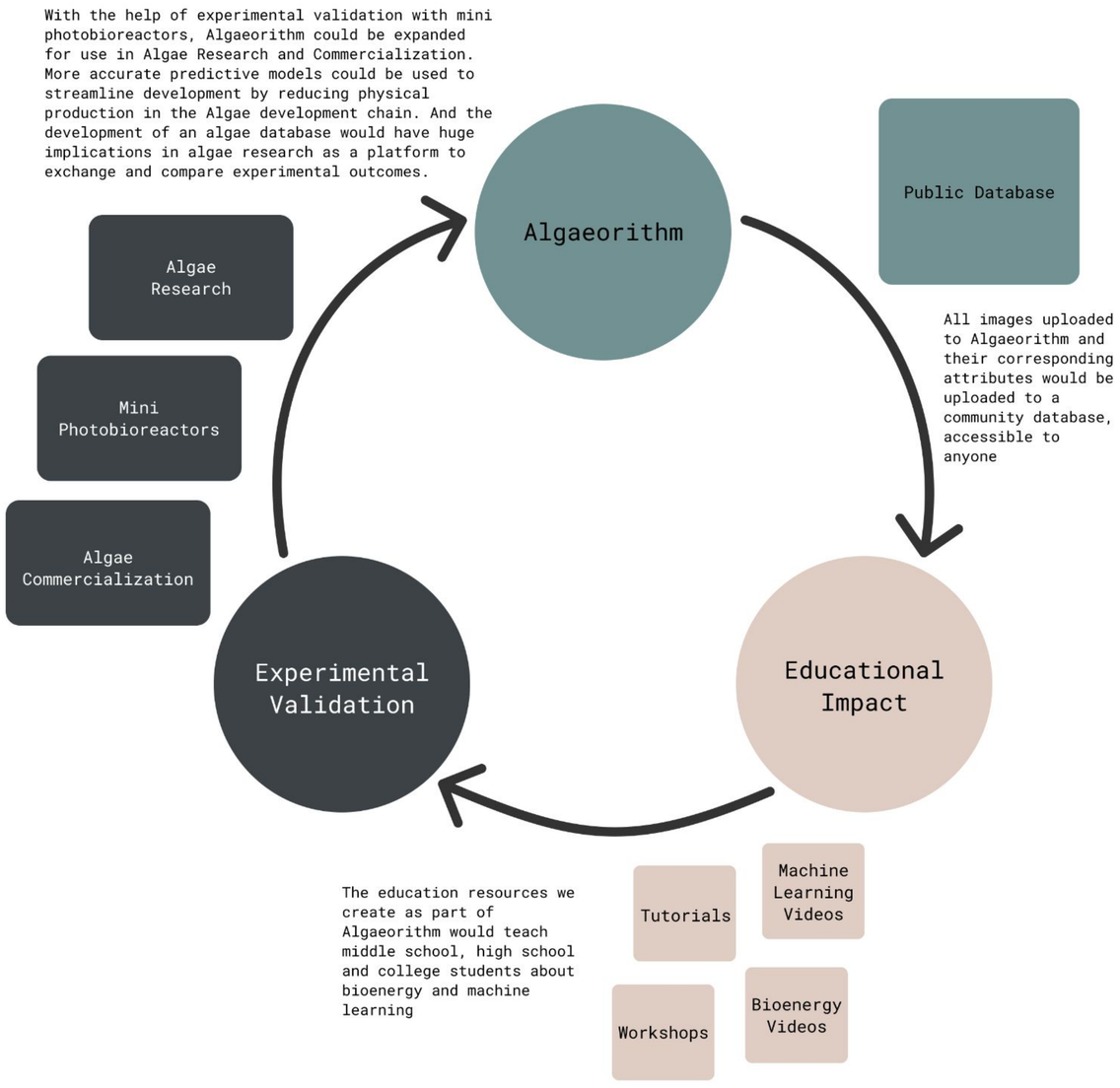
- ★ Machine learning-based web application allows students to conduct advanced microalgae analysis with limited resources.
- ★ Lab protocol standardizes the application's usage in a classroom environment.
- ★ Multimedia content explains algae's potential to disrupt the oil industry and how machine learning works within the context of our algorithms.

Demo Video

Objective: Contribute to an **educational ecosystem** that empowers the **next generation** of scientists and engineers in leveraging **algae biotechnology** to build a **sustainable future.**





Methods

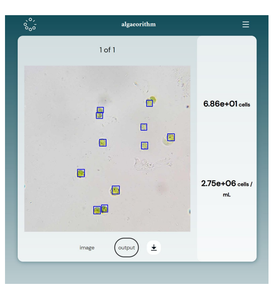
"Technology-Focused Content"

In furtherance of our overall goal to create a one-stop shot for algae experimentation and education within a classroom environment, we separated our goals, metrics, and milestones into three stages: The development of the Algaeorithm application itself, wet-lab research to verify and improve the application's technical feasibility, and content-based educational outreach to interface our research with students. Along with our goals, we also outlined specific technical components, research procedures, and production plans to assist ourselves in meeting these goals.

Technical Development:
Our ultimate goal for the core algorithm was to use the number of pixels in the image, known measurements from the species classified in the image, and the sample depth to calculate the cell concentration in each image and return this concentration along with the corresponding cell count.

Wet-lab Research:
To test and improve Algaeorithm and its core algorithms, we cultivated algae and compared the manually calculated results with the output of the application. Using *Chlamydomonas reinhardtii* and *Phaeodactylum tricornutum* as sample species, our goal was to test the performance of the application with various types of microalgae.

Content Creation:
Currently, the fields of algal bioenergy or bioproducts and machine learning face a significant lack of exposure among high school students. Our project aimed to remedy these issues with video tutorials and demonstrations that allow middle and high school students of all experience levels to use our application and gain valuable bioenergy experience working with algae.



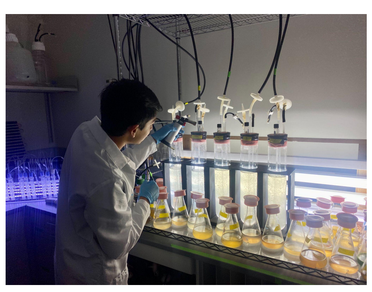


Figure 1: (From left) Neural network output, team member sampling from algae reactors, and the mini-photobioreactors.

Results

After competing development of our core object-detection algorithm and associated application, we shifted our focus to content creation and wet-lab experimentation. We have created multiple educational videos explaining the value of algae manufacturing and machine learning within the context of our application and the bioenergy industry as a whole. We have also developed a comprehensive lab protocol which standardized Algaeorithm's usage in a classroom environment by detailing every step of each experiment, from the purchase of materials to the cultivation and sampling of algae to the manual and automated analysis of algae data. By continuously following the protocol exactly as students would and updating it as needed, we hope to ensure its practicality and efficacy for all Algaeorithm users. The video content and lab protocol will reside alongside our core algorithm within the Algaeorithm application, thereby creating technology-focused content for algae experimentation and education within a classroom environment.

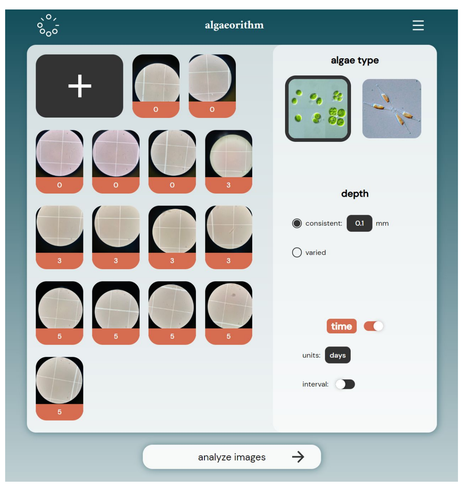


Figure 2: Final version of the Algaeorithm web application.

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