



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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Project Title A Modular and Dynamic GPU-Based Maize Simulation Using L-Systems	
<p style="text-align: center;">Abstract</p> <p>Objectives Plant field testing is often a long and costly process that is crucial to the development of efficient agricultural techniques. We aimed to create a plant topology simulator that presents a significant improvement in speed over other plant simulators by utilizing the GPU in order to model plant growth based on abiotic factors accurately.</p> <p>Methods Each plant, composed of a binary tree structure, is grown iteratively. During each iteration, both the plant and the external environment are updated. Each node keeps track of values for various factors, which affect its growth in each iteration. Nodes are evaluated in parallel using the GPU, which provides significant performance gains and runs stably on most consumer grade computers. We chose to focus on modeling corn due to its status as a staple food in many parts of the world.</p> <p>Results Our final program was able to generate data that was within a 95% confidence interval for actual plant dimensions and resource consumption. Errors can be attributed to lurking and confounding variables unable to be distinguished by the given datasets.</p> <p>Conclusions Our program has applications in 3D modeling of plants, particularly for real-time renders/simulations and uses in plant placement and crop yield optimization. In the future, we hope to expand our program to include a full-fledged plugin system to accommodate other types of plants.</p>	
Summary Statement We created a computer model that utilizes the GPU to simulate large scale plant growth based on several abiotic factors.	
Help Received We designed, programmed, and tested the algorithm independently. We received help from a mentor at our previous science fair and our statistics teacher when verifying our results. We also used data from federal databases, primarily data on plant height and leaf length from the USDA.	