Artificial Intelligence for Weed Identification and Precision Herbicide Application in Strawberry

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Summary

We have successfully trained a neural network to detect and recognize multiple weeds in strawberry fields. We have also integrated this technology into a smart sprayer and proven we can precisely apply herbicides only where weeds occur. Additional modifications are necessary to improve this technology but we are confident that precision herbicide application in strawberry fields is attainable.

Introduction

Artificial neural networks are a type of artificial intelligence (AI) that can be trained to detect and identify objects. Drs. Nathan Boyd, Shaun Sharpe and Arnold Schumann have worked together as a team to train multiple neural networks to identify common weeds found in strawberry fields. The trained AI can then be integrated into a smart sprayer so that herbicides are only applied where the weeds occur. The objective of this research was to train AI to detect and identify weeds in strawberry fields, build a prototype precision sprayer, and test the sprayer in a field.

Results

No data are presented because of the complexity of the models and because research is still on-going. Instead, we are providing a brief summary of our progress to date.

The first step taken was to train the AI to identify weeds. To do this, hundreds of pictures of a particular weed species had to be collected, organized, and modified. The pictures were then used to train the AI to recognize the weed species. The first weed species we focused on in strawberry fields was Carolina geranium (Figure 1). We successfully trained the AI to detect and identify this species. We also trained the AI to detect and distinguish nutsedge, grasses, and broadleaf weeds in row middles (Figure 2).

Next, we built a prototype sprayer to apply Stinger herbicide only where Carolina geranium occurred. We determined during the first field evaluation that the technique worked and reduced herbicide inputs. However, the controller did not have a processor adequate for the models we wanted to run. We are currently rebuilding the controller and hope to continue field trials this coming season.

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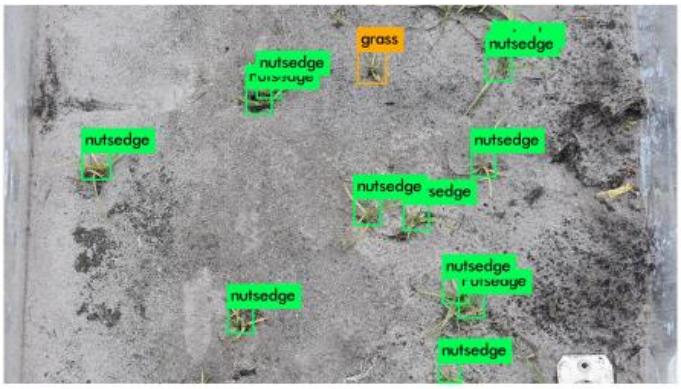
Figure 1. Detection of Carolina geranium in strawberry beds using artificial neural networks. Red boxes indicate where the program detected Carolina geranium leaves.



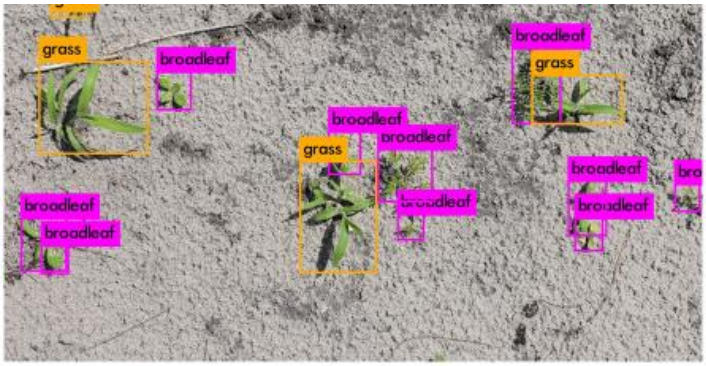


Figure 2. Detection of nutsedge, grasses, and broadleaf weeds in row middles using artificial neural networks. Boxes indicate where the program detected the weed category of interest.