Identifying Beetle Species Using Machine Learning

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INTRO:

Machin learning Artificial Intelligence (AI) hold the potential to benefit farmers and the environment. Computer models can identify lady beetles in images, and, with more training, possibly determine their presence in crop fields. As predators**, lady beetles** could be a strong **indicator** of **aphid infestations**. Using this information and AI technology, farmers could simultaneously **reduce costs** and **environmental damage** by having the ability to identify an infested area and focus pesticide applications on a specified section rather than on an entire field,. Before we reach this point, we must determine whether AI or human identification is more reliable and efficient.

METHODS

1. **Development of images using GoPro HS5**
   a) Took pictures of pinned insects against colored backgrounds at various heights
   b) Cropped images down to individuals
2. **Human Test**
   a) Presented species Word doc for 45s
   b) Removed, then presented photos
   c) Subjects ID while being timed
3. **Computer Test using Neural Network**
   a) Adjusted parameters (image & kernel sizes and # of epochs)
   b) Linked to image folders & ran model

Compare accuracy and time results

Uncropped image | *Hippodamia convergens* (Convergens) | *Coleomegilla maculate* (C-Mac) | *Diabrotica undecimpunctata* (Cucumber Beetle)

RESULTS

- Human Test Subjects proved to be **more accurate** by **4%**
- Computer Model was **fold faster**

Conclusion: With more research and training, the computer model has the potential to become more accurate and efficient at beetle species identification in images than humans.

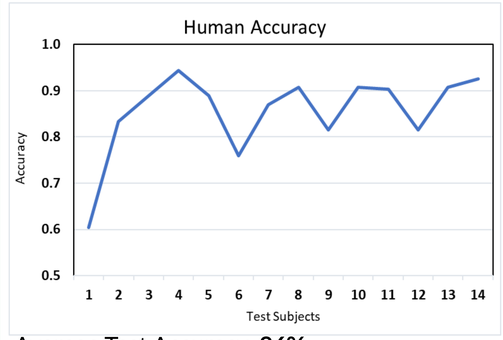
Artificial Intelligence can ID Beetles in images using Machine Learning

Hippodamia convergens (Convergens)

Coleomegilla maculate (C-Mac)

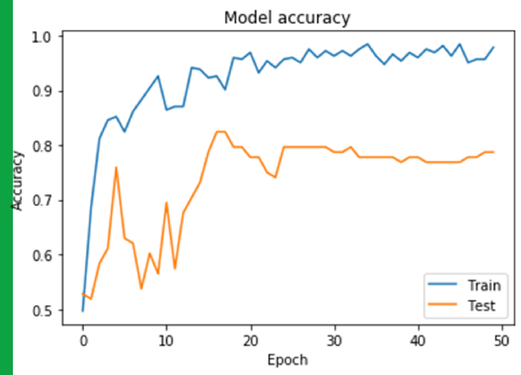
Diabrotica undecimpunctata (Cucumber Beetle)

Scan for video explanation of project!



Average Test Accuracy: **86%**
Average Time: **4 m 19 s**

***Note:** Test subject results ordered by experience to mimic model's "experience progression"(?) during training & testing.



Accuracy of Best Model: **82%**
Time of Best Model: **14 s**

	C-Mac	Convergens	Cucumber Beetle
C-Mac	**25**	13	4
Convergens	3	**30**	1
Cucumber Beetle	2	0	**30**

Confusion Matrix: describes which species the model confused & with what.
- Columns indicate what pictured specimen was, and rows are what the model identified it as.

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