National Institute of Technology, Sendai College, Hirose Canpus

Research on AI learning of fly flight patterns ~Towards pest control~

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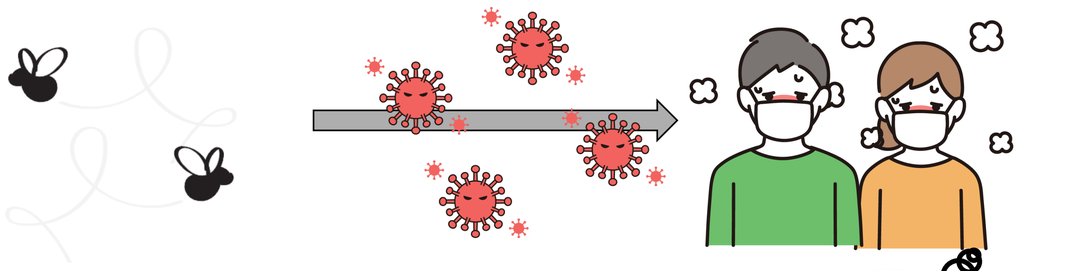
1.PROBLEM



Flies and mosquitoes are responsible for bringing us many vector infections.

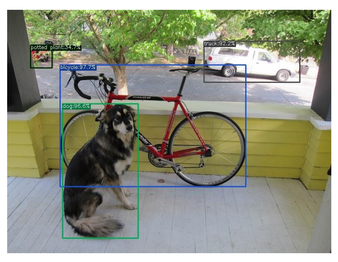
That's why we're using AI
I decided to make something that would automatically get rid of flying flies and mosquitoes

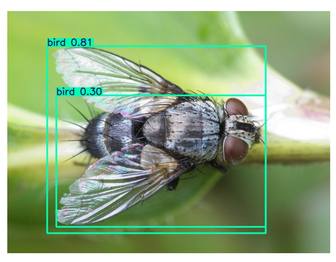
2.METHOD

(1) Detecting flies in videos

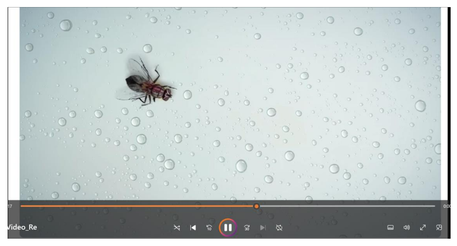
YOLO(you only look once)

YOLO is an algorism that can detect objects



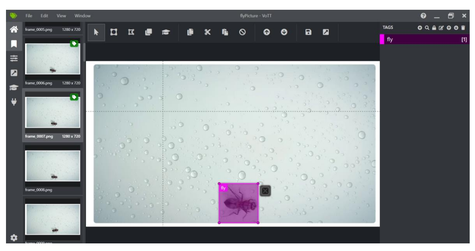


① Data collection



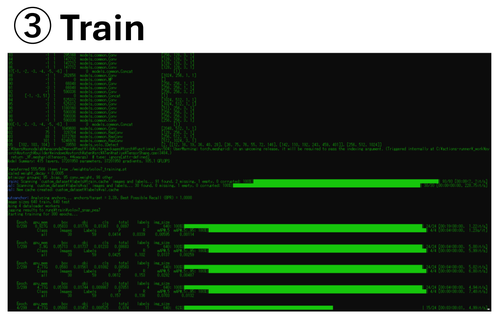
Using the video titled 'Cat Games - Get that Fly on the Window,' data was collected by capturing 10 frames per second.

② Annotation



This time, we used an annotation tool called 'labelimg'.

③ Train

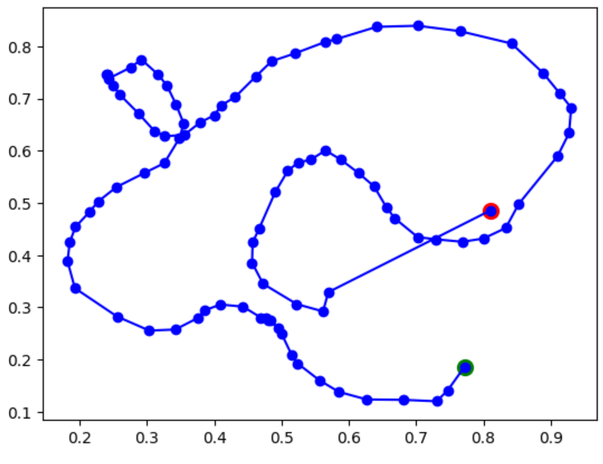


We trained YOLOv7 with 50, 100, and 200 images and then conducted testing.

(2) Locus Plotting

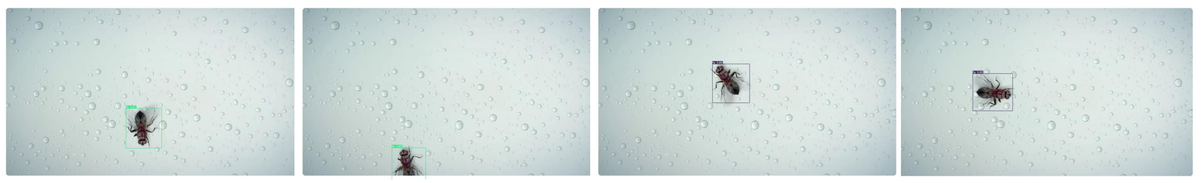
1. Start
↓
2. Enter a list of coordinates
↓
3. Plot points and find trajectory
↓
4. Calculate velocity vector
↓
5. Calculate average velocity vector
↓
6. Calculate predicted position 1 second later
↓
7. Plot coordinates 1 second later
↓
13. Finish

example

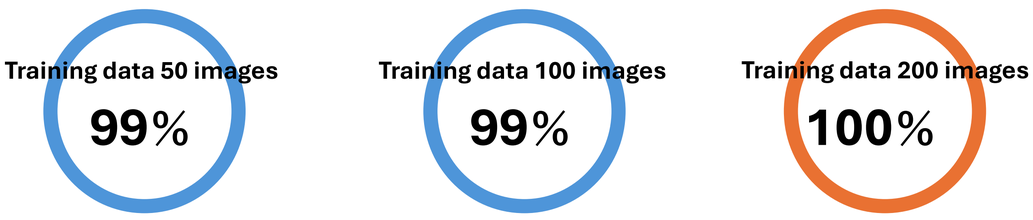


3.RESULTS

RESULTS(1)



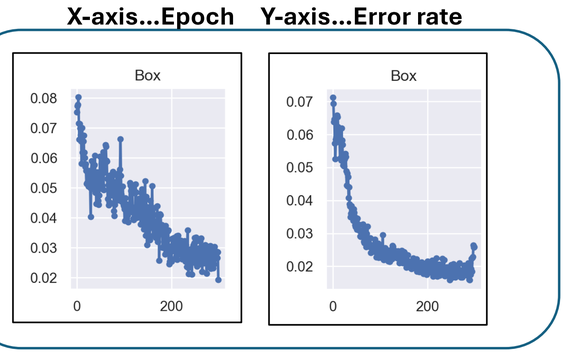
Images detected using the training model in METHOD (1)
The entire fly is surrounded by bounding boxes, indicating that the detection is accurate.



Even with only 50 training images, the accuracy was sufficient. The AI considered that the images were easy to recognize because of the white background.

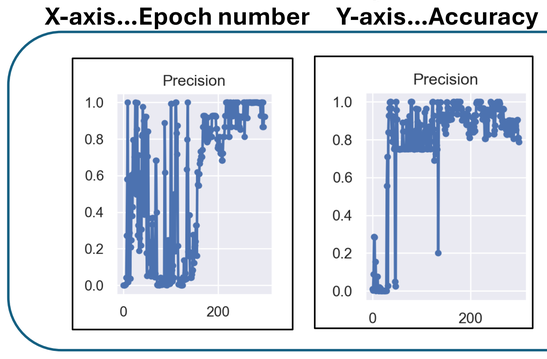
Bounding box error

X-axis...Epoch Y-axis...Error rate



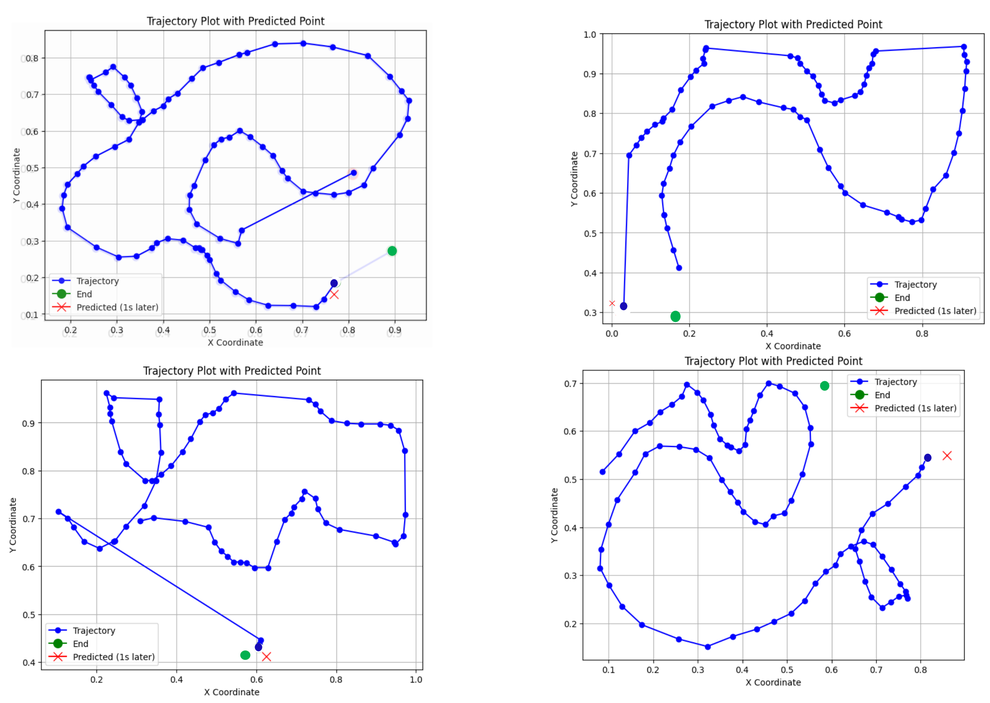
Accuracy

X-axis...Epoch number Y-axis...Accuracy



200 training data is more stable with lower error. Accuracy is also higher.

RESULTS(2),(3)



Red X marks are predicted positions, green circle marks are actual positions

4.CONCLUSION

In this study, YOLOv7 was used to detect flies in videos. The training data was increased to 50, 100, and 200 images in that order, and the accuracy was sufficient even with 50 images. This may be because the object (fly) was relatively large and the background was white, making it easy for YOLO to learn and detect. Next, we considered extermination by plotting the coordinates of the center of the bounding box, drawing a trajectory, and predicting the position of the fly one second later. We found that this could be done by using the calculation of velocity vectors to make predictions. In future research, we would like to actually detect the captured flies. As a first step, we put a fly into a white box with a background of 0.5m x 0.5m and took a video. Based on the video, YOLO is trained to detect the fly. We would like to consider a method that can make predictions more accurately and an extermination method that can set the range considering the error from the actual location.

REFERENCE

[1]Detecting original data with YOLOv7(2022)
YOLOv7でオリジナルデータを物体検出する | FarmL (farml1.com)
[2]How to install and use labelImg(2022)
labelImgのインストール方法と使い方 | Yukkuri Machine Learning (laid-back-scientist.com)
[3]Video of detected flies(2022)
https://youtu.be/CRuxSoKs_jA?si=ofwad3ClpQgXAbSm
[4]Matplotlib(2012)
Plot types — Matplotlib 3.9.2 documentation