Computer Vision-Aided Pet Detection and Diagnostics

PURDUE UNIVERSITY | The Data Mine

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Elanco

Introduction

About Elanco:
Elanco is a global leader in animal health dedicated to innovating and delivering products and services to prevent and treat disease in farm animals and pets, creating value for farmers, pet owners, veterinarians, stakeholders, and society as a whole.

Problem:
We want to utilize computer vision AI systems to enable in-home pet identification and diagnostics.

Motivation:
Perform domestic canine breed identification, key point/feature detection, detect bounding boxes, and assess behavioral classifiers.

Goal:
Given images and videos of animals, we wanted to build and clean image datasets and annotate for training/testing. We also wanted to assess algorithm accuracy for breed identification and behavioral prediction.

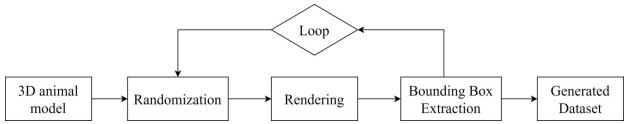
Synthetic Data Generation

To improve dataset size and variation, we developed a custom synthetic data generation pipeline powered by Autodesk Maya

Allowed us generate any amount photorealistic synthetic images with high customizability and versatility.

It can be used as a complement to the open-source datasets when training.

3D model of Dog



Synthetic Data Generation Pipeline

Pose Estimation

We used DeepLabCut's SuperAnimal-Quadruped pretrained model to for key point estimation.

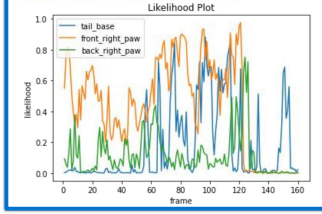
Original Video

Compressed

DeepLabCut

Video of dog pose with DeepLabCut in different frame

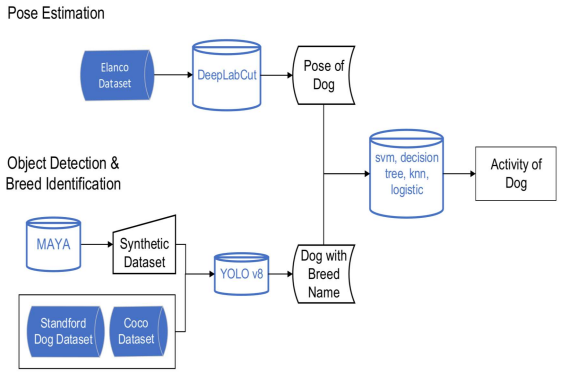
Likelihood Plot



We take the video of the sitting dog from Elanco's internal dataset and compress it with ffmpeg and then run in DeepLabCut. The model generates an annotation file with each point's location and likelihood. We ran 200 video clips in DeepLabCut to generate the training data for our classifier.

The plot on the left shows the likelihood of a body part point in DeepLabCut throughout the course of video input.

Project Workflow



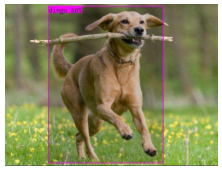
YOLO v8: YOLO (You Only Look Once), an object detection algorithm and image segmentation model.

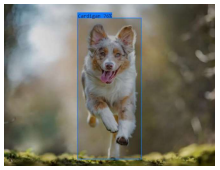
DeepLabCut: An open-source toolbox that builds on a state-of-the-art animal pose estimation algorithm.

Svm, Decision Tree, KNN: Machine learning models that uses classification algorithms for two-group classification problems.

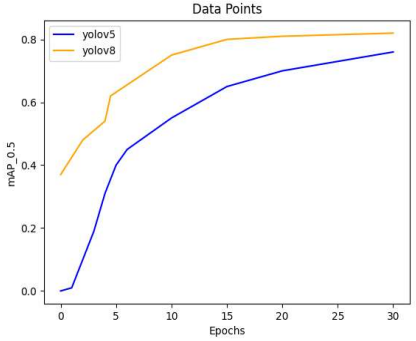
Object Detection

We custom trained the YOLO model for object detection and breed classification by using the Standford Dog dataset, which has 10K images.





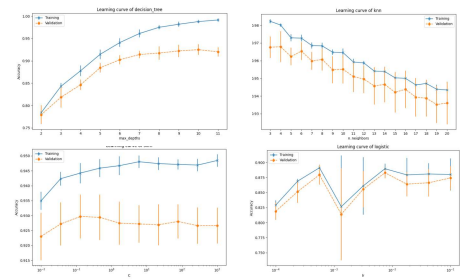
Data Points



Compared performance between YOLOv5s and YOLOv8s and found that YOLOv8s yields better performance with a 90% accuracy.
YOLOV8 is faster and more accurate than YOLOV5, it built on the YOLOv5 framework and includes several architectural and developer experience improvements.

Activity Detection and Results

Used labeled datapoints generated from DeepLabCut to train four different classification model and used cross validation to find best performing model and parameters. Classifiers can determine whether a dog in a frame is laying down or standing. Found that for binary classification, SVM yields the best result with 93% accuracy.



Used KNN model for multiple poses and detect whether a dog is walking, sitting, or laying down in a footage.

Acknowledgement and References

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