iCrow

An AI powered scarecrow to protect your home garden from animal pests

Our Team

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Home Gardening in the US

1 in 3 american households do home / community gardening

Estimated spend of over 50 billion dollars annually

Animal pests damage crop and carry over 60 diseases

Deterrents include chemicals, fence and pet dogs, which ...

... have safety concerns, are expensive & need maintenance

The Problem with Current Solutions...

Problems...	We introduce a device that...
01 Current deterrent strategies fall short	Is non-invasive, non-chemical, and low maintenance
02 Different animals require different deterrent strategies	Works for many types of animal pests
03 Effectiveness of repellent diminishes over time as pests become familiar with them	Maintains its effect as animal pests adapt

Our Mission

Create a **one stop solution** to **protect and monitor** your home garden from common animal pests **without chemicals**, at a **low cost**, requiring **minimal maintenance** and **without the commitment of owning a pet**

Enter iCrow

A compact, low-maintenance, visual and auditory scare device

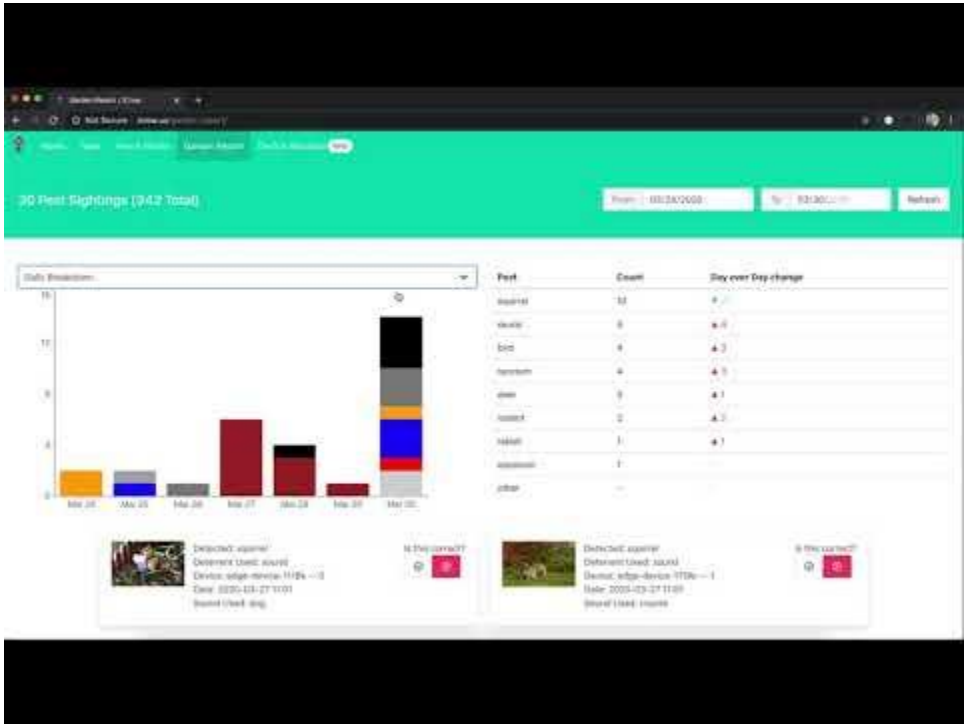
Features

1. Support multiple AI-powered cameras to **identify** the type of animal
2. Animal **specific** deterrent is applied
3. Deterrent **varies** each time to maintain “surprise” effect
4. Both visual and auditory deterrent available depending on **time of the day**
5. Custom **dashboard** provides **analytics** of pests in your garden

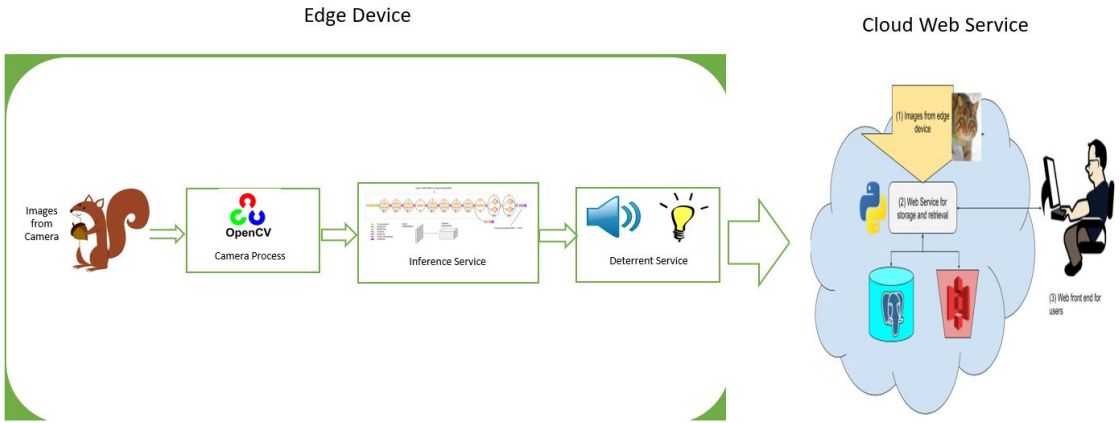
iCrow in Action

Aditya

iCrow Dashboard in Action

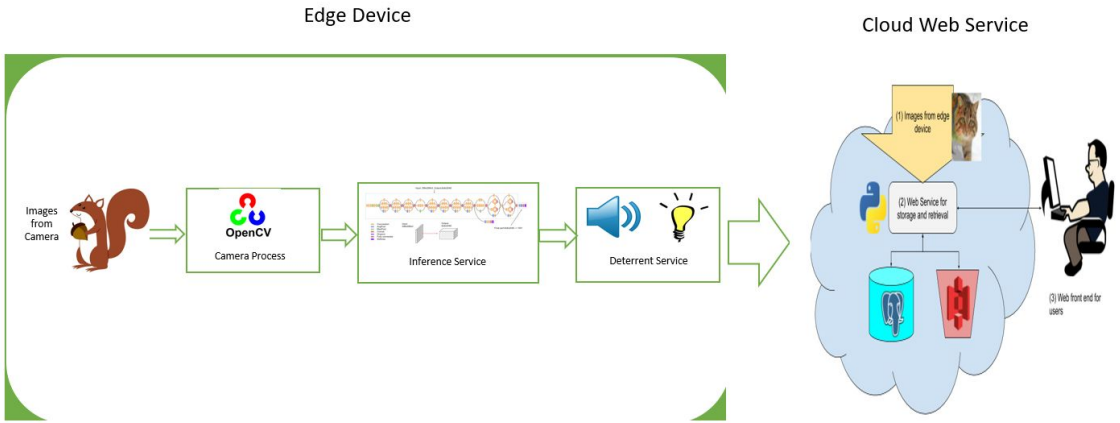


End to End Architecture - Inputs & Outputs



- Camera + Motion Capture
- Inferred pest
- Deterrent deployed
- Web UI for sightings
- Statistical visualizations

End to End Architecture - Assumptions & Choices



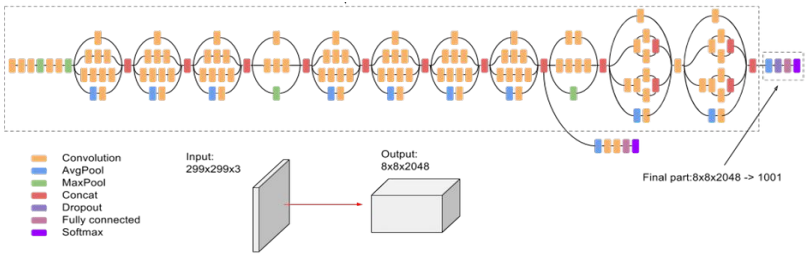
1. Cheap and low power device
2. WiFi access in the garden
3. Use Tensorflow

Raspberry Pi + Motion Detection + TF Lite

Model Overview

- Data
  - Caltech Camera Trap dataset*
  - 243,100 images
- Transfer learning
  - InceptionV3 trained on ImageNet
  - Custom dense layers on top
- Model Structure
  - Model 1: Original InceptionV3
  - Model 2: Frozen body + custom top layers
  - Model 3: Custom top layers + fine tuning full model

InceptionV3 Structure



Custom Top Layer Structure

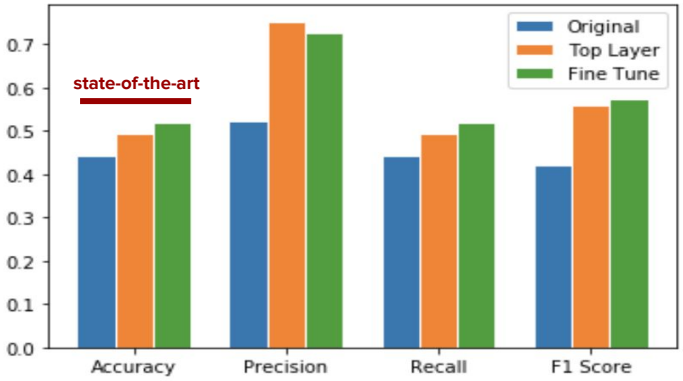
mixed10 (Concatenate)	(None, 8, 8, 2048)	0	activation_85[0][0] mixed9_1[0][0] concatenate_1[0][0] activation_93[0][0]
global_average_pooling2d (Globa	(None, 2048)	0	mixed10[0][0]
dense (Dense)	(None, 1024)	2098176	global_average_pooling2d[0][0]
dropout (Dropout)	(None, 1024)	0	dense[0][0]
dense_1 (Dense)	(None, 15)	15375	dropout[0][0]

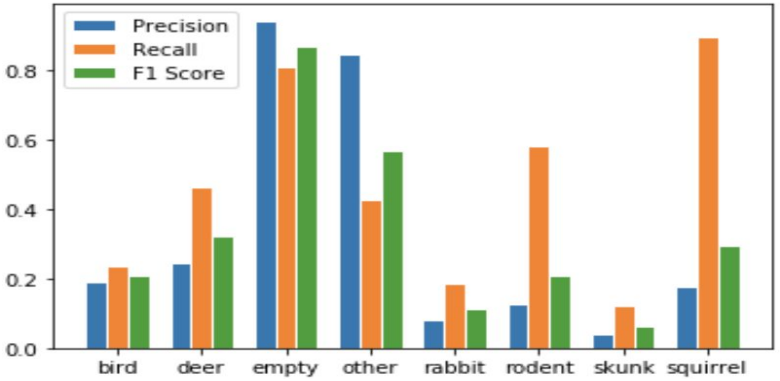
Total params: 23,916,335
Trainable params: 2,113,551
Non-trainable params: 21,802,784

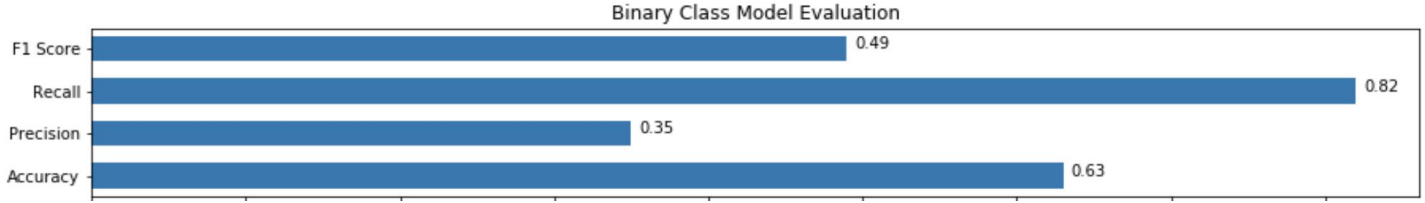
*http://lila.science/datasets/caltech-camera-traps

Model Evaluation

- Fine tuned model performs the best, followed by the model with custom top layers
- “Empty” and “other” classes have high precision and low recall, as opposed to the rest of the classes
- Model achieved 63% accuracy on binary class







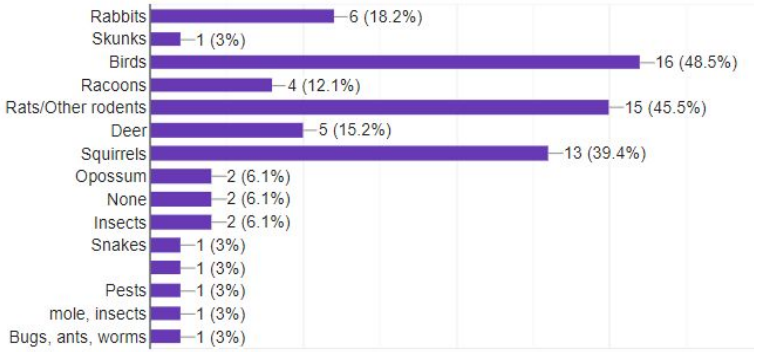
Key Technical Takeaways

- Modelling: Weighted error by class
  - For class imbalance
- Modelling: Image pre-processing
  - Saves time for training for frozen layers
- Edge device: Quantized model saves compute requirements
  - ~80mb to 20mb with 97% recall
- Edge device: multiple python processes over threads
  - python-tensorflow is inherently only built for single-threaded workloads
  - A single python process couldn’t manage two camera devices with OpenCV
- Web Backend: Use datastores optimized for your data
  - Store images in S3 and inference data in Postgres

User Feedback

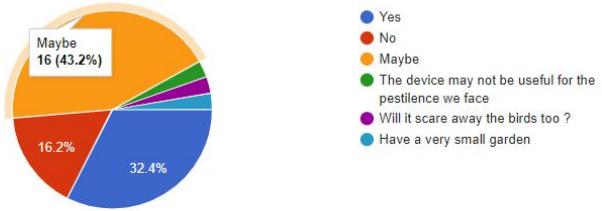
Has your garden been damaged by any of the following animal pests?

33 responses



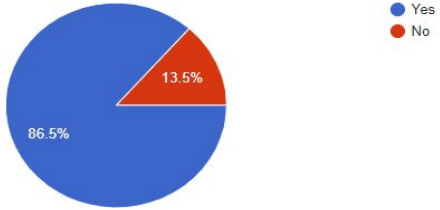
We are building a smart scarecrow device that can identify common animals harmful to home gardens like rabbits and squirrels. Once it sees an animal it uses light and sound to scare them away. Would you be interested in using it for your garden? Learn more here: http://www.icrow.us/

37 responses



Would you recommend this project to any friends or family who own home gardens? Learn more here: http://www.icrow.us/

37 responses



Future Roadmap

Detected: *squirrel*
Deterrent Used: sound
Device: edge-device-1118k -- 0
Date: 2020-03-27 08:01
Sound Used: dog

Is this correct?

- Reinforcement learning with user feedback
  - Push updated models to user device
- More deterrents, more analytics
- Model with bounding box
- Build iCrow community for users

Image courtesy of https://www.gardeners.com/how-to/community-gardening/7339.html

Fence-free

Peaceful

Worry-free

iCrow

Organic

Economical