Project Scarecrow: A Smart Autonomous Surveillance System

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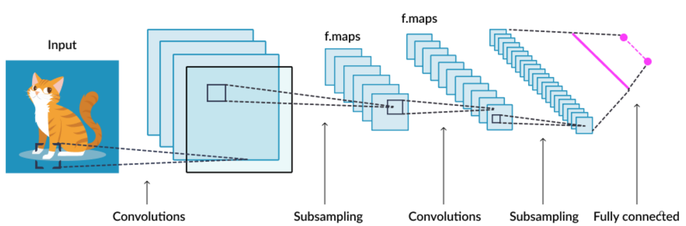
Background

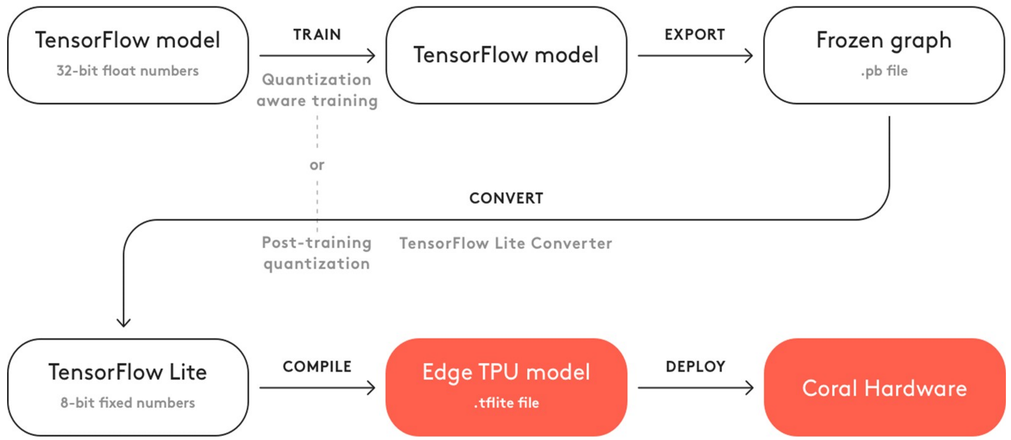
Stray animals that come in close proximity to gardens spread pathogens and ticks that harm humans, plants, and pets. Physical damages include burrowing, trampling harvest, urinating, defecating, and destroying personal property. Gardens enable animals to congregate during mating season. Counterproductive solutions are the use of inhumane traps, pesticides, and primitive idling scarecrows.

Project Goal

- Detect, identify, and classify objects within the device's projected proximity
- Survey an area on a low-power and low-latency standard with millisecond inference times
- Once an object is classified correctly, deter the intruder with basic audio-animatronics
- Ensure portability and handle convolution neural network calculations offline without a cloud



A convolutional neural network (CNN) is a multilayered system that mimics the biological neuron model. A CNN consists of an input layer, output layer, and multiple hidden layers. Each input image will pass through a series of convolution layers with filters (Kernals), pool fully connected layers (FC), and apply Softmax functions to classify an object with probabilistic values between 0 and 1.



Materials

Hardware

- Google Coral Development Board
- Coral camera module
- Stepper motor and driver
- Arduino and Bluetooth module
- Atmega32 Microcontroller
- Atmel-Ice

Software

- Debian Linux (Mendel)
- C, C++, Python
- GStreamer
- Docker
- Open Image Dataset V5
- TensorFlow Lite

Accomplishments

- Able to detect faces and start, stop, and calibrate the motor to track from given control signals
- Use pulse width modulation on the Atmega32
- Able to pair the Coral board with an Arduino Bluetooth module
- Able to classify inanimate objects using an already compiled database
- Built a prototype structure integrating the motor, Google Coral, and several modules
- Restructured project according to ABET guidelines and protocols

Future Work

- Include more biosensors such as a near-infrared camera and pollution monitoring
- Create quality audio/visual animatronics to accompany deterrent protocols
- Transfer learning by full model retraining
- Design and build the scarecrow structure with 3D printed models and natural materials.
- Implement automatic software updates through a cloud connection

References

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