Machine Learning on a Raspberry Pi

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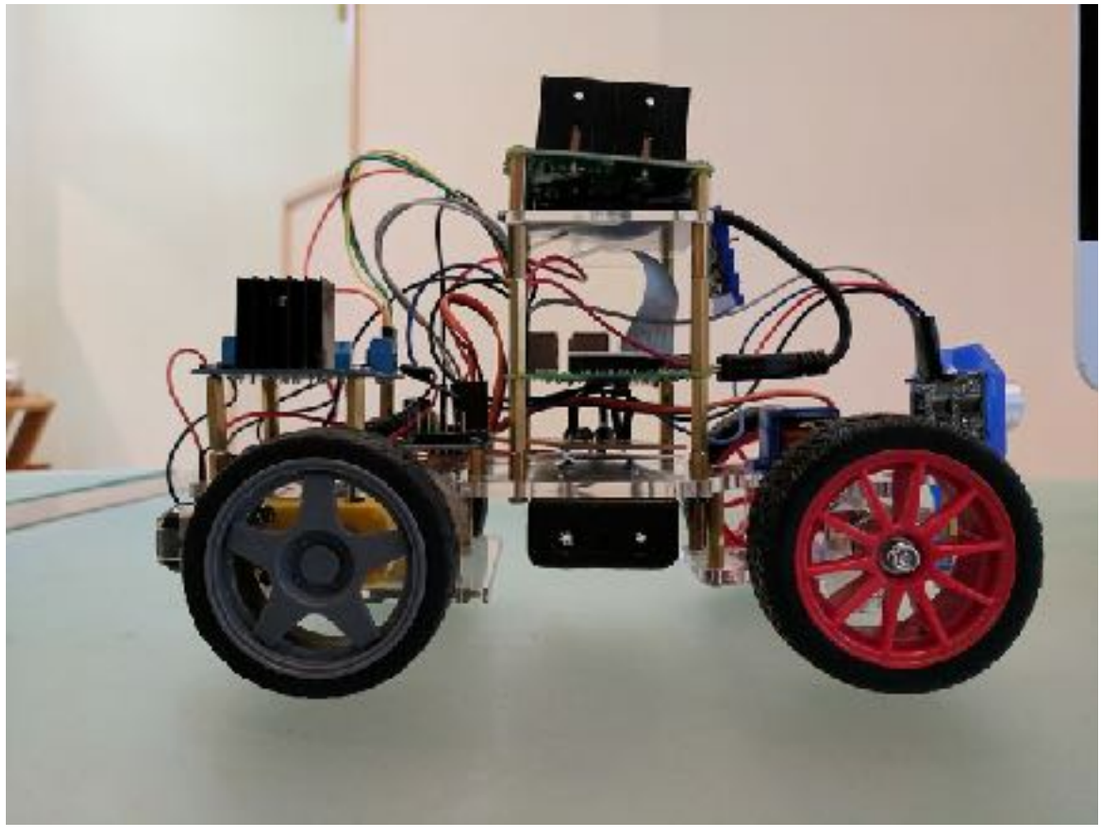
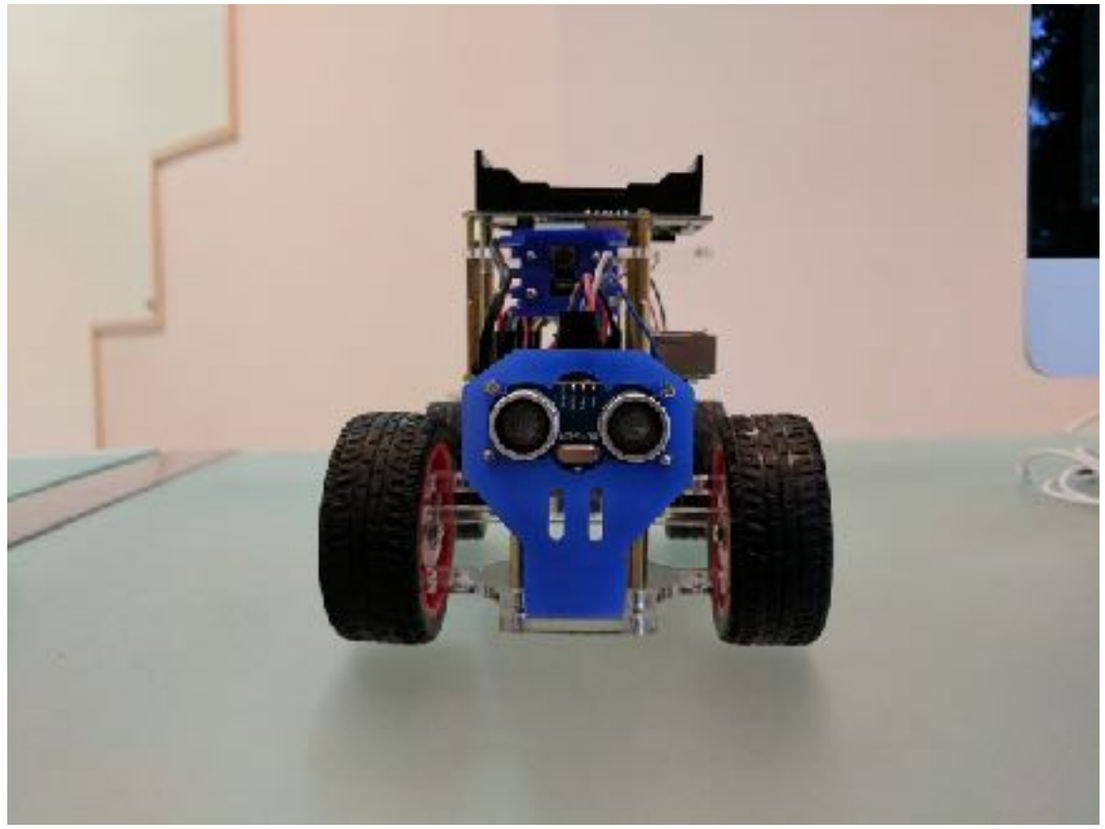
https://github.com/timestocome

Mobile Robots



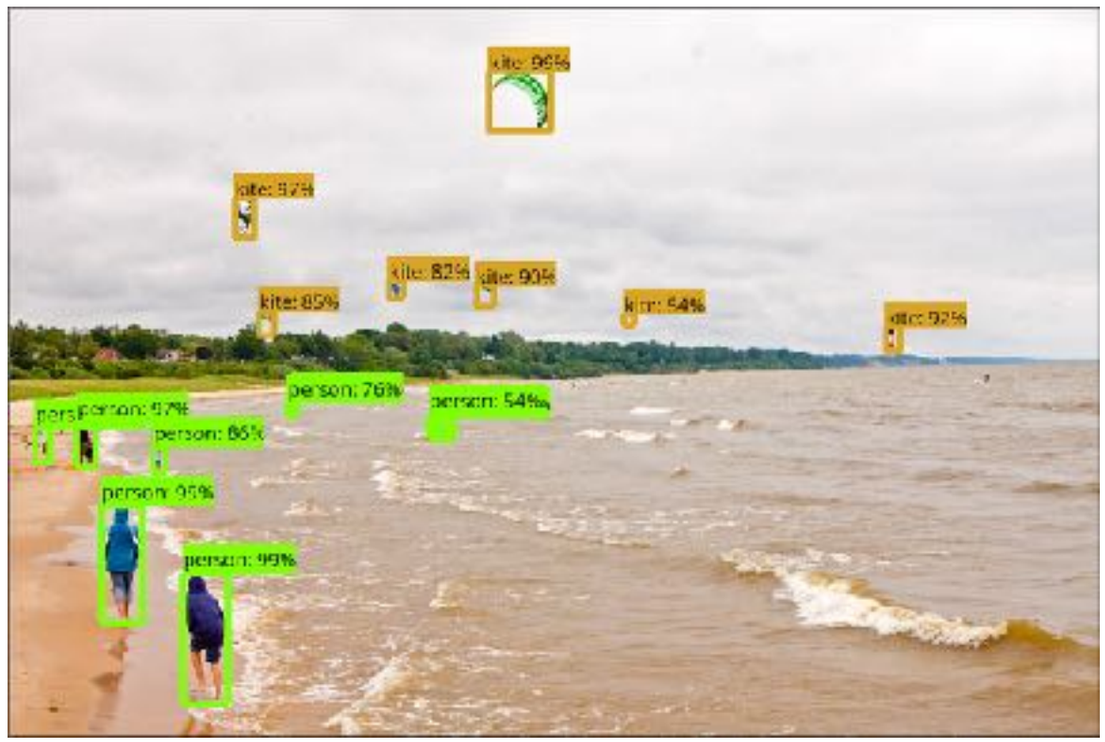


Sensors: UltraSonic distance sensor, Camera
Trained using Google's TF Mobile Models
Obstacle avoidance with simple RL

Output: Wheel movement f/r, turn servo to steer, LED lights if either cat is spotted

kits available: Frye's Amazon eBay…

Image classification



Out of the box Google Mobile Network recognizes many objects ~ 10secs/frame
Re-trained on smaller sets (both cats) runs ~ 2 frames/second

~100 images each category, 3 categories (Min, Merlin, No cat)
~30 mins on desktop, copy trained network onto Pi

*** when you retrain it the built in classifications are forgotten**

Using Tensorflow on a Pi

Change the default system Python to 3.5

Follow the directions to install TF on a Pi
https://github.com/samjabrahams/tensorflow-on-raspberry-pi/

*** Change the name of the wheel file to cp35-cp35m from cp34-cp34**

Step by step detailed directions on
https://github.com/timestocome/RaspberryPi-Robot

Building an object detector

Download and install TensorFlow models on your desktop and Pi
https://github.com/tensorflow/models

Install and Test the default model on your Pi
https://github.com/tensorflow/models/tree/master/research/object_detection

Take and image and try it out
https://github.com/timestocome/RaspberryPi-Robot/tree/master/ObjectDetection

Build a grey cat orange cat detector

You'll need Python, Tensorflow and the TF mobile models installed on your desktop and Pi

Collect images (~100 orange cat, ~100 grey cat, ~ 100 not a cat)

Put orange cat images, grey cat, not a cat images into 3 different directories

Try different models, you'l be trading speed and accuracy

Copy the saved model to your Pi

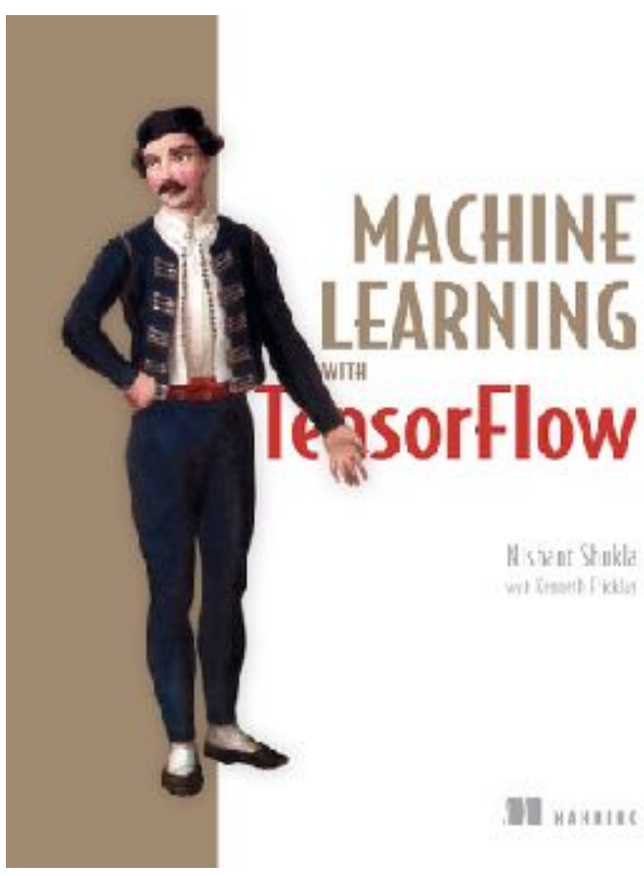
Test

Detailed directions and help
https://github.com/timestocome/RaspberryPi-Robot/tree/master/catID

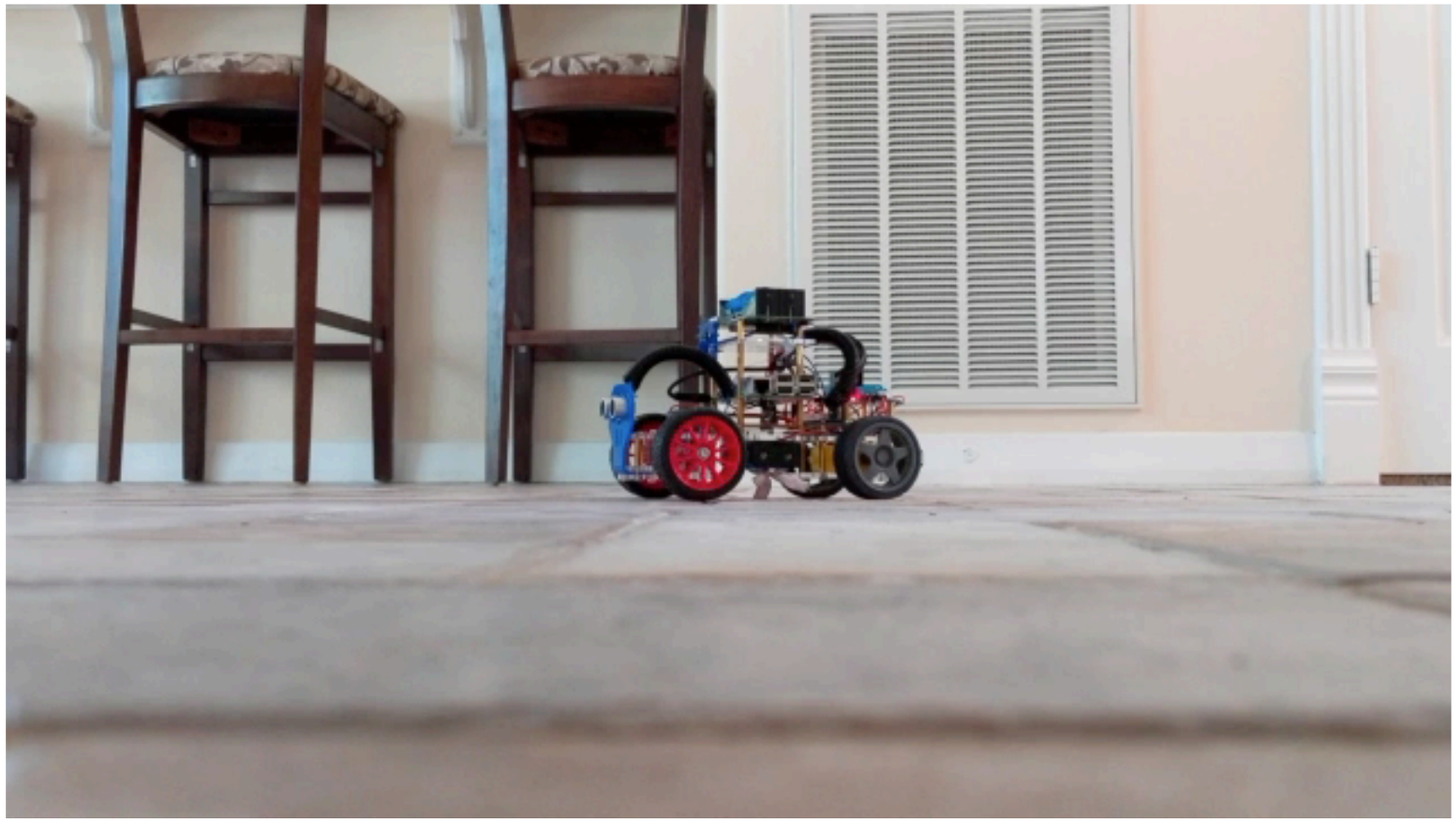
Tensorflow Resources

Tensorflow for Poets

https://codelabs.developers.google.com/codelabs/tensorflow-for-poets/#0



Self teaching



Using a small state space and one objective RL is easy
Multiple objectives is mostly unsolved

Sensor data comes in fast, use lean code and models

Simple Reinforcement Learning

The Pi'll be taking sensor data at high speeds (and in large amounts if you're using video)

Start with random values

Every time the sensor data comes back into the range in your matrices select the action with the highest value. If things get better increase that value, else decrease it

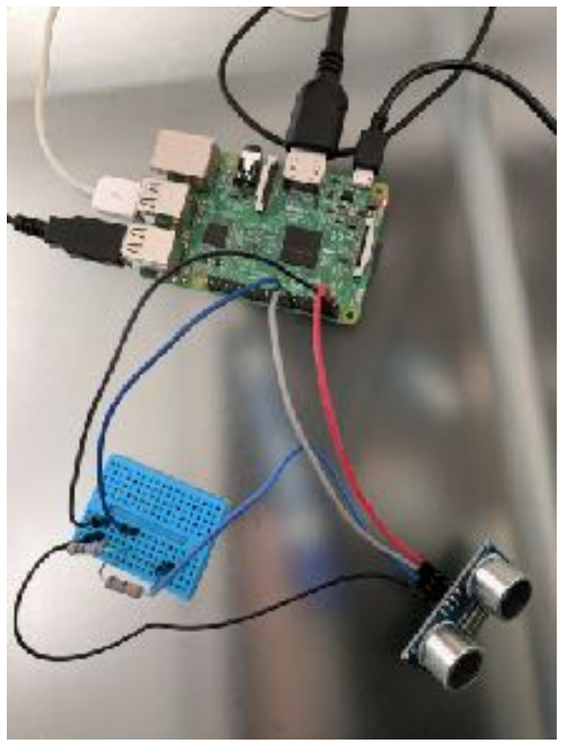
action/distance	1	2	3	4	5
forward	-0.9	0.7	0.4	-0.3	-0.4
right forward	0.7	0.8	-0.5	0.4	0.9
left forward	-0.2	-0.1	0.3	0.2	0.1
reverse	0.5	0.5	0.2	0.9	-0.6
right reverse	0.9	0.3	0.1	-0.5	0.4
left reverse	-0.6	0.1	-0.8	0.3	-0.2

UltraSonic Distance Sensor

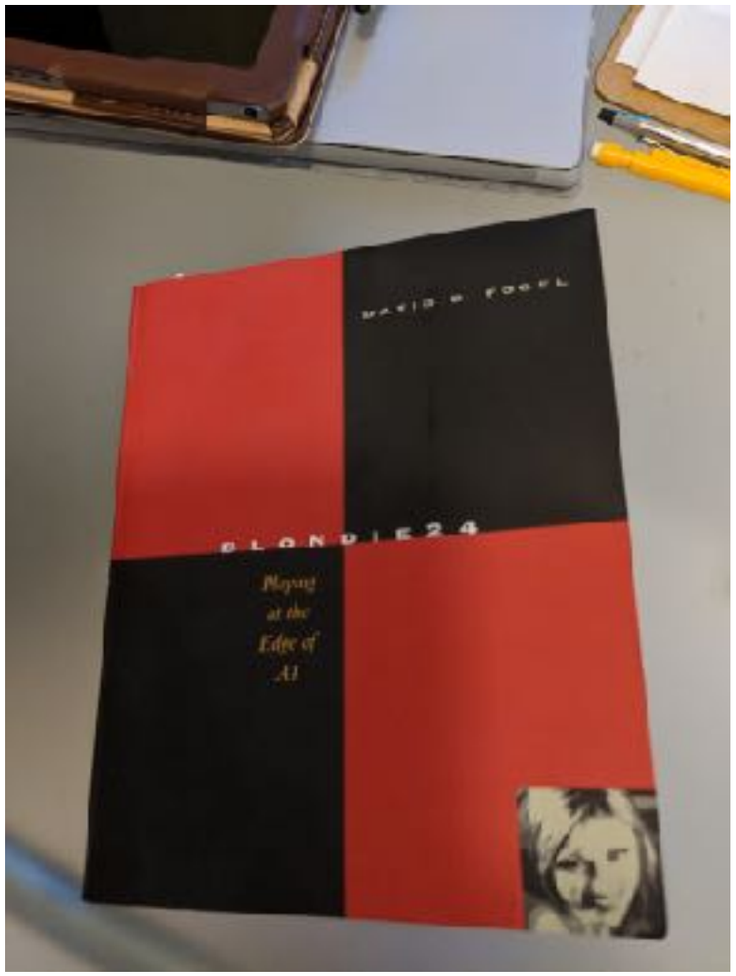
AI and ML Robotics Group (Stanford) trained several robots to map rooms using SLAM

Bumped into a RE Agent at EPO who was using these sensors to create floor plans by following walls

Car robot learns obstacle avoidance in about 100-1000 time steps, trick is to use a small state space matrix (actions, distance)



Artificial Intelligence



Before AlphaGo there was Blondie24

Everything AlphaGo does is in this book and a few things it doesn't yet do

Blondie24 played world class checkers on mid 1990s computers that were no more powerful than a Raspberry Pi

Sensor notes

Many sensors were developed for Arduino which takes up to 5V input, Pi max is 3.3V so ~2V is sent to ground using resistors

Amps are how much (think of a tank of water)
Volts are the power (think water pressure coming out of hose)
Resistors can split voltage into different wires (hoses)

Always check the spec sheets for sensors, data may need manipulation to be useful
Most sensors have been optimized for hardware not software