

Using TensorFlow to Detect Game Pieces in First Tech Challenge Robot Competitions: an Exploration in Machine Learning

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Terms, such as TensorFlow, have meaning to people who are part of the Machine Learning industry. It is a name for one of the computer software tools that may be used to create Machine Learning applications. Another term that you may run up against is Convolutional Neural Networks. These software tools and artificial intelligence concepts were used to create the machine learning ideas used in the include video tutorials. These terms are not required to understand how they are used to create these tutorials or how to answer the tutorial exercise (to be added later). There are currently a set of three video tutorials that were provided to the IEEE TryEngineering team for evaluation.

I suspect the content target audience is somewhere in the 4th through 12th grade range.

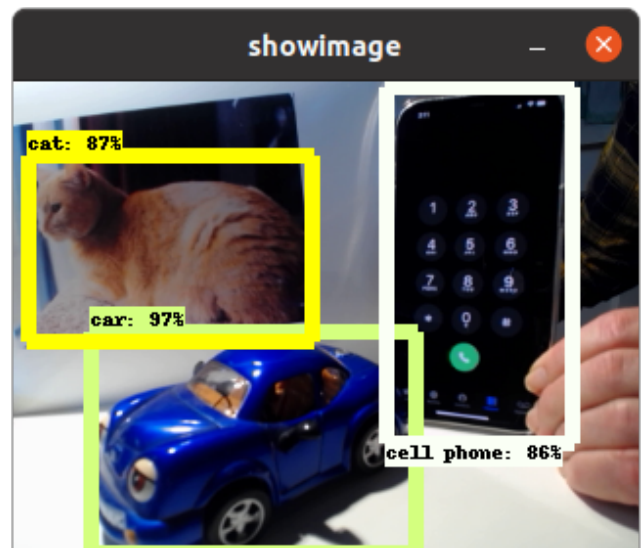
Overview

What is that thing I see in my phone's camera?

There are all sorts of reasons you may want to know what a camera sees. You may want to know if a friend is knocking on your door, a cat is crossing the street in front of your car, lima beans are being served for dinner, or you left your favorite jacket at the soccer game. We will learn about a few of the computer software tools used to answer questions like these.

Some people are real excited because computers are getting better at recognizing objects. Object Detection is the ability for a computer to identify an object in its camera's view. I will show you how a robot uses object detection to identify a gold game piece and then move it.

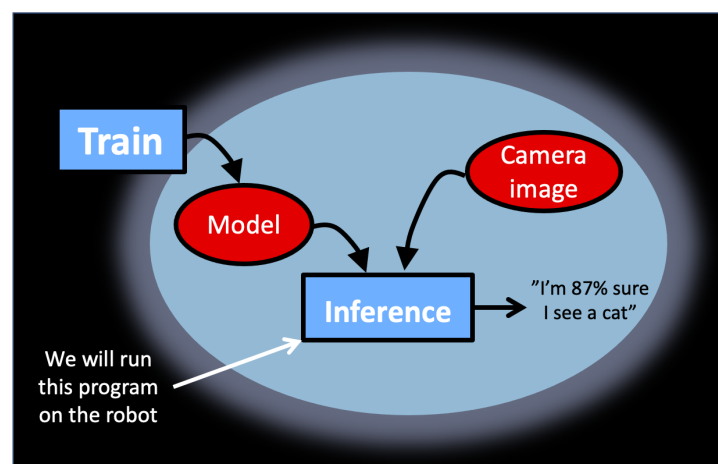
The computer program shown at the right was trained to recognize cats, cars and cell phones. The program is 87 percent sure it found a cat in this camera image.



Training a Robot to Recognize Game Pieces

Train: A big computer file called a Model is created by showing a computer a lot of pictures of an object you want a computer to recognize. An example is gold cubs. This is a lot of hard work and can take a long time. We will start out with models that someone else has trained.

Infer: A computer program can use a Model to decide which objects it sees with its camera. We'll call this step an inference. It can only recognize objects that the model was trained to see.

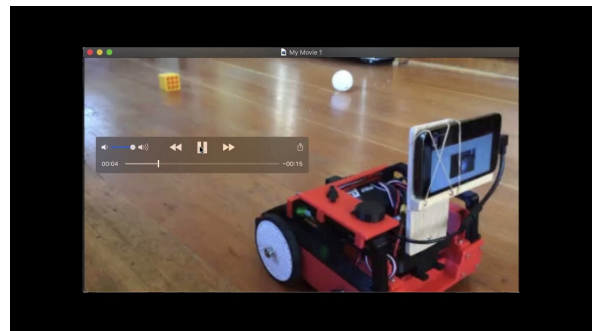


Tutorial 1: Using TensorFlow to Recognize Game Objects and Moving Them

OK! TensorFlow is a big word. I'm using that word because adults like to make machine learning sound harder than it is. TensorFlow is the name of the computer software that many people use for Machine Learning. We call it learning because it makes the cell phone sound smart. It can be used to teach our cell phones to recognize cats and lima beans. People disagree whether using TensorFlow makes a cell phone smart.

In this demo TensorFlow was used so that cell phones like the one on this robot can recognize two game pieces. The game pieces are a gold cube or white Wiffle Balls. The robot game is called Rover Ruckus. A few years ago high schools students wrote programs that played this game and competed against each other.

Click the arrow in the window on the right to make the demo start.



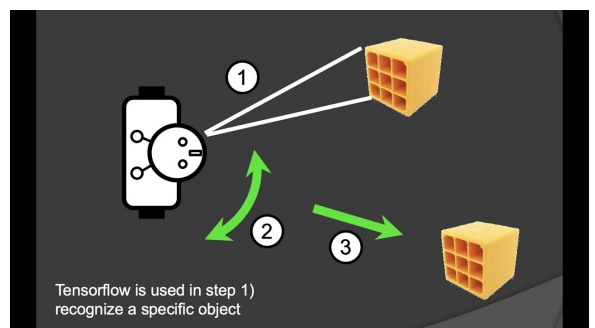
TBD: add exercises

Tutorial 2: How do we Make a Robot Recognize and Chase Down a Gold Block

To figure out how to chase down the gold cube our robot will need to solve a few smaller problems. The first problem is to recognizing the gold cube on the camera screen. This is where TensorFlow comes in.

Click the arrow in the window on the right to see how this is done.

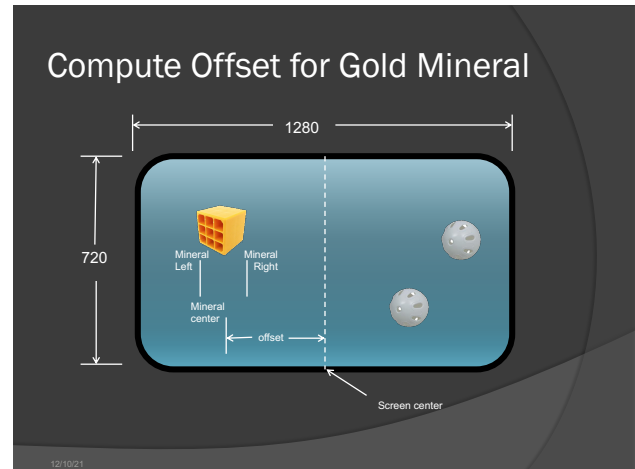
TBD: add exercises



Tutorial 3: How do You Know which way to Turn the Robot (TBD)

<note> TBD: A topic for another day.

<note> There are many other potential topics.



Tutorial 4: Can Object Recognition go Wrong?

We said that TensorFlow is the name of the computer software that many people use for Machine Learning. Can people do a poor job of training a robot? Can the robot be wrong? Well - let's see.

Click the arrow on the window on the right to find out.

TBD: add exercises

