

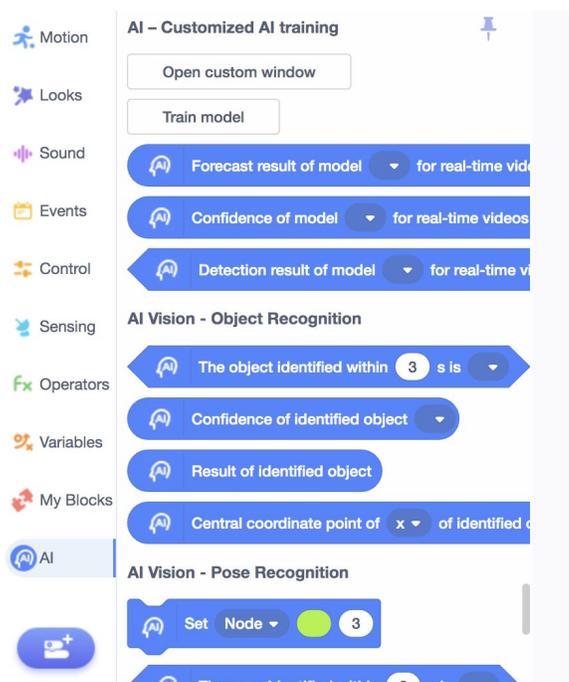
## Topic: Machine Learning

**Short Description:** In this lesson, you will train a machine learning model to distinguish between two images and build a program to steer a virtual robotic car with your model.

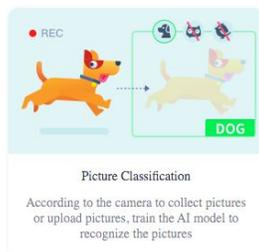
### Steps:

1. Go to [uCode](#) and select **Train model** in the **AI** drawer under AI - Customized AI training.

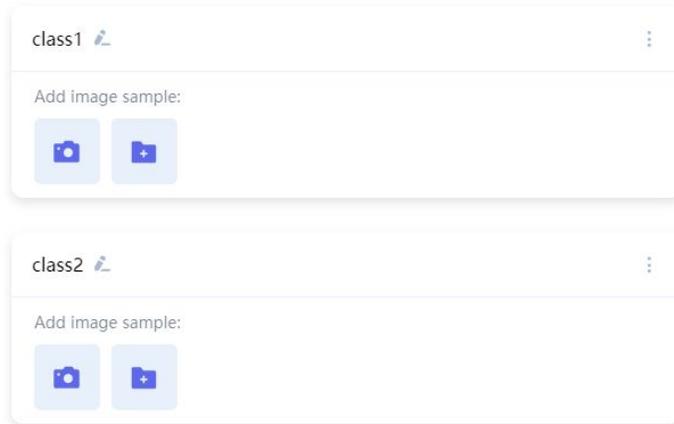
**Note:** If you do not have access to these blocks, you can add them by clicking the **Add Extension** button in the lower-left corner of your screen.



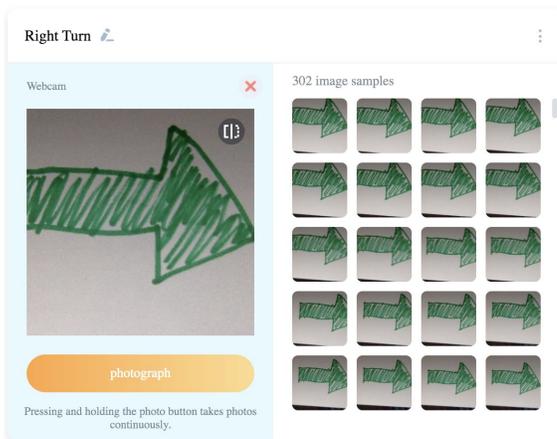
2. Select **Picture Classification**.



- Let's start by labeling the objects you are going to classify. To do this, click the image of the pencil that is located to the right of the current labels: class1 and class2. Replace the current label with the name of the object you plan to use.



- Next, click the camera button located below the label you just updated. Place your first object close to the camera and click and hold the photograph button. This will allow the webcam to start taking pictures quickly.

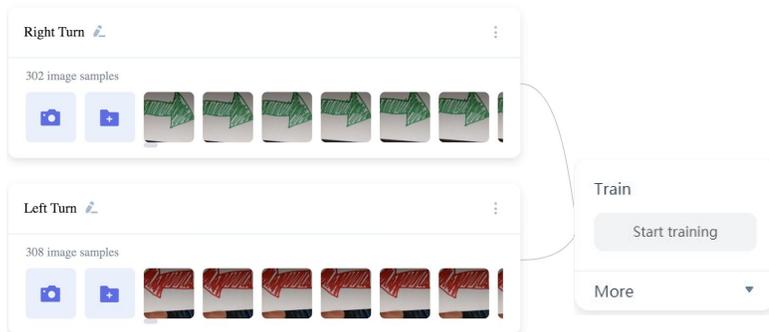


Here are a few tips:

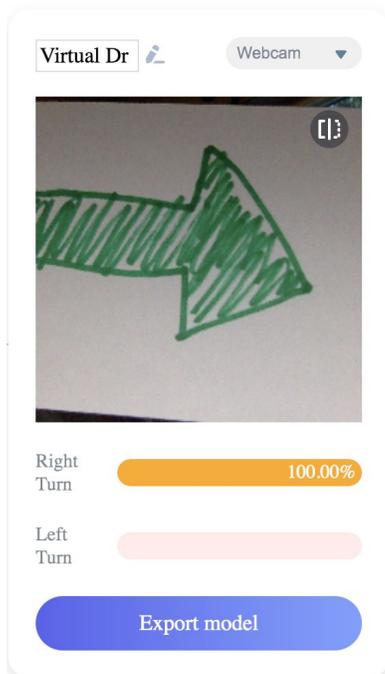
- Take as many pictures as possible – a minimum of 200 is desirable.
- Try to limit the number of distractions in the background. If possible, put a white sheet of paper behind your object.
- Turn your object to get images of all sides.

Once you have a fair amount of images, repeat the process for the other object.

5. Click **Start training**. Training may take up to a minute, depending on the number of images. It is recommended that you do not open other windows during training.



6. Test your model by doing the following:
  - a. Hold up one of the objects to see if the model recognizes the object.
  - b. The computer will give a confidence score. Try to have a model that is as confident as possible. If it isn't identifying the objects correctly, try to retrain with better images.



Once you're happy with the confidence scores, export your model. Be sure to name your model.

- Go to the **3D** tab and select **3D simulation**. Find the **Car Control** box and select **3D drive**. Adjust the window so you can see the course.



Car Control

- Build your code to navigate through the course. Here is a sample code to start with:

```

when space key pressed
  wheel mode: servo ID- 1 , rotates clockwise , speed (0-255) 75
  wheel mode: servo ID- 3 , rotates clockwise , speed (0-255) 75
  wheel mode: servo ID- 2 , rotates counterclockwise , speed (0-255) 75
  wheel mode: servo ID- 4 , rotates counterclockwise , speed (0-255) 75

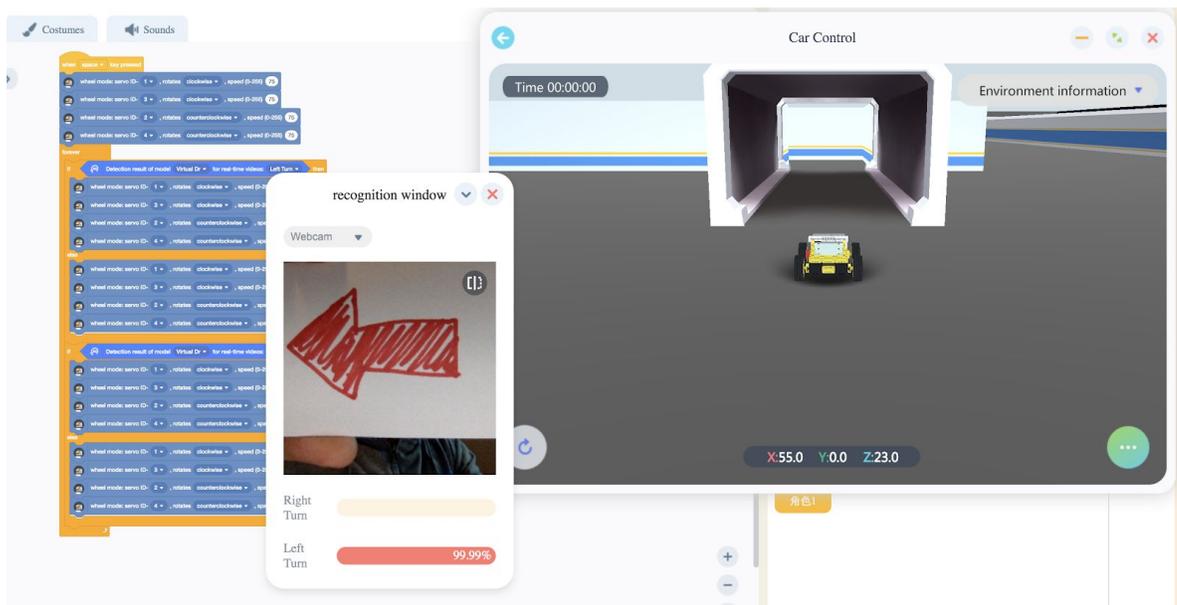
forever
  if key left arrow pressed? then
    wheel mode: servo ID- 1 , rotates clockwise , speed (0-255) 75
    wheel mode: servo ID- 3 , rotates clockwise , speed (0-255) 75
    wheel mode: servo ID- 2 , rotates counterclockwise , speed (0-255) 25
    wheel mode: servo ID- 4 , rotates counterclockwise , speed (0-255) 25
  else
    wheel mode: servo ID- 1 , rotates clockwise , speed (0-255) 75
    wheel mode: servo ID- 3 , rotates clockwise , speed (0-255) 75
    wheel mode: servo ID- 2 , rotates counterclockwise , speed (0-255) 75
    wheel mode: servo ID- 4 , rotates counterclockwise , speed (0-255) 75

  if key right arrow pressed? then
    wheel mode: servo ID- 1 , rotates clockwise , speed (0-255) 25
    wheel mode: servo ID- 3 , rotates clockwise , speed (0-255) 25
    wheel mode: servo ID- 2 , rotates counterclockwise , speed (0-255) 75
    wheel mode: servo ID- 4 , rotates counterclockwise , speed (0-255) 75
  else
    wheel mode: servo ID- 1 , rotates clockwise , speed (0-255) 75
    wheel mode: servo ID- 3 , rotates clockwise , speed (0-255) 75
    wheel mode: servo ID- 2 , rotates counterclockwise , speed (0-255) 75
    wheel mode: servo ID- 4 , rotates counterclockwise , speed (0-255) 75
  
```

- To utilize your machine learning model, replace the **key pressed?** blocks with the machine learning model detection block shown below. Now, instead of controlling the vehicle with your keyboard, you can control it with the model you created.



Here is what your final project could look like:



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