

Classification app

In this lab we will create an app for your phone that can recognize (classify) objects.

You can decide for yourself which objects have to be recognized. You take pictures of these objects. With these pictures you will train a neural network and you will put this neural network in an app.

Necessities

For this lab you need some hardware, software and data.

Hardware

- Windows computer
- Android phone
- USB cable to connect the phone to the computer

Software

- Code that you can download from GitHub
- A Python environment containing Tensorflow
- AndroidStudio

How to get this software is explained later in this guide.

Data

You are going to train a neural network with pictures. You have to take these pictures yourself with your phone.

The Lab

Look where you want to put this lab on your computer.

GitHub

First download the code from GitHub. Go to <https://github.com/fritss/weekendschool>

On this page there is a big green button with 'Code', click on it. Those who have git installed on their computers can get the code with the command

git clone <https://github.com/fritss/weekendschool>.git

If you don't have git you can download the ZIP and extract it to your computer on the chosen place.

Python and Tensorflow

You are going to train the neural network with Tensorflow. Tensorflow is a package within Python. That's why you need to install Python on your computer first. Python is maintained by Anaconda. Anaconda has a simple setup called Miniconda. If you don't have Python installed on your PC yet install *Miniconda3* from:

<https://docs.conda.io/en/latest/miniconda.html>

Download the Python 3.9 version, run the downloaded file and follow the installation instructions.

You now have a few new applications on your computer. Open Anaconda Powershell Prompt. This is a terminal where you can issue commands. With the command `ls` you can see which files and directories there are. With the command `ls <directory>` you navigate to <directory> and with the command `cd ..` you navigate one directory up. Navigate to where you have the GitHub code and navigate to *weekendschool-main* and to *weekendschool*. Here is a file *environment.yml*. Run the following command:

conda env create -f environment.yml

This command may take a while as it needs to download some files. It creates a virtual environment called *ws*. You have to activate this environment with the command

conda activate ws

We still need to install tensorflow. To do this, run the following two commands:

pip install tensorflow==2.5

pip install tf-lite support

Now that everything is installed we can start the code. Run the following command:

jupyter notebook

This will open a new tab in your browser with a notebook. In this tab, click *Classifier-eng.ipynb*. This will open another new tab in your browser with the code we need. This tab consists of cells of code. Between the cells of code are cells of comments that explain the code. You can execute the cells of code with the command `cntrl-enter` or `shift-enter`. The difference is that `shift-enter` goes straight to the next cell. Execute the first two cells of code. This will create a few new directories.

Data

Choose a few objects that your app should be able to recognize. For example your bag or your cup or your computer. Take about 35 pictures of each object with your phone, a bit from different angles and with different backgrounds (this shouldn't take too much time). Make sure that every picture has exactly one object that you want to recognize! Also take some (+- 60) pictures of the backgrounds without objects. For each object you have to create a directory in the directory *camera/objects* with a clear name of the object and put the correct pictures in the correct directory. Put the background pictures in the directory *camera/background*.

AndroidStudio

To make an app on your phone you need the AndroidStudio package. Download this from

<https://developer.android.com/studio>

Click on the *.exe* file and follow the instructions.

Your phone

To be able to put apps on your phone, you must first turn on the developer option. They've made this a bit complicated so that only real developers do this.

On your phone, go to *Settings*, then tap *About device* or *About phone*. Scroll down, then tap *Build number* seven times. ... Enter your pattern, PIN or password to enable the Developer options menu. The *Developer options* menu will now appear in your Settings menu. Turn on *USB debugging* here. You can turn everything off later with the top button.

You now need to connect the phone to your laptop via the USB cable.

Make the app

Now you can open AndroidStudio.

1. Open Android Studio. After it opens choose *Open an Existing project* from the popup
2. In the file selector, choose the directory you are working in and choose *android* and then *TFLClassify*.
3. You may need to install some updates first.
4. Choose the project *start* and build it with the button *build all*

Now you need to import your model. Select the module *start* in the project explorer on the left and right-click on the *start* module. Then select: *New > Other > TensorFlow Lite Model*. Select the place where you previously created your model: *weekendschool\export_models\model_mobilenet.tflite* and click *Finish*. Now you can check if the app works by pressing the run button. This is a green triangle pointing to the right. You may need to turn your phone back on.

Install the app

In the directory *weekendschool\android\TFLClassify\start\build\outputs\apk\debug* there is an *apk* file called *start-debug.apk*. Copy this file to your phone, for example to *Downloads*. Disconnect your phone from your PC and look for this file in your phone's file system. Tap on the file and the application will now install itself. You can then open the app.