COMPSYS 306 Artificial Intelligence and Machine Learning

JetBot introduction

Xiaozhou (Jason) Ye, Bill Peng, Akshat Bisht, and Kevin I-Kai Wang

1 General information of JetBot

NVIDIA Jetson Nano is a small and yet powerful embedded platform that allows you to run various machine learning models for applications like image classification, object detection, segmentation, and speech processing. Some basic information are provided in the following link:

https://developer.nvidia.com/embedded/jetson-nano-developer-kit

The JetBot extends around Jetson Nano to create a small robotic platform that provides various sensing (e.g. camera, line following) and actuation abilities (e.g. motor control). There are several 3rd party JetBot kits and in this project you will be using the Waveshare JetBot. In the kit you received, the JetBot is already assembled and ready to be used. If you are interested, some further readings are available in the following links:

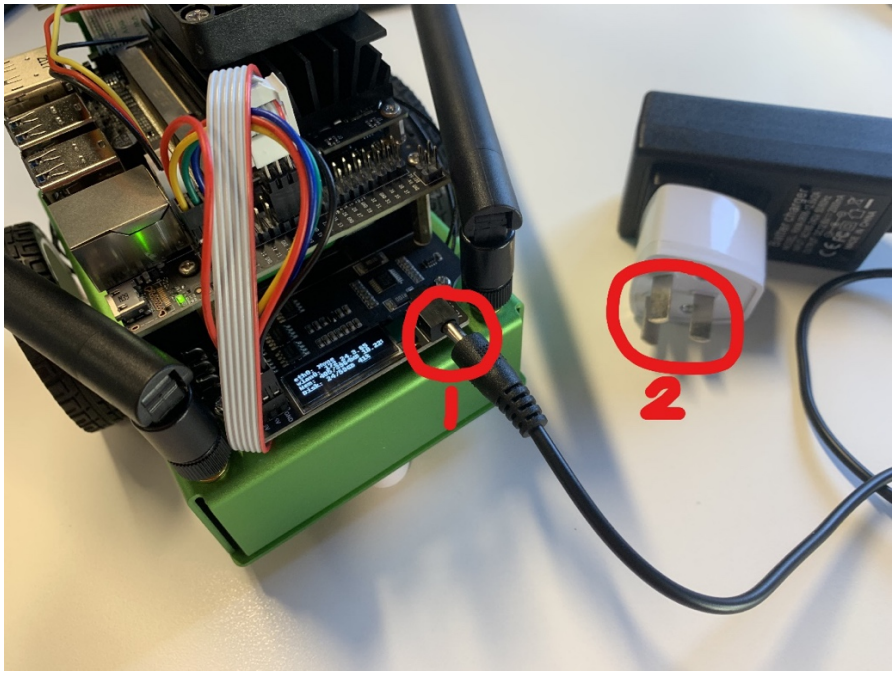
https://www.waveshare.com/wiki/JetBot_AI_Kit

https://www.waveshare.com/wiki/JetBot_AI_Kit_Assemble_Manual

2 Basic usage of JetBot

2.1 Power charging

The robot is powered through 3x 18650 Li-ion batteries to support its normal operations. A charger is provided to you as a part of the project kit to charge the batteries. **It is recommended that you charge your robot first when you receive your kit.**



2.2 Wi-Fi configuration

For your project, a local Wi-Fi network has been setup to interconnect the JetBot with your laptop. The Wi-Fi network SSID and password are as follows.

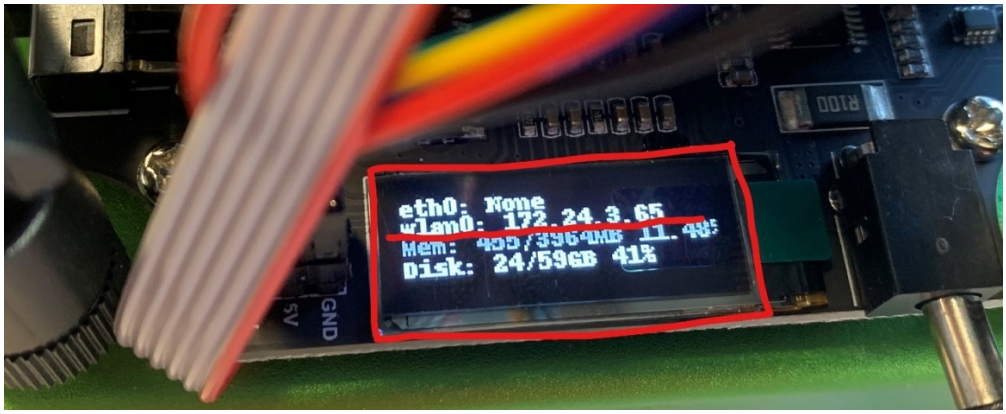
SSID: COMSYS306-2023

Password: JumpingJack222

This Wi-Fi connection and the testing table will be made available in the MDLS lab (405.522 and 536) permanently during the project period and you can use it for your project at any time with your laptop.

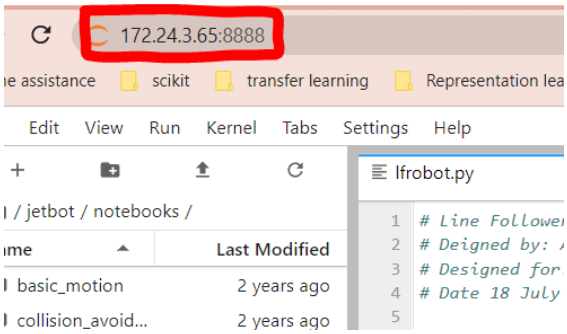
During the weekly lab session, if you prefer to use the lab PC to connect to the JetBot via this Wi-Fi, please let the lecturer and the GTA know, and we can add an additional Wi-Fi dongle to the lab PC, only during the lab session period.

Once the JetBot is connected to the Wi-Fi, the IP address should appear on the small screen on the JetBot. You will need this IP address for the next step.



2.3 Jupyter notebook

Type the IP address from the above step plus port (**:8888**) into your browser to login to the Jupyter notebook hosted in the Docker of your Jetson Nano. Jupyter notebook default password is "**jetbot**". Jupyter notebook is your project development interface.

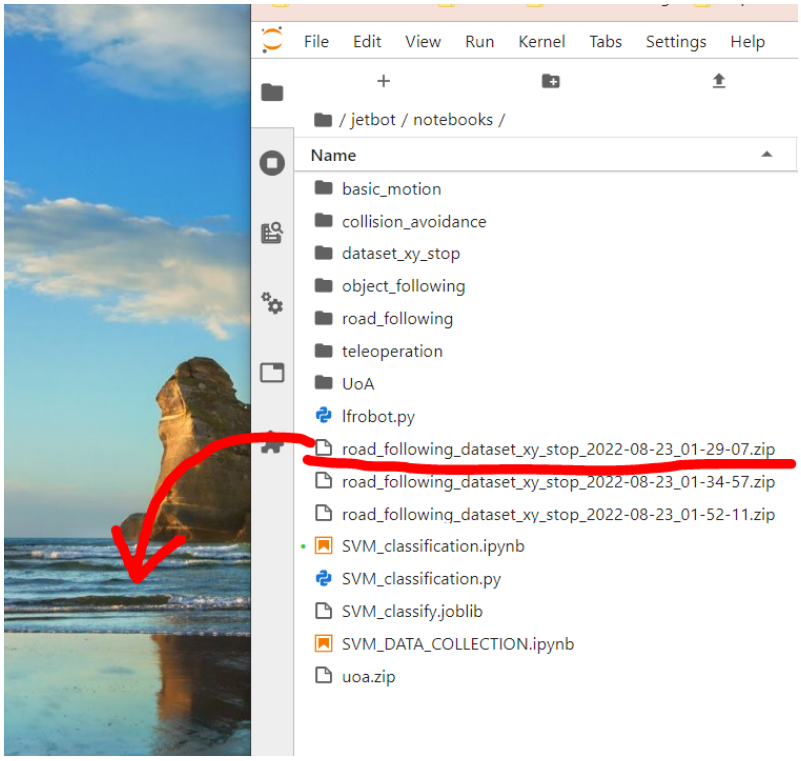


2.4 Image data collection

In project phase 2, you are required to collect your own image data to train your machine learning model. **The data you collected will have critical impact on your model performance and the correctness of the robot operation.** You should go through the following sample code, which will help you to get started with image data collection:

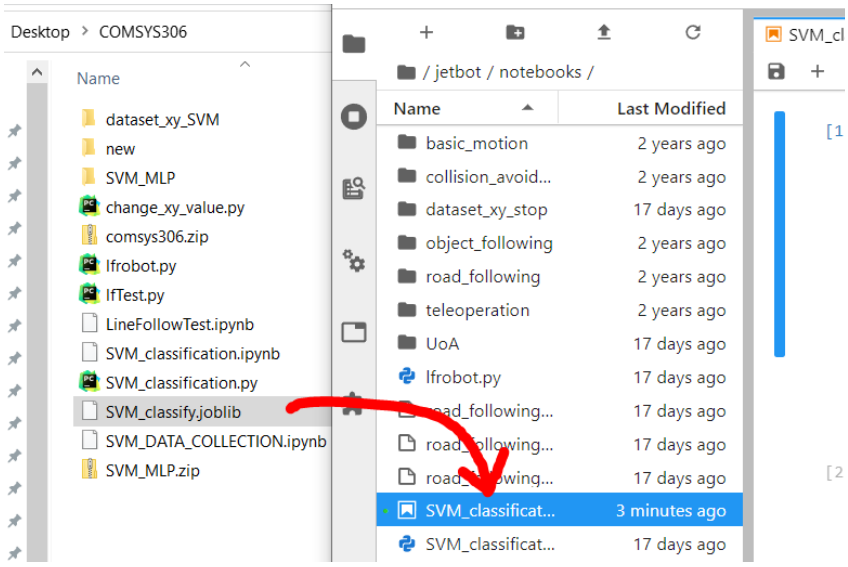
https://github.com/NVIDIA-AI-IOT/jetbot/blob/master/notebooks/road_following/data_collection.ipynb

If you think you have already collected enough data, you can zip the folder and download the data (by drag and drop) from the robot to your laptop, where the training process can happen.



2.5 Model transformation

Train a model on the JetBot is possible but can be time consuming. Therefore, we recommend you to train your model on a PC or a laptop, and then transfer the model to the JetBot. You can simply use mouse to drag the model file to the Jupyter notebook project path. (Note: You should know how to package your model into a file in project phase 1.)



3 JetBot motion control

Most of the motor control driver functions are already abstracted in the lfrobot.py file. Please read carefully about the codes in lfrobot.py and play with these functions to understand how these functions

control the car. Think about how to use these functions together with your classification model to make the JetBot change its behaviour according to the sensed environment.

The JetBot is already equipped with two optical line following sensors, which will enable the robot to follow the black line track on the testing table, as shown in the following figure.