

# **Classification of driving conditions as sunny, rainy, foggy, or dark**

*A Design Lab Project Report*

*by*

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# Introduction

Semi-autonomous vehicles are automobiles that have some automated driving features but still require human intervention and oversight. These vehicles typically incorporate advanced driver assistance systems that can handle certain driving tasks under specific conditions, such as highway driving or parking. Still, the driver must remain engaged and ready to take control at necessary times.

One such issue in semi-autonomous vehicles is automated driving condition classification. Such classification is required in semi-autonomous vehicles primarily for safety reasons. By classifying weather conditions on RPi such as sunny, rainy, foggy or dark, you can build a system for real-time driving condition monitoring.



Figure 1: Sunny



Figure 2: Rainy

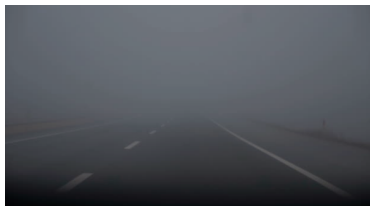


Figure 3: Foggy

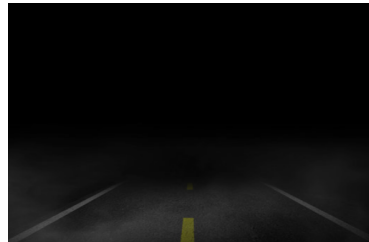


Figure 4: Dark

# Methodology

## Formatting the SD Card

1. Insert the SD Card: Plug the SD card into your computer's SD card reader. Ensure that the computer recognizes the SD card.
2. Backup Data: If there is any important data on the SD card, make sure to back it up as formatting will erase all data on the card.
3. Open Disk Management (Windows) or Disk Utility (Mac):
  - On Windows: Press Win + X and select "Disk Management."
  - On Mac: Open "Disk Utility" from the "Utilities" folder within the "Applications" folder.
4. Select the SD Card: In Disk Management or Disk Utility, locate and select your SD card from the list of available drives.
5. Format the SD Card:
  - On Windows: Right-click on the SD card volume, select "Format," choose the desired file system (e.g., FAT32), and click "Format."
  - On Mac: Click on the "Erase" tab, select the desired format (e.g., MS-DOS (FAT) for FAT32), and click "Erase."
6. Confirm the Format: Confirm that you want to format the SD card. Be aware that this will erase all data on the card.
7. Wait for Formatting to Complete: The formatting process may take a few moments, depending on the size and speed of the SD card.

## Installing Raspberry Pi OS

1. Download Raspberry Pi OS:
  - Visit the official Raspberry Pi website (<https://www.raspberrypi.org/software/>) and download the Raspberry Pi Imager tool suitable for your operating system.

- Run the Raspberry Pi Imager tool after downloading and installing it.
2. Select OS and SD Card:
    - Open the Raspberry Pi Imager tool.
    - Choose "Choose OS" and select "Raspberry Pi OS (other)" from the list.
    - Choose "Choose SD Card" and select the SD card you formatted earlier.
  3. Write the Image to the SD Card:
    - Click on "Write" to start the process of writing the Raspberry Pi OS image to the SD card.
    - You may need to provide administrator privileges to proceed with writing the image.
  4. Wait for Writing to Complete: The writing process may take a few minutes, depending on the speed of your SD card and computer.
  5. Eject the SD Card: Once the writing process is complete, safely eject the SD card from your computer.
  6. Insert the SD Card into the Raspberry Pi: Insert the SD card into the SD card slot on your Raspberry Pi.
  7. Power On the Raspberry Pi: Connect the power supply to the Raspberry Pi to boot it up. Follow the on-screen instructions to complete the initial setup of Raspberry Pi OS.

# Implementation

To implement a `.h5` model on a Raspberry Pi, you'll typically use Python and libraries like TensorFlow or Keras, which provide support for loading and using models stored in the HDF5 format. Here are the general steps to implement a `.h5` model on a Raspberry Pi:

## 1. Set up your Raspberry Pi

Ensure that your Raspberry Pi is set up and running with the necessary software. You should have Python installed on your Raspberry Pi, along with any required libraries such as TensorFlow or Keras.

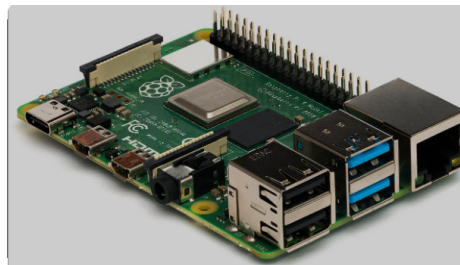


Figure 5: Raspberry Pi

## 2. Install required dependencies

If TensorFlow or Keras is not already installed on your Raspberry Pi, you'll need to install them using `pip`. Open a terminal on your Raspberry Pi and run:

```
pip install tensorflow
```

or

```
pip install keras
```

### 3. Transfer the .h5 model file to your Raspberry Pi

Transfer the .h5 model file to your Raspberry Pi. You can do this via SSH, using a USB drive, or any other method you prefer.

### 4. Load the model in your Python script

Write a Python script on your Raspberry Pi to load the .h5 model file. Here's an example script using Keras:

```
import tensorflow as tf
from tensorflow.keras.models import load_model

# Load the .h5 model file
model = load_model('path/to/your/model.h5')

# Optional: Display model summary
print(model.summary())
```

### 5. Preprocess input data (if necessary)

If your model requires input data preprocessing (e.g., resizing images, normalizing data), make sure to preprocess the input data accordingly before passing it to the model.

### 6. Make predictions or perform inference

Use the loaded model to make predictions or perform inference on your data.

### 7. Run your Python script

Execute your Python script on the Raspberry Pi. Ensure that the necessary permissions are set to run the script if needed (`chmod +x your_script.py`).

### 8. Connecting and Installing the Touch Screen Driver

To utilize the 3.2-inch Resistive Touch Screen TFT LCD with your Raspberry Pi, follow these steps:

1. Log in to the Raspberry Pi terminal. You may need to connect a keyboard and HDMI LCD to the Pi for driver installation or log in remotely with SSH.
2. Open the terminal of the Raspberry Pi and execute the following commands to install the touch driver:

```
git clone https://github.com/waveshare/LCD-show.git
cd LCD-show/
chmod +x LCD32-show
./LCD32-show
```

3. Ensure that the Raspberry Pi is connected to the network during the touch driver installation process for successful installation.
4. After installation, the touch function will be enabled. Restart the Raspberry Pi for the changes to take effect.

Following these steps will allow you to connect and install the touch screen driver for the 3.2-inch Resistive Touch Screen TFT LCD on your Raspberry Pi.



Figure 6: Raspberry Pi



Figure 7: Raspberry Pi

## 9. Problems faced

Installing Tensorflow took time since our SD card crashed 3 times and had to install all dependencies again. LCD display was faulty, spent a lot of time figuring it out after trying different methods.

Was my first time working with Hardware and learned that working things actually on hardware takes time even small things, but the satisfaction at the end of seeing results is worth it.