# Project for Group of Vision

## Introduction

There are three projects in total, relatively in the direction of Digital Image Processing, Deep Learning, and Robot Operating System (ROS). You should pick one and try your best to finish it. It's fine even if you cannot finish any of it, but you should at least show your effort and your attitude.

The main purpose is to test your ability in problem solving as well as basic of robot algorithms. You're supposed to solve problems by yourself. Feel free to ask me or some other students in charge if you meet some problems and you cannot find the answer from the interenet.

## Project 1: Building a Deep Neural Network and get it works

Student in Charge: Mr. Mingji HAN

In this project, you will learn Python and basic knowledge of deep learning and neural network.

**1.Learn Python**

Python Tutorial

Read tutorial and learn how to write python code:Python Tutorial

**2.Install Pytorch**

PyTorch is an open source deep learning platform that provides a seamless path from research prototyping to production deployment.We will use PyTorch to build our deep learning model.

Try to install PyTorch on your machine 😃 Pytorch Homepage

**3.Understand Neural Networks**

Neural Netorks is an important model in deep learning. Watch these videos and try your best to understand it.

1. What is neural networks?
2. Convolutional Neural Network

**4.Run Neural Networks Demo**

If you don't understand this demo ,it doesn't matter.It just works! [A simple PyTorch Neural Networks Demo](

## Project 2: ROS Project: A Simple navigation algorithm (Standard)

Student in Charge: Mr. Siqing MA

Navigation is very important for robots. Using ROS, we can easily get the coordinate relationship between world and robot, and can receive robot position timely. In this project, you have to write an algorithm which can navigate a robot to a goal position, you do not need to consider the obstacle on the path.

## About the Simulation:

We will not use real robot to verify our program, instead we will use ROS simulation tools “Gazebo”, and our robot model in Gazebo is Tuttlebot3-burger.

For more information about Gazebo and Turtlebot3-burger:

https://www.ncnynl.com/archives/201702/1391.html(Chinese)

https://www.ncnynl.com/archives/201707/1788.html(Chinese)

**Some tips:**

1. The max linear speed of the robot is 0.22m/s, the max angular speed is 2.5degree/s
2. You can get the robot position by subscribing “pose” topic.
3. You can get relative position between robot and goal by using tf transformations.
4. When the goal distance is smaller than the robot radius, stop the robot and print “ GOAL!^o^/ ” in the terminal.

## Some operations you may do in this project:

1.write a goal tf broadcaster;

2.write a robot tf broadcaster;

3.write a main program including:

- A navigation kernel

- A centre tf subscribe node(get goal location)

- method to subscribe “/scan”and “/cmd_vel” topic

- send message to robot(control it)

## Recommended tutorials:

http://wiki.ros.org/ROS/Tutorials

http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29

## Project 3: Digital Image Processing

Stuent in Charge: Mr. Siyu ZHANG

**Notice:** You are suggested to do which ever you're interested in. If you think Bonus task is the most interesting one, you can go direct to it. Either C++ or Python will be fine for this task.

**Basic Task: Implementation of filters(手搓滤波器)**

1. Implementation of Gaussian Low Pass Filter
2. Implementation of Edge Detection（the easiest one is just Difference of Gaussian)

**Advanced Task: Code Reading (密码识别)**

Given an image of Speed Dial (九宫格), output the right code according to the sequence from upper left to lower right.

For example, given:

| | | |
|---|---|---|
| 7 | 8 | 2 |
| 3 | 3 | 4 |
| 1 | 0 | 7 |

Program should output: 782334107.

**Keywords you may want to search and refer to: **

1. Corner Detection, OpenCV角点检测
2. Template Matching，图像模版匹配

**Bonus Task: Code Reading++ (电子管密码识别)**

Given a image of tube, output right time .

For example, given:


Program should output : 40253

**Keywords you may want to search refer to: **

1. Sliding Window，滑动窗口
2. **tube_drawing.py(given in reference folder)**: program used to draw the tube