Terrestrial-Aerial-Navigation on Ubuntu20.04

一、 下载ROS及其附属

```
wget http://fishros.com/install -O fishros && . fishros
#鱼香ROS一键安装
```

二、 下载源码

- `git clone https://github.com/ZJU-FAST-Lab/Terrestrial-Aerial-Navigation.git`

三、 安装依赖

1. 安装显卡驱动

- 查看是否安装NVIDIA显卡与驱动，若未出现状态面板，则未安装驱动

```
lspci | grep -i nvidia
nvidia-smi
```

- 安装驱动

```
sudo add-apt-repository ppa:graphics-drivers/ppa
sudo apt update
#添加源并更新软件包列表
```

```
ubuntu-drivers devices
#检查可安装的驱动,在弹出的列表中选择一个合适的驱动进行安装
sudo apt install nvidia-driver-XXX
#安装后重启，就可以通过nvidia-smi看到显卡信息
```

重启后可能会导致无法进入桌面

- 在开机启动页面进入Ubuntu(recovery mode)
- 在Recovery Menu里选择root
- 卸载Nvidia显卡驱动

```
sudo apt-get purge nvidia*
sudo apt-get autoremove
#卸载Nvidia驱动
```

```
sudo apt-get install --reinstall ubuntu-desktop
#重装ubuntu-desktop

sudo reboot
#重启
```

重复上面安装Nvidia驱动的步骤，选择不同的驱动版本再次尝试

2. 安装CUDA

- 降低g++版本

```
sudo apt-get install gcc-7 g++-7

sudo update-alternatives --install /usr/bin/gcc gcc /usr/bin/gcc-7 9
sudo update-alternatives --install /usr/bin/gcc gcc /usr/bin/gcc-9 1

sudo update-alternatives --display gcc

sudo update-alternatives --install /usr/bin/g++ g++ /usr/bin/g++-7 9
sudo update-alternatives --install /usr/bin/g++ g++ /usr/bin/g++-9 1

sudo update-alternatives --display g++
```

- 去官网下载CUDA(https://developer.nvidia.com/cuda-toolkit-archive)

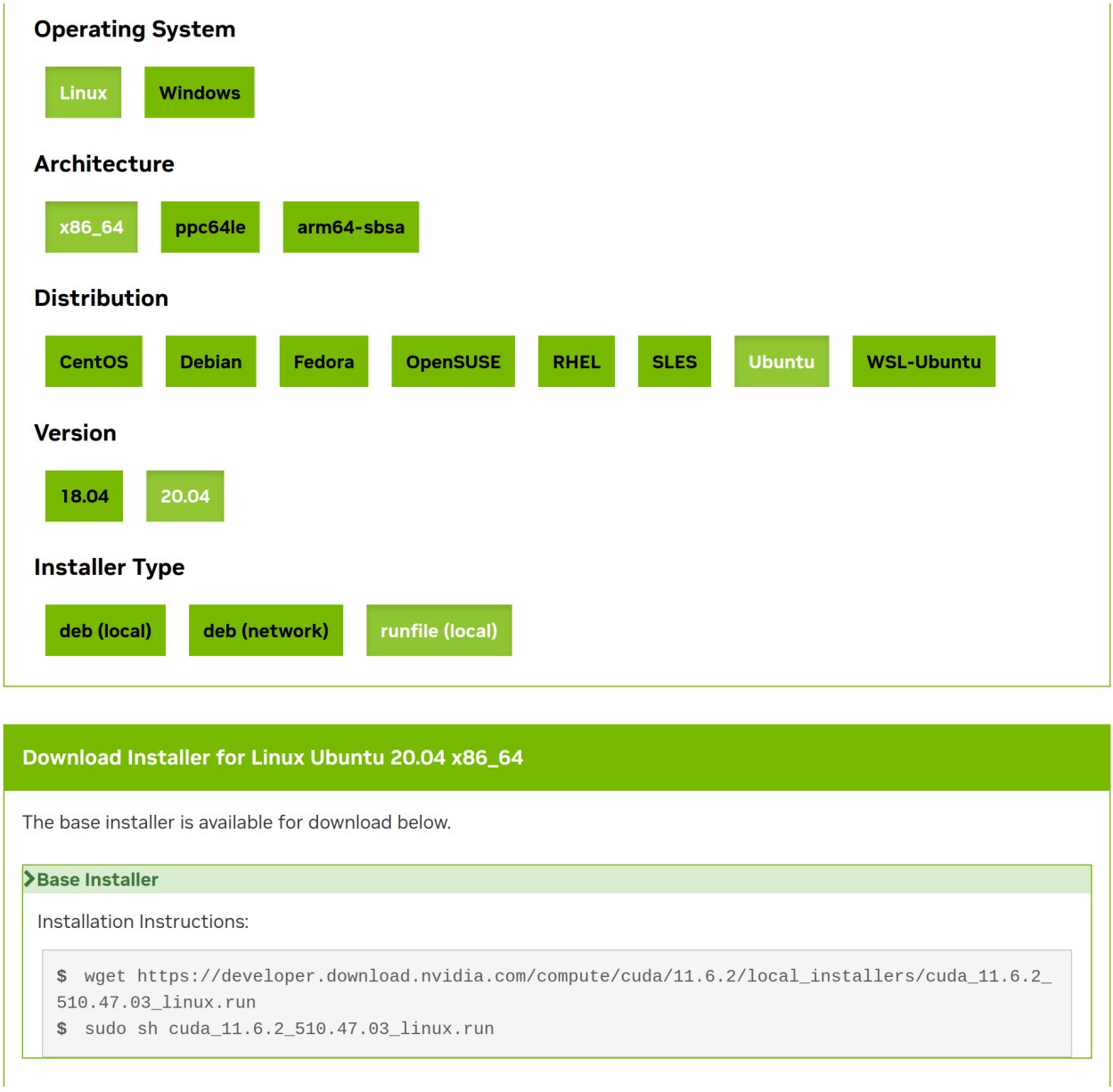
在wiki上查找自己显卡对应CUDA版本
(https://en.wikipedia.org/wiki/CUDA#Version_features_and_specifications)

如图

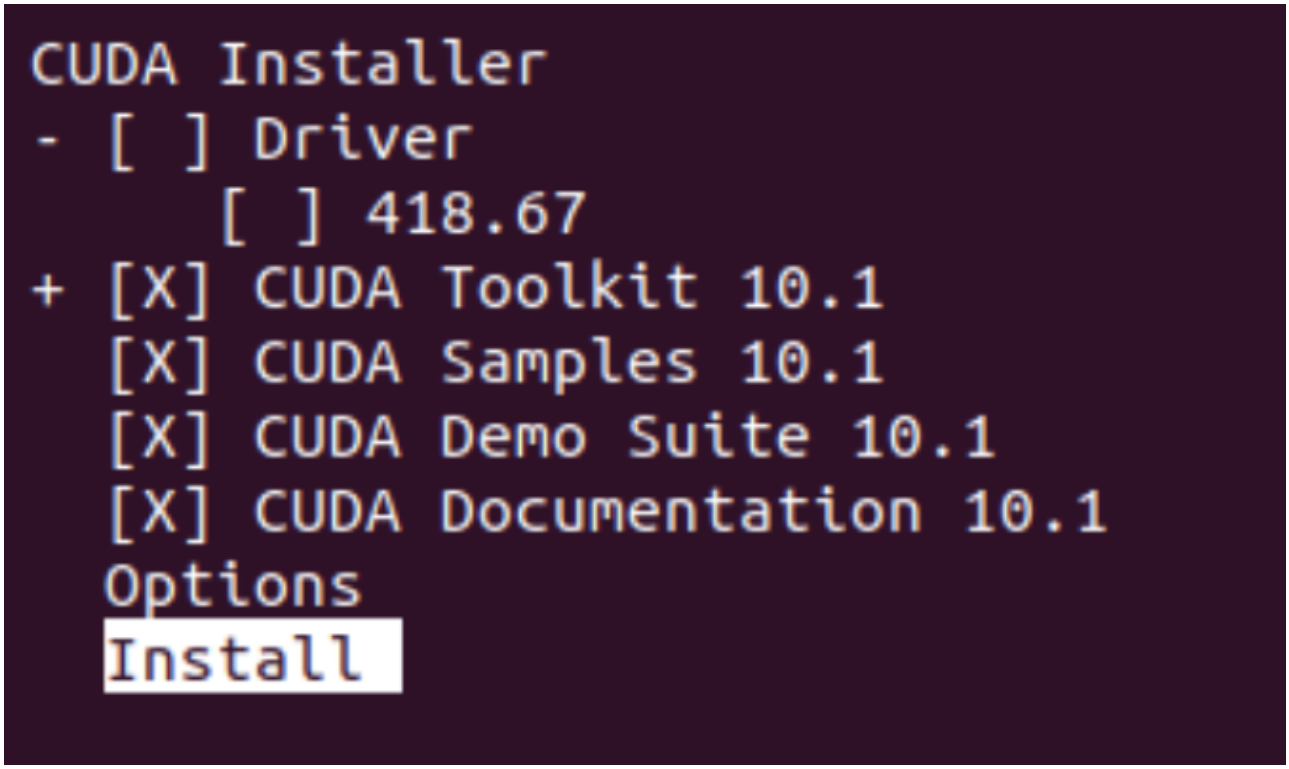
Compute Capability (CUDA SDK support vs. Microarchitecture)

CUDA SDK version(s)	Tesla	Fermi	Kepler (early)	Kepler (late)	Maxwell	Pascal	Volta	Turing	Ampere	Ada Lovelace	Hopper
1.0[33]	1.0 – 1.1										
1.1	1.0 – 1.1+x										
2.0	1.0 – 1.1+x										
2.1 - 2.3.1[34][35][36][37]	1.0 – 1.3										
3.0 - 3.1[38][39]	1.0 –	2.0									
3.2[40]	1.0 –	2.1									
4.0 - 4.2	1.0 –	2.1+x									
5.0 - 5.5	1.0 –			3.5							
6.0	1.0 –			3.5							
6.5	1.1 –				5.x						
7.0 - 7.5		2.0 –			5.x						
8.0		2.0 –				6.x					
9.0 - 9.2			3.0 –				7.0				
10.0 - 10.2			3.0 –					7.5			
11.0[41]				3.5 –					8.0		
11.1 - 11.4[42]				3.5 –					8.6		
11.5 - 11.7.1[43]				3.5 –					8.7		
11.8[44]				3.5 –							9.0
12.0 - 12.2					5.0 –						9.0

- 按照下图选择并运行网页提供的代码



在安装项处取消勾选显卡驱动，如下图



- 配置环境变量

```
export PATH=/usr/local/cuda-XX.X/bin${PATH:+:${PATH}}
# XX.X为安装的CUDA版本

export LD_LIBRARY_PATH=/usr/local/cuda-
XX.X/lib64\${LD_LIBRARY_PATH:+:${LD_LIBRARY_PATH}}
# XX.X为安装的CUDA版本

source ~/.bashrc
```

- 将这个文件中

/Terrestrial-Aerial-Navigation/src/uav_simulator/local_sensing/CMakeLists.txt

把

```
set(CUDA_NVCC_FLAGS
#        -gencode arch=compute_20,code=sm_20;
#        -gencode arch=compute_20,code=sm_21;
#        -gencode arch=compute_30,code=sm_30;
#        -gencode arch=compute_35,code=sm_35;
#        -gencode arch=compute_50,code=sm_50;
#        -gencode arch=compute_52,code=sm_52;
#        -gencode arch=compute_60,code=sm_60;
#       -gencode arch=compute_61,code=sm_61;
        -gencode arch=compute_80,code=sm_80;
)
```

中的两个80改为自己GPU所对应的数字，可以在这里找到(https://arnon.dk/matching-sm-architectures-arch-and-gencode-for-various-nvidia-cards/)

3. 安装OpenCV

- 安装所有依赖软件包

```
sudo apt install build-essential cmake git pkg-config libgtk-3-dev \
libavcodec-dev libavformat-dev libswscale-dev libv4l-dev \
libxvidcore-dev libx264-dev libjpeg-dev libpng-dev libtiff-dev \
gfortran openexr libatlas-base-dev python3-dev python3-numpy \
libtbb2 libtbb-dev libdc1394-22-dev libopenexr-dev \
libgstreamer-plugins-base1.0-dev libgstreamer1.0-dev
```

- 下载OpenCV和OpenCV contrib源码

```
mkdir ~/opencv_build && cd ~/opencv_build

git clone https://github.com/opencv/opencv.git

git clone https://github.com/opencv/opencv_contrib.git
```

- 配置构建OpenCV

```
cd ~/opencv_build/opencv
mkdir -p build && cd build

cmake -D CMAKE_BUILD_TYPE=RELEASE \
```

```
      -D CMAKE_INSTALL_PREFIX=/usr/local \
      -D INSTALL_C_EXAMPLES=ON \
      -D INSTALL_PYTHON_EXAMPLES=ON \
      -D OPENCV_GENERATE_PKGCONFIG=ON \
      -D OPENCV_EXTRA_MODULES_PATH=~/opencv_build/opencv_contrib/modules \
      -D BUILD_EXAMPLES=ON ..

      # OPENCV_EXTRA_MODULES_PATH后面为自己的opencv_contrib路径
```

- 编译(16改为自己处理器的核心数量)

```
make -j16
```

- 安装

```
sudo make install
```

- 查看版本

```
pkg-config --modversion opencv4
```

4. 安装NLopt

- 前往官网下载压缩包(https://nlopt.readthedocs.io/en/latest/) 解压后在文件夹内执行

```
cmake . && make && sudo make install
```

5. 安装其他库(可能已安装)

```
sudo apt-get update
```

- Eigen3

```
sudo apt-get install libeigen3-dev
```

- boost

```
sudo apt-get install libboost-all-dev
```

- armadillo

```
sudo apt-get install libarmadillo-dev ros-noetic-nlopt
```

四、根据ubuntu20.04修改相关内容

1. 修改/Terrestrial-Aerial-Navigation/src/uav_simulator/Utils/poly_traj_server/CMakeLists.txt 添加以下内容


```
cmake_minimum_required(VERSION 2.8)
project(poly_traj_server)

# set(CMAKE_VERBOSE_MAKEFILE "false")
set(CMAKE_BUILD_TYPE "Release")
set(CMAKE_CXX_FLAGS "-std=c++11 -march=native -DEIGEN_DONT_PARALLELIZE ${CMAKE_CXX_FLAGS} -g -O3 -Wall")

find_package(catkin REQUIRED COMPONENTS
    roscpp
    std_msgs
    nav_msgs
    sensor_msgs
    quadrotor_msgs
    tf)

find_package(Eigen3 REQUIRED)

catkin_package(

)

include_directories(
    include
    ${catkin_INCLUDE_DIRS}
    ${EIGEN3_INCLUDE_DIR}
    )

add_executable (poly_traj_server_node
    src/traj_server.cpp)

target_link_libraries(poly_traj_server_node
    ${catkin_LIBRARIES})

```

2. 修改Terrestrial-Aerial-Navigation/src/TIE_navigation/bspline_opt/CMakeLists.txt文件，将所有和NLopt相关的代码修改为

```
find_package(NLopt REQUIRED)
set(NLopt_INCLUDE_DIRS ${NLOPT_INCLUDE_DIR})

...

include_directories(
    SYSTEM
    include
    ${catkin_INCLUDE_DIRS}
    ${Eigen3_INCLUDE_DIRS}
    ${PCL_INCLUDE_DIRS}
    ${NLOPT_INCLUDE_DIR}
)

...

add_library( bspline_opt
    src/bspline_optimizer.cpp
    )
target_link_libraries( bspline_opt
    ${catkin_LIBRARIES}
    ${NLOPT_LIBRARIES}
    )
```

3. 在所有包的CMakeLists.txt文件内添加

```
set(CMAKE_CXX_STANDARD 14)
```

编译并运行

```
cd Terrestrial-Aerial-Navigation
catkin_make
source devel/setup.bash
sh src/run.sh
```

- 进入RViz以后使用2D Nav Goal给出目标点