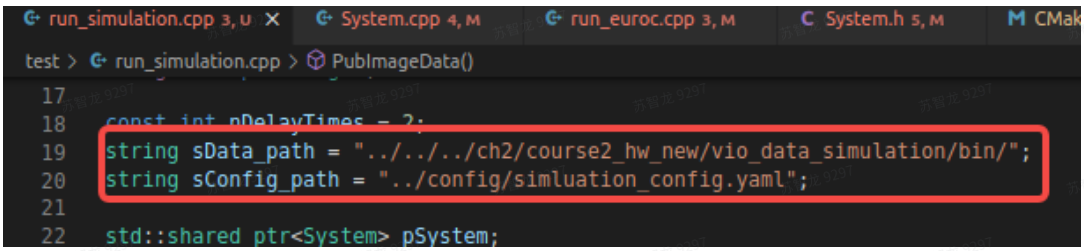
SOUSIC-第 7 章作业

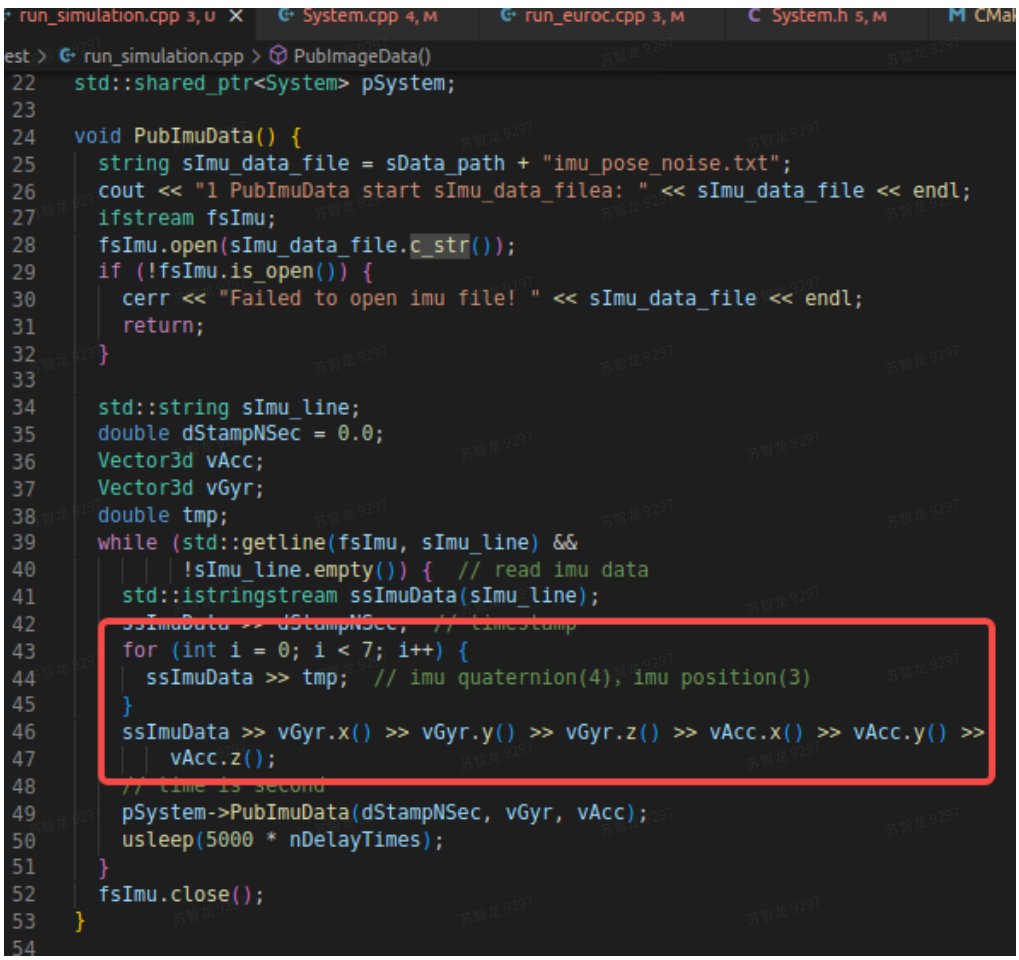
1. 代码修改

1. 创建文件 run_simulation.cpp，内容基本参照 run_euroc.cpp，修改一下数据路径和读取数据的方法

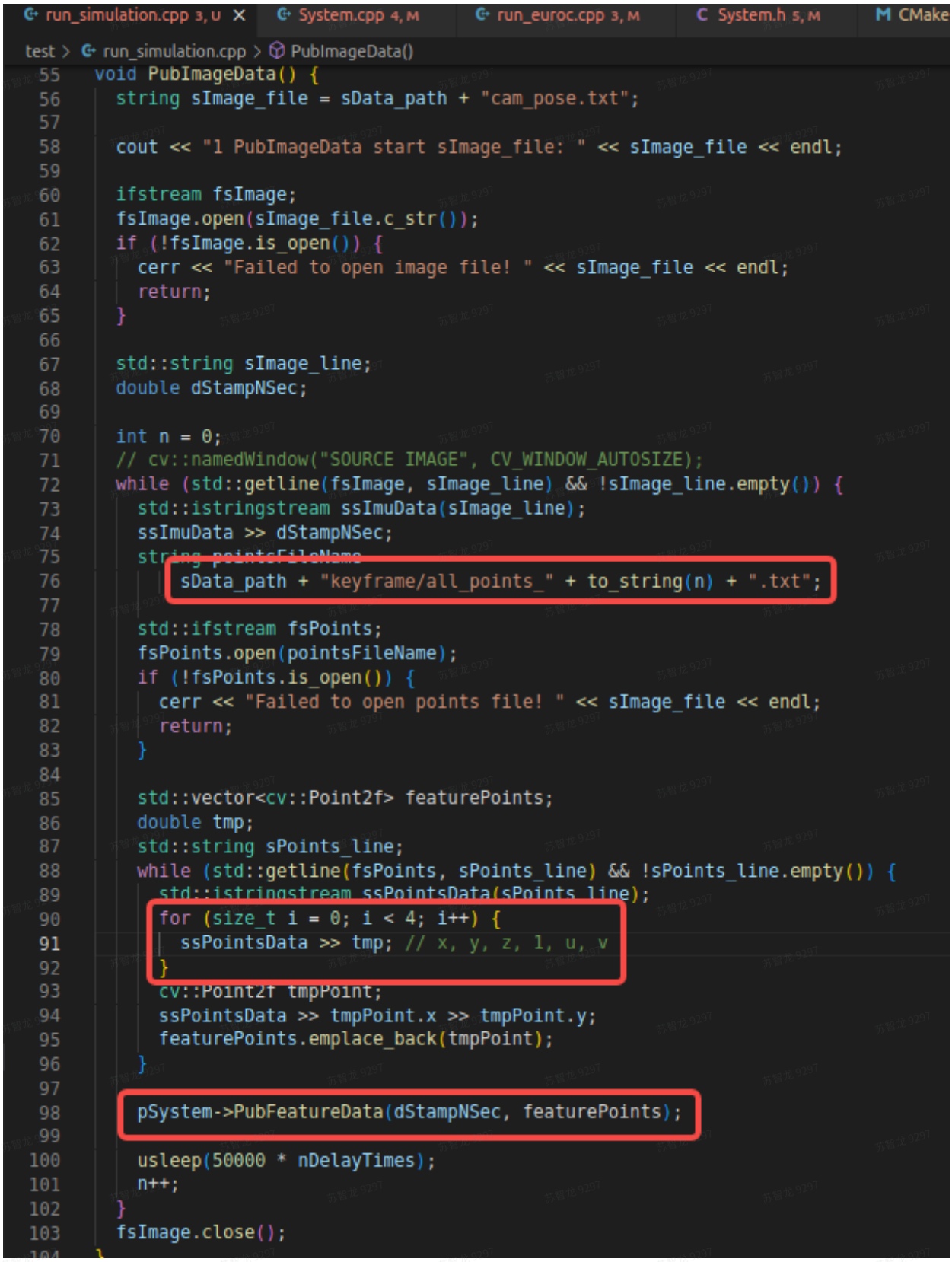
   a. 数据路径



   b. `PubImuData()` 修改：注意把前面 7 个不需要的数据先输出到 tmp 中



   c. `PubImageData()` 修改：注意 txt 文件的路径；x, y, z, 1 不需要，先输出到 tmp 中；新建一个函数 `pSystem->PubFeatureData` 来处理 features



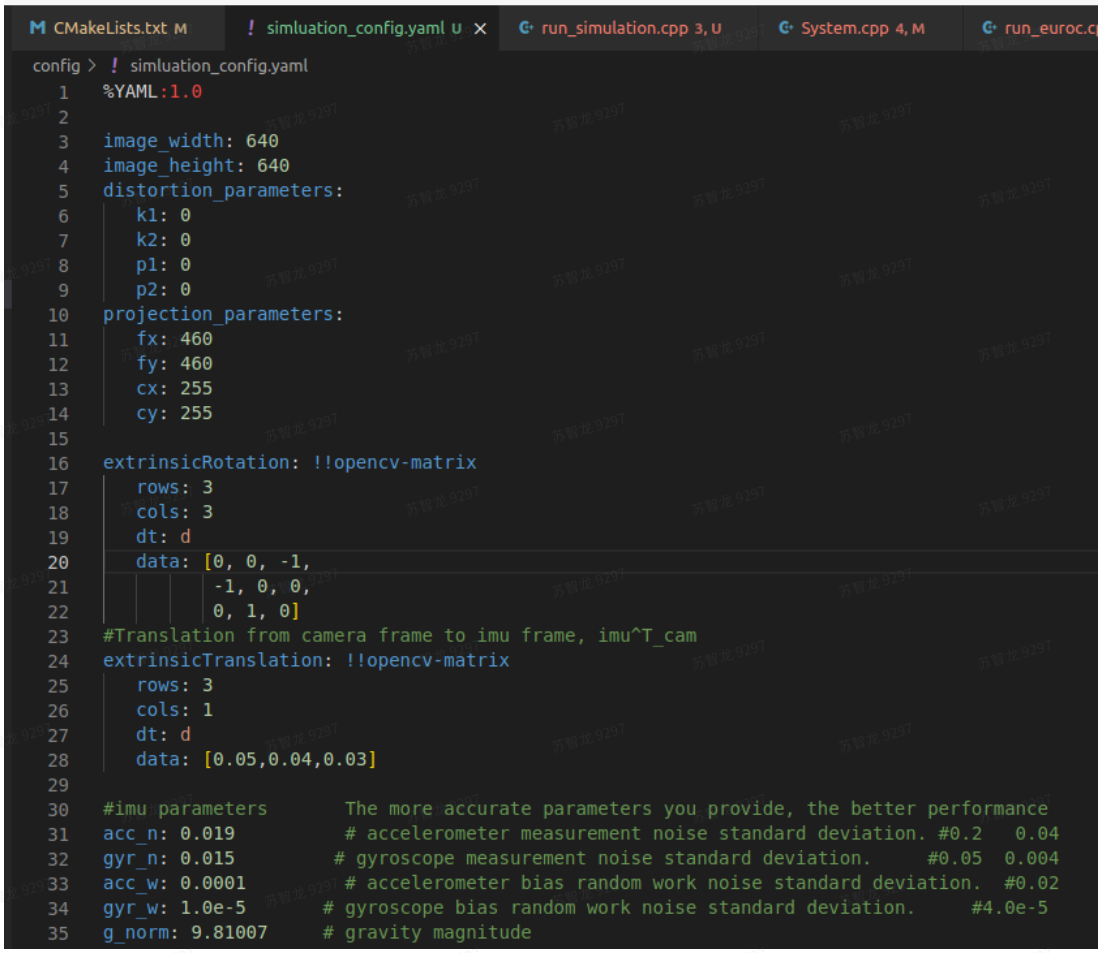
d. 在 System.cpp 中新建 `pSystem->PubFeatureData` 函数

```cpp
void System::PubFeatureData(double dStampSec, const vector<cv::Point2f> &featurePoints) {
    if (!init_feature) {
        cout << "1 PubImageData skip the first detected feature, which doesn't contain optical flow speed" << en
        init_feature = 1;
        return;
    }

    if (first_image_flag) {      You, 6 minutes ago • Uncommitted changes
        cout << "2 PubImageData first_image_flag" << endl;
        first_image_flag = false;
        first_image_time = dStampSec;
        last_image_time = dStampSec;
        return;
    }
    // detect unstable camera stream 发现时间戳不连续甚至倒退，提示重新输入
    if (dStampSec - last_image_time > 1.0 || dStampSec < last_image_time) {
        cerr << "3 PubImageData image discontinue! reset the feature tracker!" << endl;
        first_image_flag = true;
        last_image_time = 0;
        pub_count = 1;
        return;
    }
    last_image_time = dStampSec;

    PUB_THIS_FRAME = true;

    TicToc t_r;

    if (PUB_THIS_FRAME) {
        pub_count++;
        shared_ptr<IMG_MSG> feature_points(new IMG_MSG());
        feature_points->header = dStampSec;
        vector<set<int>> hash_ids(NUM_OF_CAM);
        for (int i = 0; i < NUM_OF_CAM; i++) {
            for (unsigned int j = 0; j < featurePoints.size(); j++) {
                int p_id = j;
                hash_ids[i].insert(p_id);
                double x = featurePoints[j].x;
                double y = featurePoints[j].y;
                double z = 1;
                feature_points->points.push_back(Vector3d(x, y, z));
                feature_points->id_of_point.push_back(p_id * NUM_OF_CAM + i);

                float u = 460 * x + 255;
                float v = 460 * y + 255;
                feature_points->u_of_point.push_back(u);
                feature_points->v_of_point.push_back(v);
                feature_points->velocity_x_of_point.push_back(0);
                feature_points->velocity_y_of_point.push_back(0);
            }

            // skip the first image; since no optical speed on frist image
            if (!init_pub) {
                cout << "4 PubImage init_pub skip the first image!" << endl;
                init_pub = 1;
            } else {
                m_buf.lock();
                feature_buf.push(feature_points);
                // cout << "5 PubImage t : " << fixed << feature_points->header
                //      << " feature_buf size: " << feature_buf.size() << endl;
                m_buf.unlock();
                con.notify_one();
            }
        }
    }
}
```

2. 修改 CmakeLists.txt

```
84
85  add_executable(run_simulation test/run_simulation.cpp)
86  target_link_libraries(run_simulation
87    MyVio
88    -lpthread)
89
```

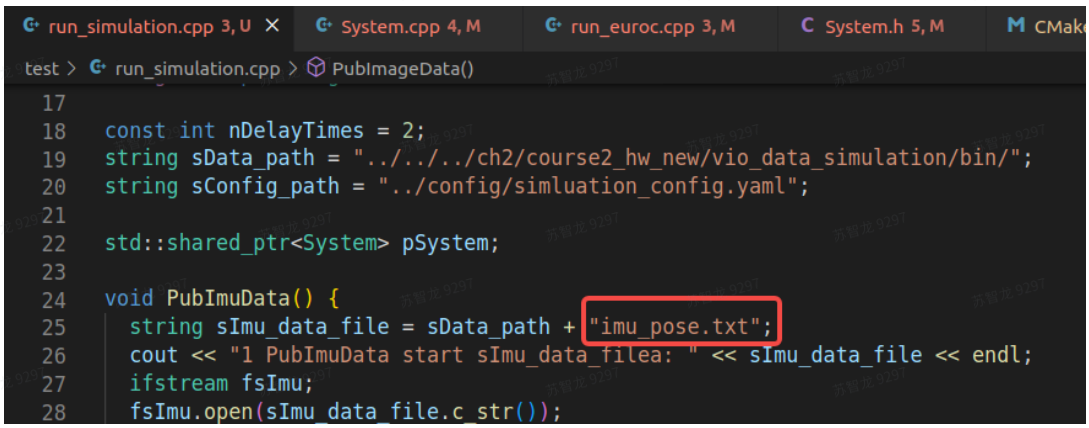
3. 在 config 文件夹下创建 simluation_config.yaml，复制 euroc_config.yaml 中需要的部分，并做如下修改：



```yaml
%YAML:1.0

image_width: 640
image_height: 640
distortion_parameters:
   k1: 0
   k2: 0
   p1: 0
   p2: 0
projection_parameters:
   fx: 460
   fy: 460
   cx: 255
   cy: 255

extrinsicRotation: !!opencv-matrix
   rows: 3
   cols: 3
   dt: d
   data: [0, 0, -1,
          -1, 0, 0,
          0, 1, 0]
#Translation from camera frame to imu frame, imu^T_cam
extrinsicTranslation: !!opencv-matrix
   rows: 3
   cols: 1
   dt: d
   data: [0.05,0.04,0.03]

#imu parameters       The more accurate parameters you provide, the better performance
acc_n: 0.019          # accelerometer measurement noise standard deviation. #0.2   0.04
gyr_n: 0.015         # gyroscope measurement noise standard deviation.     #0.05  0.004
acc_w: 0.0001         # accelerometer bias random work noise standard deviation.  #0.02
gyr_w: 1.0e-5       # gyroscope bias random work noise standard deviation.     #4.0e-5
g_norm: 9.81007     # gravity magnitude
```

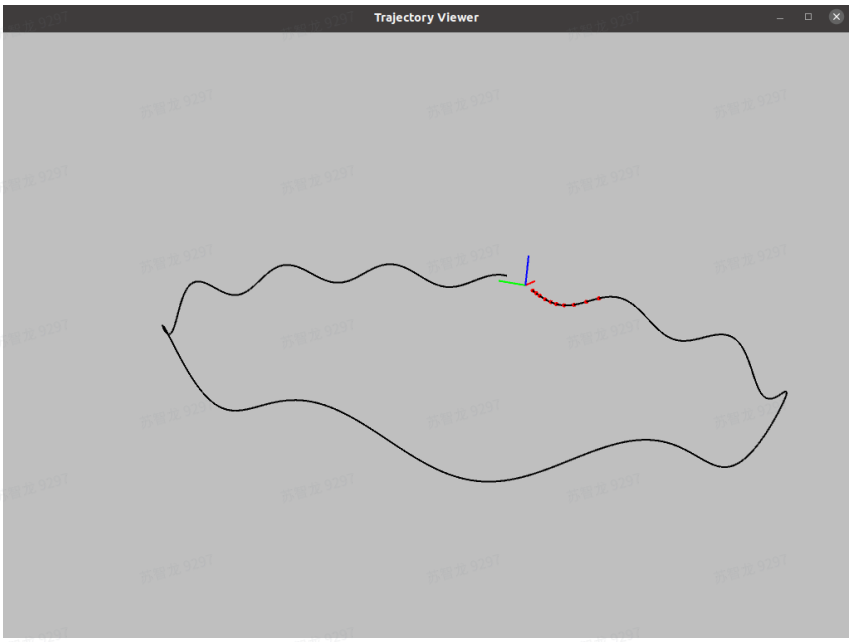
2. 无噪声

2.1 代码修改

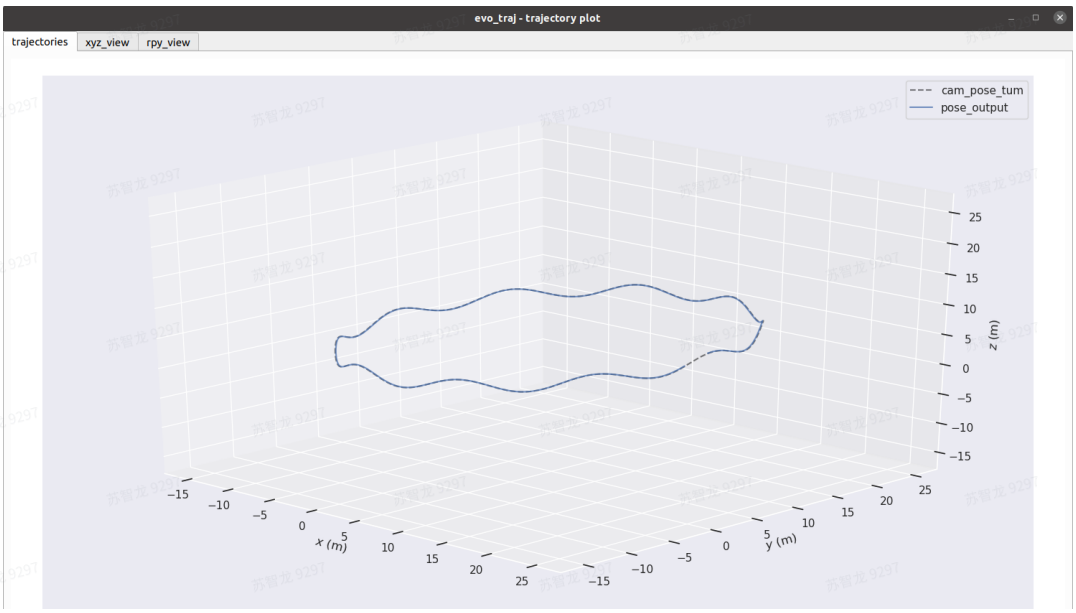


```cpp
const int nDelayTimes = 2;
string sData_path = "../../../ch2/course2_hw_new/vio_data_simulation/bin/";
string sConfig_path = "../config/simluation_config.yaml";

std::shared_ptr<System> pSystem;

void PubImuData() {
  string sImu_data_file = sData_path + "imu_pose.txt";
  cout << "1 PubImuData start sImu_data_filea: " << sImu_data_file << endl;
  ifstream fsImu;
  fsImu.open(sImu_data_file.c_str());
```

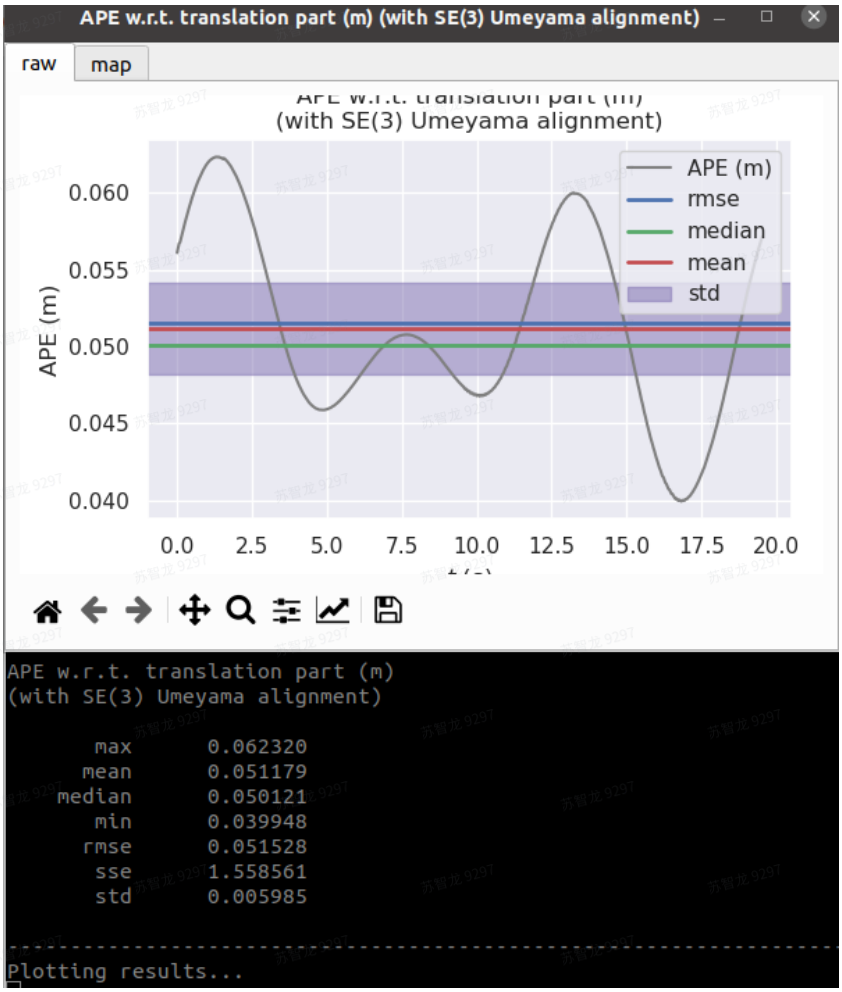
2.2 结果



2.3 evo traj

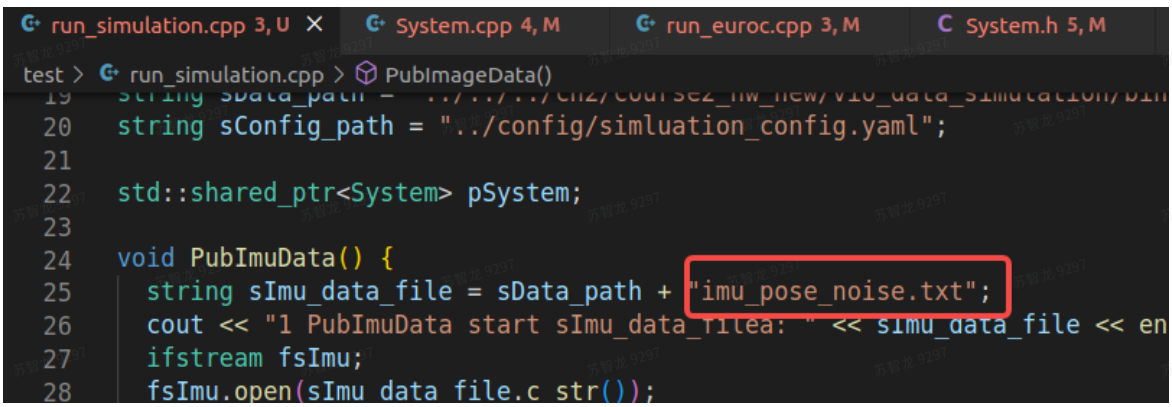


2.2 evo ape



3. 加噪声

- 修改 ch2 中数据生成中的 noise，并修改输入数据路径：



增加噪声后的运行结果如下：

3.1 小噪声

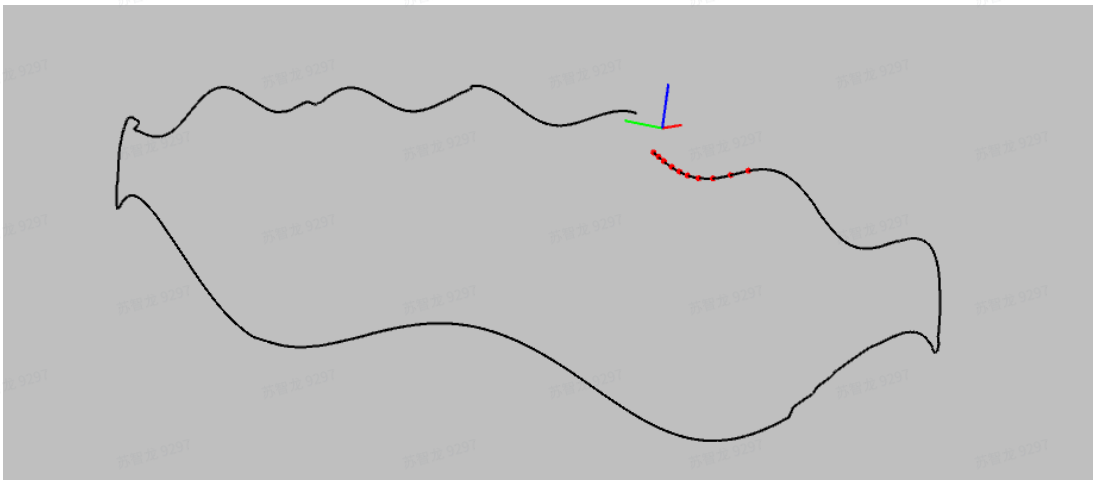
3.1.1 代码修改

param.h | CMakeLists.txt

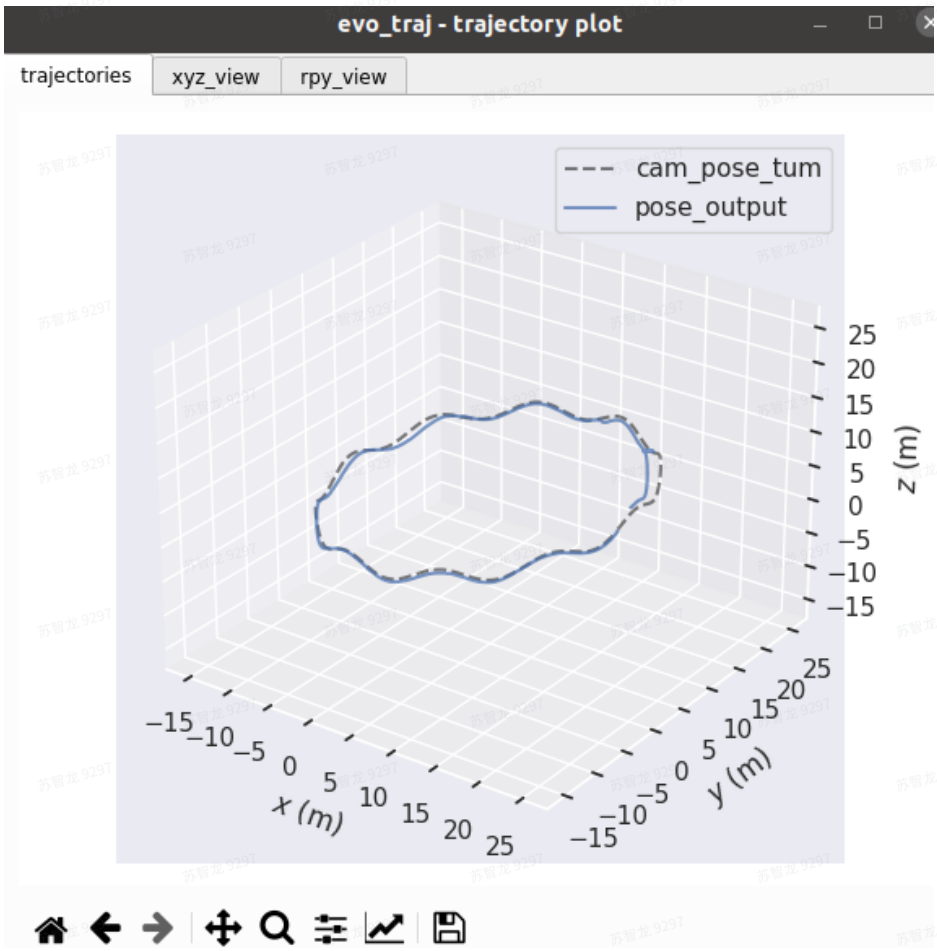
src > param.h > ...

```
23
24      // noise
25      double gyro_bias_sigma = 1.0e-6;
26      double acc_bias_sigma = 0.00001;
27
28      double gyro_noise_sigma = 0.0015;    // rad/s
29      double acc_noise_sigma = 0.0019;      //  m/(
30
31      double pixel_noise = 1;              // 1 pix
```

3.1.2 结果

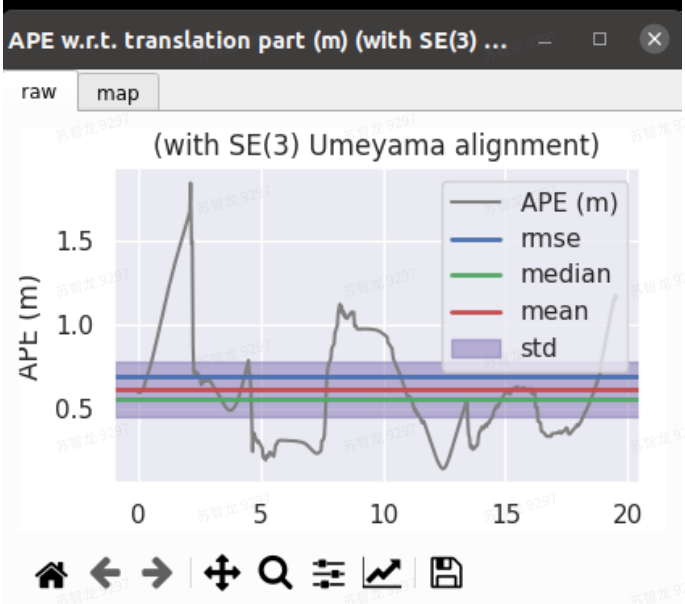


3.1.3 evo traj



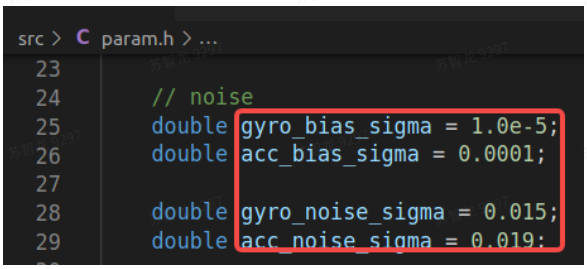
3.1.4 evo ape

```
APE w.r.t. translation part (m)
(with SE(3) Umeyama alignment)

       max      1.844232
      mean      0.608415
    median      0.554803
       min      0.137606
      rmse      0.690970
       sse      280.257336
       std      0.327522
```

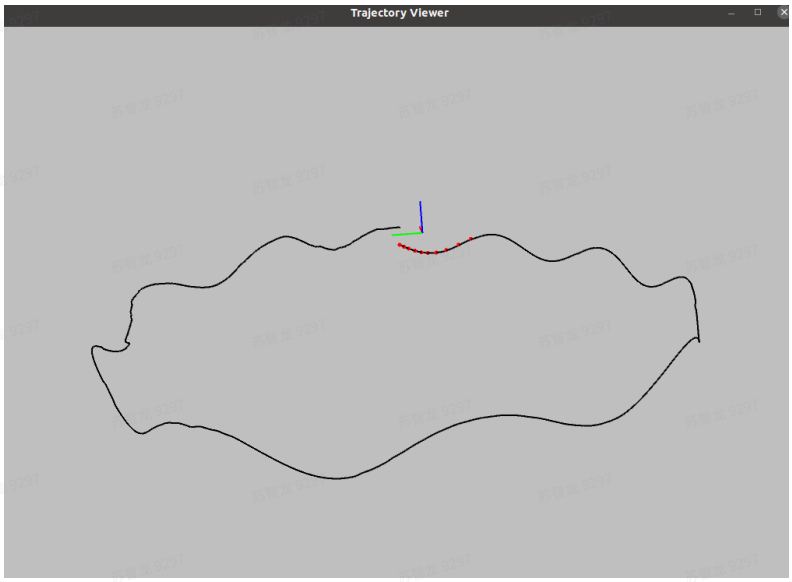


3.2 大噪声

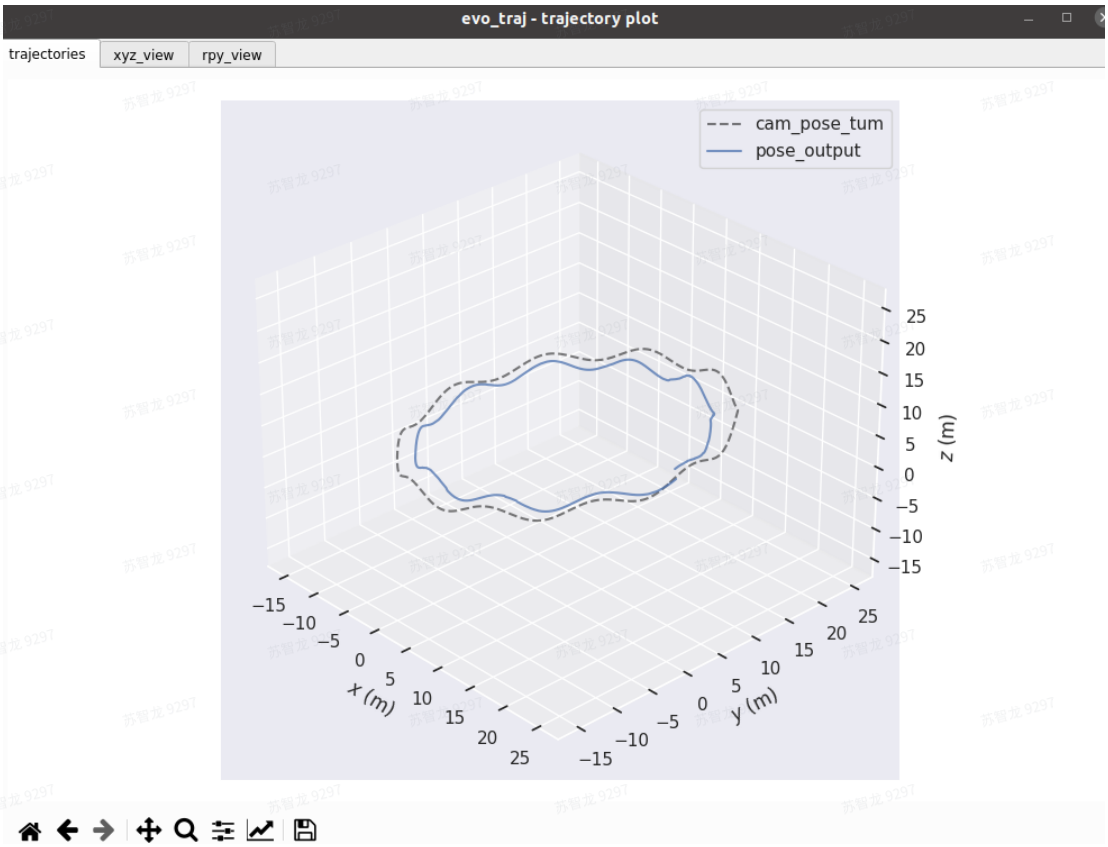
3.2.1 代码修改



3.2.2 结果



3.2.3 evo traj



3.2.4 evo ape

```
APE w.r.t. translation part (m)
(with SE(3) Umeyama alignment)

       max      3.398316
      mean      2.312648
    median      2.312985
       min      1.375330
      rmse      2.370403
       sse      3298.242429
       std      0.520067
```