

hw1-CSE252C

May 3, 2020

1 CSE252C: Homework 1

1.1 Computing Resources

Please read the README file of this repository for the instructions ## Instructions 1. Attempt all questions. 2. Please comment all your code adequately. 3. Include all relevant information such as text answers, output images in notebook. 4. **Academic integrity:** The homework must be completed individually.

5. Submission instructions:

- (a) Submit the notebook and its PDF version on Gradescope.
- (b) Rename your submission files as Lastname_Firstname.ipynb and Lastname_Firstname.pdf.
- (c) Correctly select pages for each answer on Gradescope to allow proper grading.

6. Due date: Assignments are due Mon, May 4, by 4pm PST.

1.2 Question 1: Warm Up

We will first try SFM using the original implementation from `libviso2`[8],[9]. We will test on a dataset containing 300 images from one sequence of the KITTI dataset with ground-truth camera poses and camera calibration information.

Run the SFM algorithm using the following script. You are required to report two error metrics. The error metric for rotation is defined as the mean of Frobenius norm of the difference between the ground-truth rotation matrix and predicted rotation matrix. The error metric for translation is defined as mean of the L2 distance. Both errors will be printed on the screen as you run the code. (**5 points**)

```
[2]: import os
import sys
# change your base path
os.chdir('./pyviso/') # './'
print(os.getcwd())
```

/Users/QV/code-project/hw/spring2019/cse252c/cse252c_hw1/pyviso

```
[6]: import os
import numpy as np
np.set_printoptions(precision=4)
np.set_printoptions(suppress=True)
import viso2
import matplotlib.pyplot as plt
from skimage.io import imread
import time

def errorMetric(RPred, RGt, TPred, TGt):
    diffRot = (RPred - RGt)
    diffTrans = (TPred - TGt)
    errorRot = np.sqrt(np.sum(np.multiply(diffRot.reshape(-1), diffRot.
    ↪reshape(-1))))
    errorTrans = np.sqrt(np.sum(np.multiply(diffTrans.reshape(-1), diffTrans.
    ↪reshape(-1)))))

    return errorRot, errorTrans

if_vis = True # set to True to do the visualization per frame; the images will
    ↪be saved at '.vis/'. Turn off if you just want the camera poses and errors
if_on_screen = False # if True the visualization per frame is going to be
    ↪displayed realtime on screen; if False there will be no display, but in both
    ↪options the images will be saved

# parameter settings (for an example, please download
# dataset_path = '../dataset'
dataset_path = '/Users/QV/code-project/datasets/dataset_SfM' # On the ``ieng6.
    ↪ucsd.edu`` server
img_dir      = os.path.join(dataset_path, 'sequences/00/image_0')
gt_dir       = os.path.join(dataset_path, 'poses/00.txt')
calibFile    = os.path.join(dataset_path, 'sequences/00/calib.txt')
border       = 50
gap          = 15

# Load the camera calibration information
with open(calibFile) as fid:
    calibLines = fid.readlines()
    calibLines = [calibLine.strip() for calibLine in calibLines]

calibInfo = [float(calibStr) for calibStr in calibLines[0].split(' ')[1:]]
# param = {'f': calibInfo[0], 'cu': calibInfo[2], 'cv': calibInfo[6]}

# Load the ground-truth depth and rotation
with open(gt_dir) as fid:
    gtTr = [[float(TrStr) for TrStr in line.strip().split(' ')] for line in fid.
    ↪readlines()]
```

```

gtTr = np.asarray(gtTr).reshape(-1, 3, 4)

# param['height'] = 1.6
# param['pitch'] = -0.08
# param['match'] = {'pre_step_size': 64}
first_frame = 0
last_frame = 300
epi = 1e-8

# init visual odometry
params = viso2.Mono_parameters()
params.calib.f = calibInfo[0]
params.calib.cu = calibInfo[2]
params.calib.cv = calibInfo[6]
params.height = 1.6
params.pitch = -0.08

first_frame = 0
last_frame = 300

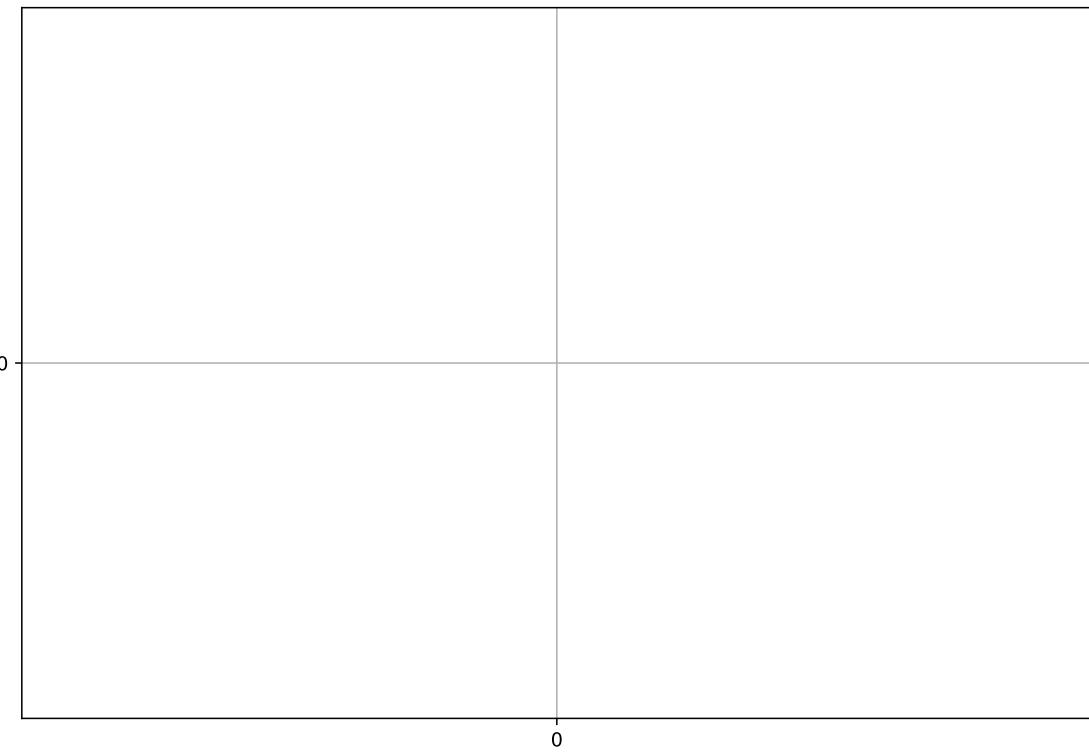
# init transformation matrix array
Tr_total = []
Tr_total_np = []
Tr_total.append(viso2.Matrix_eye(4))
Tr_total_np.append(np.eye(4))

# init viso module
visoMono = viso2.VisualOdometryMono(params)

if if_vis:
    save_path = 'vis'
    os.makedirs(save_path, exist_ok=True)

    # create figure
    fig = plt.figure(figsize=(10, 15))
    ax1 = plt.subplot(211)
    ax1.axis('off')
    ax2 = plt.subplot(212)
    ax2.set_xticks(np.arange(-100, 100, step=10))
    ax2.set_yticks(np.arange(-500, 500, step=10))
    ax2.axis('equal')
    ax2.grid()
    if if_on_screen:
        plt.ion()
    else:
        plt.ioff()

```



```
[8]: # for all frames do
if_replace = False
errorTransSum = 0
errorRotSum = 0
errorRot_list = []
errorTrans_list = []

for frame in range(first_frame, last_frame):
    # 1-based index
    k = frame-first_frame+1

    # read current images
    I = imread(os.path.join(img_dir, '%06d.png'%frame))
    assert(len(I.shape) == 2) # should be grayscale

    # compute egomotion
    process_result = visoMono.process_frame(I, if_replace)
    Tr = visoMono.getMotion()
    matrixer = viso2.Matrix(Tr)
    Tr_np = np.zeros((4, 4))
    Tr.toNumpy(Tr_np) # so awkward...

    # accumulate egomotion, starting with second frame
    if k > 1:
        if process_result is False:
            if_replace = True
            Tr_total.append(Tr_total[-1])
            Tr_total_np.append(Tr_total_np[-1])
        else:
            if_replace = False
            Tr_total.append(Tr_total[-1] * viso2.Matrix_inv(Tr))
            Tr_total_np.append(Tr_total_np[-1] @ np.linalg.inv(Tr_np)) # should be the same
    print(Tr_total_np[-1])

    # output statistics
    num_matches = visoMono.getNumberOfMatches()
    num_inliers = visoMono.getNumberOfInliers()
    matches = visoMono.getMatches()
    matches_np = np.empty([4, matches.size()])

    for i,m in enumerate(matches):
        matches_np[:, i] = (m.u1p, m.v1p, m.u1c, m.v1c)

    if if_vis:
        # update image
        ax1.clear()
```

```

        ax1.imshow(I, cmap='gray', vmin=0, vmax=255)
        if num_matches != 0:
            for n in range(num_matches):
                ax1.plot([matches_np[0, n], matches_np[2, n]], [matches_np[1, n], matches_np[3, n]])
        ax1.set_title('Frame %d'%frame)

        # update trajectory
        if k > 1:
            ax2.plot([Tr_total_np[k-2][0, 3], Tr_total_np[k-1][0, 3]], \
                      [Tr_total_np[k-2][2, 3], Tr_total_np[k-1][2, 3]], 'b.-', \
                      linewidth=1)
            ax2.plot([gtTr[k-2][0, 3], gtTr[k-1][0, 3]], \
                      [gtTr[k-2][2, 3], gtTr[k-1][2, 3]], 'r.-', linewidth=1)
        ax2.set_title('Blue: estimated trajectory; Red: ground truth trajectory')

        plt.draw()

    # Compute rotation
    Rpred_p = Tr_total_np[k-2][0:3, 0:3]
    Rpred_c = Tr_total_np[k-1][0:3, 0:3]
    Rpred = Rpred_c.transpose() @ Rpred_p
    Rgt_p = np.squeeze(gtTr[k-2, 0:3, 0:3])
    Rgt_c = np.squeeze(gtTr[k-1, 0:3, 0:3])
    Rgt = Rgt_c.transpose() @ Rgt_p
    # Compute translation
    Tpred_p = Tr_total_np[k-2][0:3, 3:4]
    Tpred_c = Tr_total_np[k-1][0:3, 3:4]
    Tpred = Tpred_c - Tpred_p
    Tgt_p = gtTr[k-2, 0:3, 3:4]
    Tgt_c = gtTr[k-1, 0:3, 3:4]
    Tgt = Tgt_c - Tgt_p
    # Compute errors
    errorRot, errorTrans = errorMetric(Rpred, Rgt, Tpred, Tgt)
    errorRotSum = errorRotSum + errorRot
    errorTransSum = errorTransSum + errorTrans
    # errorRot_list.append(errorRot)
    # errorTrans_list.append(errorTrans)
    print('Mean Error Rotation: %.5f' %(errorRotSum / (k-1+epi)))
    print('Mean Error Translation: %.5f' %(errorTransSum / (k-1+epi)))

    print('== [Result] Frame: %d, Matches %d, Inliers: %.2f'%(frame, \
    num_matches, 100*num_inliers/(num_matches+1e-8)))

    if if_vis:

```

```

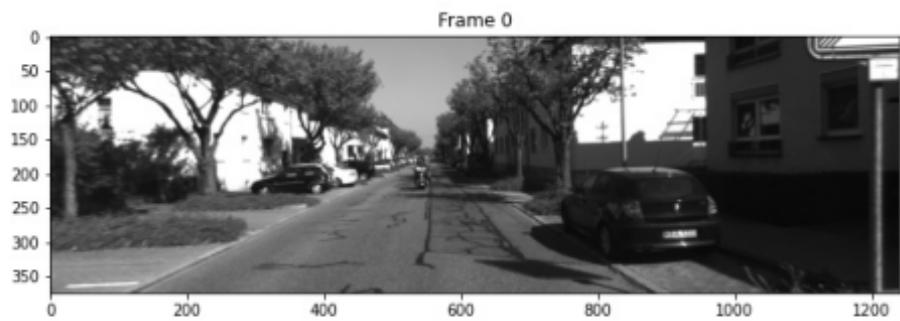
# input('Paused; Press Enter to continue') # Option 1: Manually pause
→and resume
if if_on_screen:
    plt.pause(0.1) # Or Option 2: enable this to auto pause for a
→while after daring to enable animation in case of a delay in drawing
    vis_path = os.path.join(save_path, 'frame%03d.jpg'%frame)
    fig.savefig(vis_path)
    print('Saved at %s'%vis_path)

if frame % 50 == 0 or frame == last_frame-1:
    plt.figure(figsize=(10, 15))
    plt.imshow(plt.imread(vis_path))
    plt.axis('off')
    plt.show()

# input('Press Enter to exit')

```

Mean Error Rotation: 6947558.55240
Mean Error Translation: 9718750861.05217
== [Result] Frame: 0, Matches 0, Inliers: 0.00
Saved at vis/frame000.jpg
<Figure size 432x288 with 0 Axes>



Blue: estimated trajectory; Red: ground truth trajectory



```

[[ 1.      -0.0016 -0.003  -0.0052]
 [ 0.0016   1.      -0.0021 -0.0045]
 [ 0.003    0.0021   1.      0.4767]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.07306
Mean Error Translation: 97.57250
== [Result] Frame: 1, Matches 320, Inliers: 89.69
Saved at vis/frame001.jpg
[[ 1.      -0.0011 -0.0079 -0.0057]
 [ 0.0011   1.      -0.0036 -0.0085]
 [ 0.0079   0.0036   1.      0.9479]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.03858
Mean Error Translation: 48.98120
== [Result] Frame: 2, Matches 325, Inliers: 83.38
Saved at vis/frame002.jpg
[[ 0.9999 -0.0021 -0.0123 -0.0119]
 [ 0.002    1.      -0.0046 -0.0159]
 [ 0.0123   0.0046   0.9999  1.4281]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.02701
Mean Error Translation: 32.78121
== [Result] Frame: 3, Matches 329, Inliers: 83.59
Saved at vis/frame003.jpg
[[ 0.9998 -0.0029 -0.0179 -0.0188]
 [ 0.0028   1.      -0.0051 -0.0207]
 [ 0.018    0.0051   0.9998  1.9135]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.02163
Mean Error Translation: 24.67970
== [Result] Frame: 4, Matches 338, Inliers: 81.66
Saved at vis/frame004.jpg
[[ 0.9998 -0.0019 -0.0213 -0.0413]
 [ 0.0018   1.      -0.0053 -0.0269]
 [ 0.0213   0.0053   0.9998  2.4154]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.01778
Mean Error Translation: 19.81543
== [Result] Frame: 5, Matches 316, Inliers: 79.11
Saved at vis/frame005.jpg
[[ 0.9997  0.001   -0.0252 -0.0662]
 [-0.0012   1.      -0.0066 -0.0328]
 [ 0.0251   0.0066   0.9997  2.9207]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.01553
Mean Error Translation: 16.57182

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== [Result] Frame: 6, Matches 318, Inliers: 85.53
Saved at vis/frame006.jpg
[[ 0.9995  0.0041 -0.03  -0.0885]
 [-0.0043  1.       -0.0071 -0.0377]
 [ 0.03    0.0072  0.9995  3.4317]
 [ 0.      0.       0.       1.      ]]
Mean Error Rotation: 0.01409
Mean Error Translation: 14.25433
== [Result] Frame: 7, Matches 322, Inliers: 79.50
Saved at vis/frame007.jpg
[[ 0.9994  0.004  -0.0348 -0.1071]
 [-0.0042  1.       -0.0056 -0.0426]
 [ 0.0348  0.0058  0.9994  3.9615]
 [ 0.      0.       0.       1.      ]]
Mean Error Rotation: 0.01301
Mean Error Translation: 12.51379
== [Result] Frame: 8, Matches 324, Inliers: 83.02
Saved at vis/frame008.jpg
[[ 0.9992  0.0035 -0.0392 -0.1321]
 [-0.0036  1.       -0.0029 -0.0483]
 [ 0.0391  0.003   0.9992  4.5277]
 [ 0.      0.       0.       1.      ]]
Mean Error Rotation: 0.01229
Mean Error Translation: 11.15604
== [Result] Frame: 9, Matches 334, Inliers: 83.83
Saved at vis/frame009.jpg
[[ 0.9991  0.0031 -0.0429 -0.16  ]
 [-0.0031  1.       -0.0003 -0.0559]
 [ 0.0429  0.0004  0.9991  5.1116]
 [ 0.      0.       0.       1.      ]]
Mean Error Rotation: 0.01166
Mean Error Translation: 10.06807
== [Result] Frame: 10, Matches 318, Inliers: 85.22
Saved at vis/frame010.jpg
[[ 0.9989  0.0034 -0.0464 -0.1853]
 [-0.0034  1.       -0.001  -0.0612]
 [ 0.0464  0.0012  0.9989  5.6788]
 [ 0.      0.       0.       1.      ]]
Mean Error Rotation: 0.01079
Mean Error Translation: 9.17933
== [Result] Frame: 11, Matches 328, Inliers: 83.23
Saved at vis/frame011.jpg
[[ 0.9988  0.0025 -0.0488 -0.2158]
 [-0.0025  1.       -0.0012 -0.0678]
 [ 0.0488  0.0013  0.9988  6.2625]
 [ 0.      0.       0.       1.      ]]
Mean Error Rotation: 0.01010
Mean Error Translation: 8.43742

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== [Result] Frame: 12, Matches 321, Inliers: 88.47
Saved at vis/frame012.jpg
[[ 0.9987 -0.0017 -0.0513 -0.2408]
 [ 0.0016  1.       -0.0017 -0.0731]
 [ 0.0513  0.0016  0.9987  6.8455]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00984
Mean Error Translation: 7.80973
== [Result] Frame: 13, Matches 325, Inliers: 87.69
Saved at vis/frame013.jpg
[[ 0.9987  0.002   -0.0516 -0.2904]
 [-0.002   1.       -0.0008 -0.0811]
 [ 0.0516  0.0009  0.9987  7.4244]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00954
Mean Error Translation: 7.27186
== [Result] Frame: 14, Matches 320, Inliers: 81.25
Saved at vis/frame014.jpg
[[ 0.9986  0.0004 -0.0525 -0.3297]
 [-0.0005  1.       -0.002   -0.0801]
 [ 0.0525  0.002   0.9986  8.0364]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00906
Mean Error Translation: 6.80333
== [Result] Frame: 15, Matches 315, Inliers: 84.76
Saved at vis/frame015.jpg
[[ 0.9985  0.0024 -0.0554 -0.3583]
 [-0.0026  1.       -0.005   -0.083 ]
 [ 0.0554  0.0051  0.9985  8.6546]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00857
Mean Error Translation: 6.39349
== [Result] Frame: 16, Matches 293, Inliers: 81.23
Saved at vis/frame016.jpg
[[ 0.9984  0.0016 -0.0573 -0.3924]
 [-0.002   1.       -0.0077 -0.0889]
 [ 0.0573  0.0078  0.9983  9.2851]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00820
Mean Error Translation: 6.03152
== [Result] Frame: 17, Matches 307, Inliers: 82.74
Saved at vis/frame017.jpg
[[ 0.9983  0.0062 -0.0587 -0.4407]
 [-0.0067  0.9999 -0.0092 -0.1006]
 [ 0.0587  0.0096  0.9982  9.9086]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00784
Mean Error Translation: 5.71070

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== [Result] Frame: 18, Matches 301, Inliers: 84.39
Saved at vis/frame018.jpg
[[ 0.9982  0.0064 -0.06   -0.4842]
 [-0.0069  0.9999 -0.0089 -0.1106]
 [ 0.0599  0.0093  0.9982 10.5608]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00750
Mean Error Translation: 5.42270
== [Result] Frame: 19, Matches 316, Inliers: 83.86
Saved at vis/frame019.jpg
[[ 0.9981  0.0065 -0.0609 -0.5349]
 [-0.007   0.9999 -0.0075 -0.1226]
 [ 0.0608  0.0079  0.9981 11.2201]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00719
Mean Error Translation: 5.16362
== [Result] Frame: 20, Matches 310, Inliers: 80.97
Saved at vis/frame020.jpg
[[ 0.998   0.007  -0.0623 -0.5795]
 [-0.0074  1.     -0.0063 -0.1318]
 [ 0.0622  0.0067  0.998  11.882 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00687
Mean Error Translation: 4.92932
== [Result] Frame: 21, Matches 317, Inliers: 80.44
Saved at vis/frame021.jpg
[[ 0.998   0.0072 -0.0632 -0.6222]
 [-0.0077  1.     -0.0064 -0.1408]
 [ 0.0632  0.0069  0.998  12.513 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00662
Mean Error Translation: 4.71803
== [Result] Frame: 22, Matches 323, Inliers: 82.04
Saved at vis/frame022.jpg
[[ 0.9979  0.0078 -0.0646 -0.6737]
 [-0.0083  0.9999 -0.0075 -0.1496]
 [ 0.0646  0.008   0.9979 13.1775]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00637
Mean Error Translation: 4.52375
== [Result] Frame: 23, Matches 313, Inliers: 79.87
Saved at vis/frame023.jpg
[[ 0.9979  0.0068 -0.0651 -0.7239]
 [-0.0073  0.9999 -0.0083 -0.1602]
 [ 0.0651  0.0088  0.9978 13.8239]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00617
Mean Error Translation: 4.34654

```

```

== [Result] Frame: 24, Matches 302, Inliers: 81.79
Saved at vis/frame024.jpg
[[ 0.9978  0.0064 -0.0666 -0.7627]
 [-0.0068  1.       -0.0066 -0.1699]
 [ 0.0666  0.0071  0.9978 14.4768]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00596
Mean Error Translation: 4.18368
== [Result] Frame: 25, Matches 300, Inliers: 77.67
Saved at vis/frame025.jpg
[[ 0.9977  0.0076 -0.0671 -0.8046]
 [-0.0078  1.       -0.0031 -0.182 ]
 [ 0.067   0.0037  0.9977 15.1304]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00578
Mean Error Translation: 4.03359
== [Result] Frame: 26, Matches 285, Inliers: 77.89
Saved at vis/frame026.jpg
[[ 0.9978  0.0074 -0.0661 -0.8555]
 [-0.0074  1.       0.0004 -0.1884]
 [ 0.0661  0.0001  0.9978 15.8458]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00563
Mean Error Translation: 3.89239
== [Result] Frame: 27, Matches 290, Inliers: 76.21
Saved at vis/frame027.jpg
[[ 0.9979  0.005  -0.0651 -0.899 ]
 [-0.0049  1.       0.0024 -0.1897]
 [ 0.0651 -0.0021  0.9979 16.543 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00550
Mean Error Translation: 3.76219
== [Result] Frame: 28, Matches 283, Inliers: 76.33
Saved at vis/frame028.jpg
[[ 0.9979  0.0072 -0.0643 -0.9421]
 [-0.0071  1.       0.003  -0.1954]
 [ 0.0643 -0.0025  0.9979 17.2771]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00544
Mean Error Translation: 3.63977
== [Result] Frame: 29, Matches 302, Inliers: 81.46
Saved at vis/frame029.jpg
[[ 0.998   0.0092 -0.0628 -0.994 ]
 [-0.0093  1.       -0.0002 -0.2014]
 [ 0.0628  0.0008  0.998  17.996 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00535
Mean Error Translation: 3.52610

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```

== [Result] Frame: 30, Matches 300, Inliers: 77.67
Saved at vis/frame030.jpg
[[ 0.998   0.0108 -0.0626 -1.0344]
 [-0.0111  0.9999 -0.0052 -0.209 ]
 [ 0.0626  0.0059  0.998  18.7213]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00522
Mean Error Translation: 3.41969
== [Result] Frame: 31, Matches 290, Inliers: 82.76
Saved at vis/frame031.jpg
[[ 0.9981  0.0102 -0.0612 -1.0813]
 [-0.0107  0.9999 -0.0079 -0.2198]
 [ 0.0611  0.0085  0.9981 19.4001]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00510
Mean Error Translation: 3.32158
== [Result] Frame: 32, Matches 303, Inliers: 81.52
Saved at vis/frame032.jpg
[[ 0.9981  0.0071 -0.0607 -1.1221]
 [-0.0076  0.9999 -0.0069 -0.2301]
 [ 0.0606  0.0074  0.9981 20.0676]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00498
Mean Error Translation: 3.23006
== [Result] Frame: 33, Matches 280, Inliers: 80.36
Saved at vis/frame033.jpg
[[ 0.9981  0.0072 -0.0609 -1.1666]
 [-0.0073  1.       -0.0019 -0.2406]
 [ 0.0609  0.0023  0.9981 20.7374]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00490
Mean Error Translation: 3.14406
== [Result] Frame: 34, Matches 282, Inliers: 77.66
Saved at vis/frame034.jpg
[[ 0.9981  0.0038 -0.0615 -1.2109]
 [-0.0037  1.       0.0017 -0.2531]
 [ 0.0615 -0.0015  0.9981 21.4157]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00478
Mean Error Translation: 3.06284
== [Result] Frame: 35, Matches 277, Inliers: 72.92
Saved at vis/frame035.jpg
[[ 0.998   -0.0062 -0.0633 -1.2383]
 [ 0.0063   1.       0.0008 -0.2579]
 [ 0.0633 -0.0012  0.998  22.0772]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00475
Mean Error Translation: 2.98662

```

```

== [Result] Frame: 36, Matches 276, Inliers: 71.01
Saved at vis/frame036.jpg
[[ 0.9978 -0.0099 -0.0657 -1.2695]
 [ 0.0097  0.9999 -0.0029 -0.2668]
 [ 0.0657  0.0022  0.9978 22.7118]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00466
Mean Error Translation: 2.91523
== [Result] Frame: 37, Matches 257, Inliers: 77.43
Saved at vis/frame037.jpg
[[ 0.9977 -0.0104 -0.0676 -1.3111]
 [ 0.01     0.9999 -0.007   -0.2737]
 [ 0.0677  0.0063  0.9977 23.3754]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00459
Mean Error Translation: 2.84697
== [Result] Frame: 38, Matches 280, Inliers: 76.79
Saved at vis/frame038.jpg
[[ 0.9975 -0.0102 -0.0703 -1.3561]
 [ 0.0097  0.9999 -0.0077 -0.2837]
 [ 0.0704  0.007   0.9975 24.0193]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00451
Mean Error Translation: 2.78342
== [Result] Frame: 39, Matches 281, Inliers: 79.72
Saved at vis/frame039.jpg
[[ 0.9974 -0.0109 -0.0715 -1.3999]
 [ 0.0105  0.9999 -0.0059 -0.2965]
 [ 0.0716  0.0052  0.9974 24.6384]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00442
Mean Error Translation: 2.72486
== [Result] Frame: 40, Matches 283, Inliers: 77.03
Saved at vis/frame040.jpg
[[ 0.9974 -0.0068 -0.072   -1.4569]
 [ 0.0066  1.       -0.0033 -0.307 ]
 [ 0.072   0.0028  0.9974 25.2813]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00435
Mean Error Translation: 2.66817
== [Result] Frame: 41, Matches 276, Inliers: 78.26
Saved at vis/frame041.jpg
[[ 0.9973 -0.0069 -0.0736 -1.5025]
 [ 0.0068  1.       -0.0022 -0.3157]
 [ 0.0736  0.0017  0.9973 25.9216]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00426
Mean Error Translation: 2.61431

```

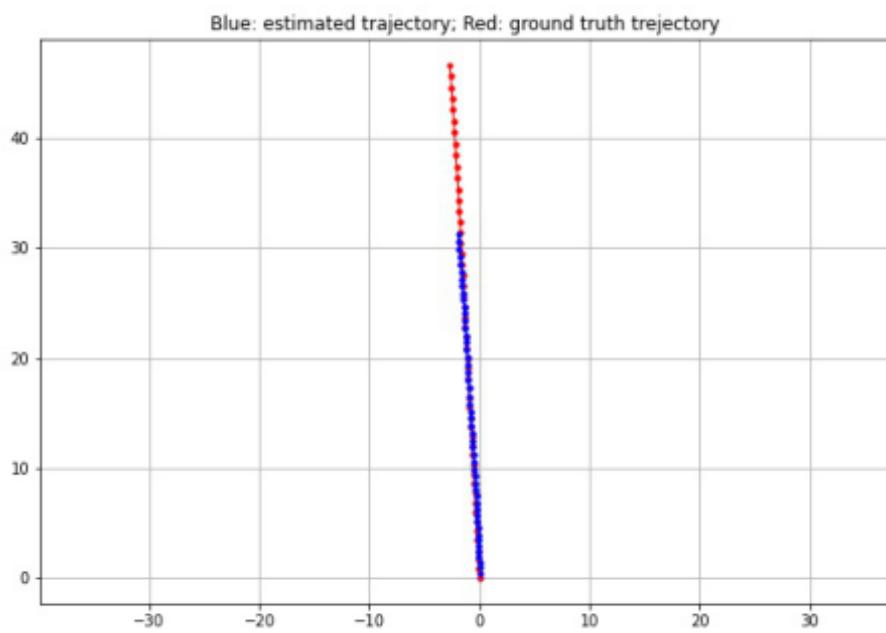
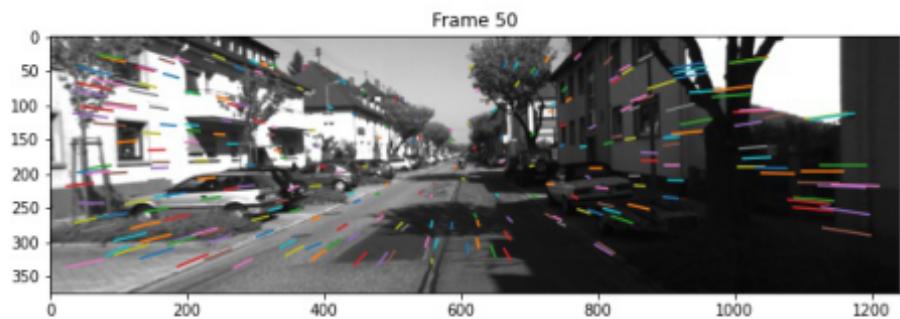
```

== [Result] Frame: 42, Matches 279, Inliers: 72.76
Saved at vis/frame042.jpg
[[ 0.9971 -0.0085 -0.0755 -1.5387]
 [ 0.0085  1.       0.0002 -0.3228]
 [ 0.0755 -0.0008  0.9971 26.5458]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00425
Mean Error Translation: 2.56306
== [Result] Frame: 43, Matches 267, Inliers: 74.91
Saved at vis/frame043.jpg
[[ 0.9972 -0.0064 -0.0745 -1.5978]
 [ 0.0067  1.       0.0034 -0.3331]
 [ 0.0744 -0.0039  0.9972 27.1927]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00424
Mean Error Translation: 2.51366
== [Result] Frame: 44, Matches 266, Inliers: 74.06
Saved at vis/frame044.jpg
[[ 0.9971 -0.0013 -0.0757 -1.6475]
 [ 0.0017  1.       0.0056 -0.3386]
 [ 0.0757 -0.0058  0.9971 27.8529]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00419
Mean Error Translation: 2.46589
== [Result] Frame: 45, Matches 263, Inliers: 80.99
Saved at vis/frame045.jpg
[[ 0.9971 -0.0016 -0.0761 -1.7052]
 [ 0.002   1.       0.0048 -0.3419]
 [ 0.0761 -0.005   0.9971 28.5588]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00414
Mean Error Translation: 2.41919
== [Result] Frame: 46, Matches 271, Inliers: 81.92
Saved at vis/frame046.jpg
[[ 0.9971 -0.0027 -0.0763 -1.7577]
 [ 0.003   1.       0.0028 -0.3449]
 [ 0.0763 -0.003   0.9971 29.2495]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00408
Mean Error Translation: 2.37454
== [Result] Frame: 47, Matches 278, Inliers: 80.94
Saved at vis/frame047.jpg
[[ 0.9971  0.0016 -0.0757 -1.8259]
 [-0.0015  1.       0.001   -0.3565]
 [ 0.0757 -0.0009  0.9971 29.9353]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00406
Mean Error Translation: 2.33174

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```
== [Result] Frame: 48, Matches 286, Inliers: 76.92
Saved at vis/frame048.jpg
[[ 0.997  0.0001 -0.0771 -1.878 ]
 [-0.      1.      0.0009 -0.3642]
 [ 0.0771 -0.0009  0.997  30.6241]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00402
Mean Error Translation: 2.29055
== [Result] Frame: 49, Matches 282, Inliers: 80.85
Saved at vis/frame049.jpg
[[ 0.9969 -0.0028 -0.0785 -1.9334]
 [ 0.0029  1.      0.0019 -0.3722]
 [ 0.0785 -0.0021  0.9969 31.3429]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00397
Mean Error Translation: 2.25038
== [Result] Frame: 50, Matches 276, Inliers: 77.90
Saved at vis/frame050.jpg

<Figure size 432x288 with 0 Axes>
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[[ 0.9968 -0.0017 -0.0796 -1.9944]
 [ 0.0019  1.       0.003  -0.3848]
 [ 0.0796 -0.0031  0.9968 32.0799]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00392
Mean Error Translation: 2.21133
== [Result] Frame: 51, Matches 283, Inliers: 72.08
Saved at vis/frame051.jpg
[[ 0.9968  0.0006 -0.0798 -2.0623]
 [-0.0007  1.       -0.0005 -0.3961]
 [ 0.0798  0.0006  0.9968 32.8262]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00388
Mean Error Translation: 2.17343
== [Result] Frame: 52, Matches 300, Inliers: 78.33
Saved at vis/frame052.jpg
[[ 0.9967 -0.0001 -0.0815 -2.1202]
 [-0.0003  1.       -0.0047 -0.4068]
 [ 0.0815  0.0047  0.9967 33.5696]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00386
Mean Error Translation: 2.13686
== [Result] Frame: 53, Matches 307, Inliers: 79.48
Saved at vis/frame053.jpg
[[ 0.9966  0.0007 -0.0819 -2.1945]
 [-0.0012  1.       -0.006  -0.4195]
 [ 0.0819  0.0061  0.9966 34.336 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00380
Mean Error Translation: 2.10130
== [Result] Frame: 54, Matches 309, Inliers: 80.26
Saved at vis/frame054.jpg
[[ 0.9966 -0.0002 -0.0828 -2.2518]
 [-0.       1.       -0.0026 -0.4327]
 [ 0.0828  0.0026  0.9966 35.0977]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00375
Mean Error Translation: 2.06710
== [Result] Frame: 55, Matches 299, Inliers: 80.27
Saved at vis/frame055.jpg
[[ 0.9966 -0.0013 -0.0828 -2.3213]
 [ 0.0013  1.       0.0003 -0.4445]
 [ 0.0828 -0.0004  0.9966 35.8764]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00373
Mean Error Translation: 2.03374

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== [Result] Frame: 56, Matches 305, Inliers: 85.57
Saved at vis/frame056.jpg
[[ 0.9965 -0.0028 -0.0832 -2.3805]
 [ 0.0029  1.       0.0009 -0.4542]
 [ 0.0832 -0.0011  0.9965 36.586 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00367
Mean Error Translation: 2.00265
== [Result] Frame: 57, Matches 309, Inliers: 80.58
Saved at vis/frame057.jpg
[[ 0.9965 -0.0068 -0.0834 -2.4349]
 [ 0.0068  1.       -0.0006 -0.4627]
 [ 0.0834 -0.       0.9965 37.2796]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00363
Mean Error Translation: 1.97278
== [Result] Frame: 58, Matches 308, Inliers: 78.25
Saved at vis/frame058.jpg
[[ 0.9965 -0.0076 -0.083   -2.4968]
 [ 0.0074  1.       -0.0022 -0.4707]
 [ 0.083   0.0016  0.9965 37.9516]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00364
Mean Error Translation: 1.94430
== [Result] Frame: 59, Matches 313, Inliers: 82.11
Saved at vis/frame059.jpg
[[ 0.9964 -0.0103 -0.0842 -2.55  ]
 [ 0.0103  0.9999 -0.001  -0.4823]
 [ 0.0842  0.0001  0.9964 38.6194]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00361
Mean Error Translation: 1.91675
== [Result] Frame: 60, Matches 291, Inliers: 83.85
Saved at vis/frame060.jpg
[[ 0.9962 -0.0152 -0.0855 -2.6039]
 [ 0.0155  0.9999  0.0033 -0.4925]
 [ 0.0854 -0.0046  0.9963 39.3026]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00361
Mean Error Translation: 1.88991
== [Result] Frame: 61, Matches 315, Inliers: 80.32
Saved at vis/frame061.jpg
[[ 0.9962 -0.0166 -0.0859 -2.6672]
 [ 0.0173  0.9998  0.0079 -0.495 ]
 [ 0.0858 -0.0093  0.9963 39.9997]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00357
Mean Error Translation: 1.86370

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== [Result] Frame: 62, Matches 314, Inliers: 77.07
Saved at vis/frame062.jpg
[[ 0.9961 -0.0154 -0.0872 -2.7246]
 [ 0.0164  0.9998  0.0101 -0.5019]
 [ 0.0871 -0.0115  0.9961 40.6989]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00353
Mean Error Translation: 1.83813
== [Result] Frame: 63, Matches 309, Inliers: 82.20
Saved at vis/frame063.jpg
[[ 0.9958 -0.0165 -0.0898 -2.7824]
 [ 0.0171  0.9998  0.0058 -0.5058]
 [ 0.0897 -0.0073  0.9959 41.4095]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00355
Mean Error Translation: 1.81302
== [Result] Frame: 64, Matches 290, Inliers: 77.93
Saved at vis/frame064.jpg
[[ 0.9957 -0.0162 -0.0916 -2.8469]
 [ 0.0161  0.9999 -0.0017 -0.516 ]
 [ 0.0916  0.0002  0.9958 42.1278]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00352
Mean Error Translation: 1.78832
== [Result] Frame: 65, Matches 293, Inliers: 79.86
Saved at vis/frame065.jpg
[[ 0.9956 -0.0132 -0.0926 -2.9127]
 [ 0.0126  0.9999 -0.0069 -0.5244]
 [ 0.0927  0.0057  0.9957 42.7897]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00352
Mean Error Translation: 1.76507
== [Result] Frame: 66, Matches 294, Inliers: 81.29
Saved at vis/frame066.jpg
[[ 0.9956 -0.0086 -0.0937 -2.9809]
 [ 0.0081  0.9999 -0.0059 -0.537 ]
 [ 0.0937  0.0051  0.9956 43.4368]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00348
Mean Error Translation: 1.74266
== [Result] Frame: 67, Matches 295, Inliers: 82.71
Saved at vis/frame067.jpg
[[ 0.9956 -0.0039 -0.0941 -3.059 ]
 [ 0.0035  1.       -0.0039 -0.5492]
 [ 0.0941  0.0036  0.9956 44.1016]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00347
Mean Error Translation: 1.72049

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== [Result] Frame: 68, Matches 306, Inliers: 78.76
Saved at vis/frame068.jpg
[[ 0.9955 -0.0002 -0.0951 -3.1281]
 [ 0.       1.       -0.0023 -0.5644]
 [ 0.0951  0.0023  0.9955 44.7401]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00344
Mean Error Translation: 1.69910
== [Result] Frame: 69, Matches 297, Inliers: 78.45
Saved at vis/frame069.jpg
[[ 0.9952 -0.0018 -0.0974 -3.1845]
 [ 0.0015  1.       -0.0025 -0.5746]
 [ 0.0974  0.0024  0.9952 45.3698]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00343
Mean Error Translation: 1.67826
== [Result] Frame: 70, Matches 295, Inliers: 85.76
Saved at vis/frame070.jpg
[[ 0.9952  0.0031 -0.098  -3.2669]
 [-0.0033  1.       -0.0017 -0.5871]
 [ 0.098   0.002   0.9952 46.0151]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00345
Mean Error Translation: 1.65759
== [Result] Frame: 71, Matches 283, Inliers: 79.51
Saved at vis/frame071.jpg
[[ 0.995   0.0033 -0.0996 -3.3344]
 [-0.0034  1.       -0.0011 -0.6004]
 [ 0.0996  0.0014  0.995   46.6572]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00343
Mean Error Translation: 1.63736
== [Result] Frame: 72, Matches 294, Inliers: 86.73
Saved at vis/frame072.jpg
[[ 0.9948  0.0024 -0.1021 -3.3932]
 [-0.0025  1.       -0.0007 -0.6145]
 [ 0.1021  0.001   0.9948 47.311 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00340
Mean Error Translation: 1.61734
== [Result] Frame: 73, Matches 272, Inliers: 84.93
Saved at vis/frame073.jpg
[[ 0.9946  0.0018 -0.1042 -3.4562]
 [-0.0017  1.       0.0007 -0.627 ]
 [ 0.1042 -0.0005  0.9946 47.9632]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00338
Mean Error Translation: 1.59771

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== [Result] Frame: 74, Matches 283, Inliers: 81.98
Saved at vis/frame074.jpg
[[ 0.9941 -0.0024 -0.1088 -3.4921]
 [ 0.0028  1.       0.0034 -0.6419]
 [ 0.1088 -0.0036  0.9941 48.6078]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00347
Mean Error Translation: 1.57859
== [Result] Frame: 75, Matches 289, Inliers: 80.28
Saved at vis/frame075.jpg
[[ 0.9938 -0.0024 -0.111   -3.5617]
 [ 0.0033  1.       0.0072 -0.649 ]
 [ 0.111   -0.0076  0.9938 49.2779]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00347
Mean Error Translation: 1.55945
== [Result] Frame: 76, Matches 288, Inliers: 79.51
Saved at vis/frame076.jpg
[[ 0.9935 -0.0029 -0.1141 -3.6311]
 [ 0.0039  1.       0.0088 -0.6565]
 [ 0.1141 -0.0092  0.9934 49.9687]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00349
Mean Error Translation: 1.54034
== [Result] Frame: 77, Matches 295, Inliers: 86.78
Saved at vis/frame077.jpg
[[ 0.9933 -0.0011 -0.1155 -3.7122]
 [ 0.0017  1.       0.0047 -0.6656]
 [ 0.1155 -0.0049  0.9933 50.5999]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00347
Mean Error Translation: 1.52218
== [Result] Frame: 78, Matches 294, Inliers: 84.01
Saved at vis/frame078.jpg
[[ 0.9931 -0.0016 -0.1175 -3.7794]
 [ 0.0013  1.       -0.0025 -0.6767]
 [ 0.1175  0.0024  0.9931 51.1875]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00344
Mean Error Translation: 1.50473
== [Result] Frame: 79, Matches 305, Inliers: 78.36
Saved at vis/frame079.jpg
[[ 0.9929 -0.0029 -0.1187 -3.8486]
 [ 0.0019  1.       -0.0086 -0.6861]
 [ 0.1187  0.0083  0.9929 51.7297]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00341
Mean Error Translation: 1.48806

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== [Result] Frame: 80, Matches 315, Inliers: 88.57
Saved at vis/frame080.jpg
[[ 0.993  0.0012 -0.1179 -3.9286]
 [-0.0024  0.9999 -0.0102 -0.6914]
 [ 0.1179  0.0104  0.993  52.2409]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00343
Mean Error Translation: 1.47198
== [Result] Frame: 81, Matches 327, Inliers: 83.79
Saved at vis/frame081.jpg
[[ 0.9927  0.0029 -0.1202 -3.977 ]
 [-0.0037  1.       -0.0065 -0.7071]
 [ 0.1202  0.0069  0.9927 52.7107]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00342
Mean Error Translation: 1.45656
== [Result] Frame: 82, Matches 320, Inliers: 82.50
Saved at vis/frame082.jpg
[[ 0.9924 -0.0008 -0.1229 -4.0235]
 [ 0.0003  1.       -0.0043 -0.7198]
 [ 0.1229  0.0043  0.9924 53.1739]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00347
Mean Error Translation: 1.44136
== [Result] Frame: 83, Matches 321, Inliers: 86.60
Saved at vis/frame083.jpg
[[ 0.992  -0.0077 -0.1259 -4.0557]
 [ 0.0067  0.9999 -0.0077 -0.7348]
 [ 0.126   0.0067  0.992  53.5979]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00349
Mean Error Translation: 1.42668
== [Result] Frame: 84, Matches 325, Inliers: 84.31
Saved at vis/frame084.jpg
[[ 0.9917 -0.0182 -0.127  -4.0893]
 [ 0.0167  0.9998 -0.013  -0.7459]
 [ 0.1273  0.0108  0.9918 53.9972]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00350
Mean Error Translation: 1.41241
== [Result] Frame: 85, Matches 324, Inliers: 89.81
Saved at vis/frame085.jpg
[[ 0.9916 -0.0239 -0.1273 -4.1245]
 [ 0.0218  0.9996 -0.018  -0.7565]
 [ 0.1276  0.015   0.9917 54.3888]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00349
Mean Error Translation: 1.39836

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== [Result] Frame: 86, Matches 323, Inliers: 90.40
Saved at vis/frame086.jpg
[[ 0.9923 -0.0192 -0.1224 -4.1885]
 [ 0.017   0.9997 -0.0184 -0.7664]
 [ 0.1228  0.0162  0.9923 54.7641]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00351
Mean Error Translation: 1.38466
== [Result] Frame: 87, Matches 319, Inliers: 88.09
Saved at vis/frame087.jpg
[[ 0.9928 -0.0155 -0.1187 -4.2323]
 [ 0.0138  0.9998 -0.015  -0.7802]
 [ 0.1189  0.0132  0.9928 55.115 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00350
Mean Error Translation: 1.37142
== [Result] Frame: 88, Matches 318, Inliers: 90.57
Saved at vis/frame088.jpg
[[ 0.9932 -0.0184 -0.1149 -4.2664]
 [ 0.0171  0.9998 -0.012  -0.7899]
 [ 0.1151  0.0099  0.9933 55.4816]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00349
Mean Error Translation: 1.35814
== [Result] Frame: 89, Matches 325, Inliers: 89.23
Saved at vis/frame089.jpg
[[ 0.9941 -0.0181 -0.1068 -4.3242]
 [ 0.0173  0.9998 -0.0083 -0.7959]
 [ 0.107   0.0064  0.9942 55.8452]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00354
Mean Error Translation: 1.34508
== [Result] Frame: 90, Matches 327, Inliers: 91.44
Saved at vis/frame090.jpg
[[ 0.9947 -0.0238 -0.0997 -4.3445]
 [ 0.0234  0.9997 -0.0048 -0.807 ]
 [ 0.0998  0.0024  0.995  56.2032]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00353
Mean Error Translation: 1.33221
== [Result] Frame: 91, Matches 325, Inliers: 90.15
Saved at vis/frame091.jpg
[[ 0.9957 -0.0228 -0.0902 -4.3642]
 [ 0.0225  0.9997 -0.0046 -0.8176]
 [ 0.0903  0.0025  0.9959 56.5549]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00353
Mean Error Translation: 1.31947

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== [Result] Frame: 92, Matches 325, Inliers: 87.08
Saved at vis/frame092.jpg
[[ 0.9971 -0.0173 -0.0744 -4.4002]
 [ 0.0169  0.9998 -0.0049 -0.8234]
 [ 0.0744  0.0036  0.9972 56.9118]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00350
Mean Error Translation: 1.30684
== [Result] Frame: 93, Matches 341, Inliers: 88.86
Saved at vis/frame093.jpg
[[ 0.9981 -0.0167 -0.059  -4.3938]
 [ 0.0165  0.9999 -0.0039 -0.8336]
 [ 0.059   0.003   0.9983 57.2557]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00354
Mean Error Translation: 1.29449
== [Result] Frame: 94, Matches 347, Inliers: 88.76
Saved at vis/frame094.jpg
[[ 0.9991 -0.018  -0.0371 -4.3972]
 [ 0.018   0.9998 -0.0028 -0.8383]
 [ 0.0371  0.0021  0.9993 57.5986]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00351
Mean Error Translation: 1.28226
== [Result] Frame: 95, Matches 337, Inliers: 87.24
Saved at vis/frame095.jpg
[[ 0.9997 -0.0232 -0.0118 -4.3797]
 [ 0.0231  0.9997 -0.0012 -0.8438]
 [ 0.0118  0.0009  0.9999 57.9324]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00350
Mean Error Translation: 1.27022
== [Result] Frame: 96, Matches 346, Inliers: 89.02
Saved at vis/frame096.jpg
[[ 0.9995 -0.024  0.0182 -4.3642]
 [ 0.024   0.9997  0.0012 -0.8483]
 [-0.0183 -0.0008  0.9998 58.2711]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00348
Mean Error Translation: 1.25834
== [Result] Frame: 97, Matches 338, Inliers: 87.57
Saved at vis/frame097.jpg
[[ 0.9984 -0.0306  0.0466 -4.2906]
 [ 0.0305  0.9995  0.0025 -0.8546]
 [-0.0466 -0.001   0.9989 58.5924]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00355
Mean Error Translation: 1.24679

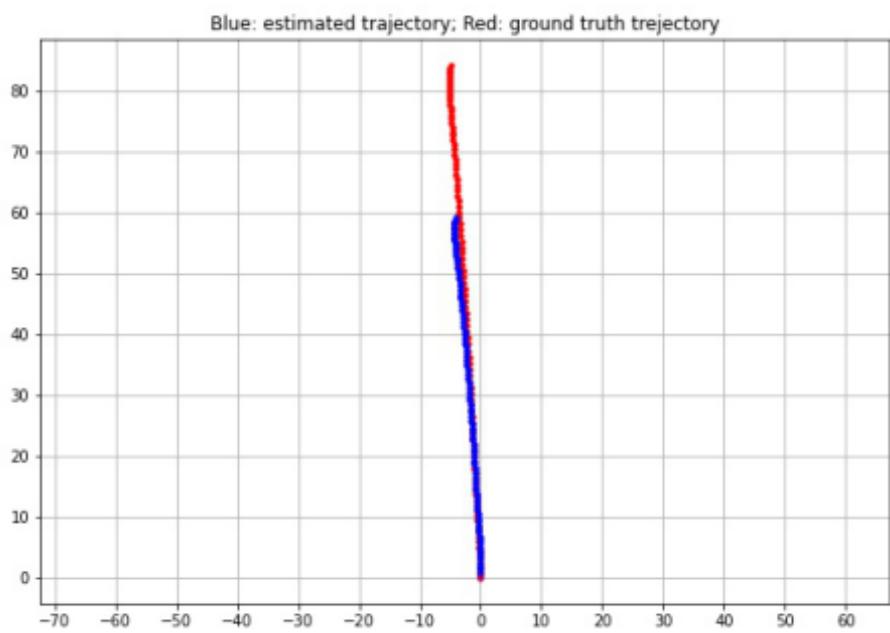
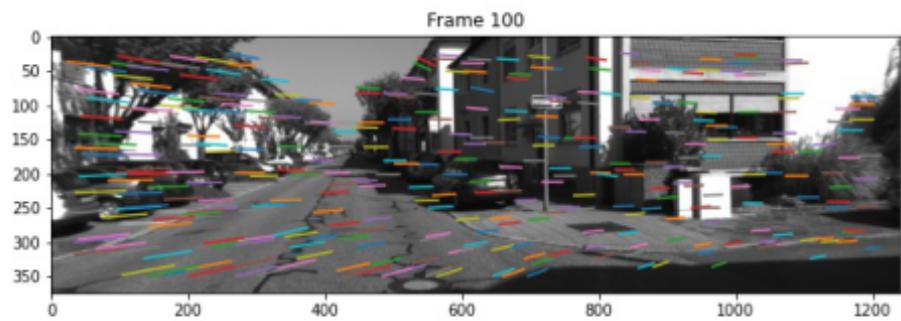
```

```
== [Result] Frame: 98, Matches 333, Inliers: 85.89
Saved at vis/frame098.jpg
[[ 0.996 -0.0311  0.084 -4.2435]
 [ 0.0308  0.9995  0.0042 -0.8562]
 [-0.0841 -0.0016  0.9965 58.9289]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00353
Mean Error Translation: 1.23520
== [Result] Frame: 99, Matches 332, Inliers: 89.76
Saved at vis/frame099.jpg
[[ 0.9916 -0.0319  0.125 -4.1778]
 [ 0.0315  0.9995  0.0057 -0.8575]
 [-0.1251 -0.0017  0.9921 59.2574]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00351
Mean Error Translation: 1.22390
== [Result] Frame: 100, Matches 332, Inliers: 89.16
Saved at vis/frame100.jpg

<Figure size 432x288 with 0 Axes>
```



```

[[ 0.9853 -0.0343  0.1676 -4.0781]
 [ 0.0336  0.9994  0.007  -0.8612]
 [-0.1678 -0.0012  0.9858  59.5674]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00352
Mean Error Translation: 1.21284
== [Result] Frame: 101, Matches 330, Inliers: 87.58
Saved at vis/frame101.jpg
[[ 0.976  -0.0357  0.215  -3.9673]
 [ 0.0351  0.9994  0.0065 -0.8641]
 [-0.215   0.0012  0.9766  59.8724]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00353
Mean Error Translation: 1.20183
== [Result] Frame: 102, Matches 336, Inliers: 91.07
Saved at vis/frame102.jpg
[[ 0.9631 -0.0359  0.2668 -3.8471]
 [ 0.0355  0.9993  0.0061 -0.8687]
 [-0.2669  0.0036  0.9637  60.1591]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00351
Mean Error Translation: 1.19120
== [Result] Frame: 103, Matches 342, Inliers: 87.72
Saved at vis/frame103.jpg
[[ 0.9459 -0.0373  0.3224 -3.7171]
 [ 0.0372  0.9993  0.0066 -0.8702]
 [-0.3224  0.0057  0.9466  60.4345]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00350
Mean Error Translation: 1.18065
== [Result] Frame: 104, Matches 338, Inliers: 86.09
Saved at vis/frame104.jpg
[[ 0.9248 -0.038   0.3786 -3.5624]
 [ 0.0381  0.9992  0.0074 -0.8684]
 [-0.3786  0.0076  0.9255  60.6987]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00349
Mean Error Translation: 1.17033
== [Result] Frame: 105, Matches 339, Inliers: 89.97
Saved at vis/frame105.jpg
[[ 0.8986 -0.0398  0.4369 -3.3938]
 [ 0.0403  0.9992  0.0081 -0.8623]
 [-0.4368  0.0104  0.8995  60.9586]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00348
Mean Error Translation: 1.16014

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```

== [Result] Frame: 106, Matches 329, Inliers: 87.54
Saved at vis/frame106.jpg
[[ 0.8693 -0.0438  0.4924 -3.1955]
 [ 0.0464  0.9989  0.0069 -0.8491]
 [-0.4921  0.0169  0.8704 61.1806]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00351
Mean Error Translation: 1.15009
== [Result] Frame: 107, Matches 329, Inliers: 81.16
Saved at vis/frame107.jpg
[[ 0.8386 -0.0464  0.5427 -2.9693]
 [ 0.0522  0.9986  0.0047 -0.8279]
 [-0.5422  0.0244  0.8399 61.3677]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00359
Mean Error Translation: 1.14046
== [Result] Frame: 108, Matches 336, Inliers: 80.06
Saved at vis/frame108.jpg
[[ 0.8031 -0.0499  0.5938 -2.7498]
 [ 0.0562  0.9984  0.008  -0.8207]
 [-0.5932  0.0269  0.8046 61.5709]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00361
Mean Error Translation: 1.13071
== [Result] Frame: 109, Matches 340, Inliers: 81.18
Saved at vis/frame109.jpg
[[ 0.7652 -0.0516  0.6417 -2.5176]
 [ 0.0571  0.9983  0.0122 -0.8077]
 [-0.6412  0.0273  0.7669 61.7591]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00363
Mean Error Translation: 1.12127
== [Result] Frame: 110, Matches 337, Inliers: 81.01
Saved at vis/frame110.jpg
[[ 0.7245 -0.0536  0.6872 -2.268 ]
 [ 0.0593  0.9981  0.0153 -0.7975]
 [-0.6867  0.0297  0.7263 61.9373]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00363
Mean Error Translation: 1.11188
== [Result] Frame: 111, Matches 330, Inliers: 83.03
Saved at vis/frame111.jpg
[[ 0.6841 -0.0568  0.7271 -2.0051]
 [ 0.0662  0.9977  0.0157 -0.7864]
 [-0.7263  0.0374  0.6863 62.0633]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00368
Mean Error Translation: 1.10276

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```

== [Result] Frame: 112, Matches 337, Inliers: 85.46
Saved at vis/frame112.jpg
[[ 0.6415 -0.0611  0.7646 -1.7347]
 [ 0.073   0.9972  0.0185 -0.7821]
 [-0.7636  0.0439  0.6442 62.2081]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00368
Mean Error Translation: 1.09367
== [Result] Frame: 113, Matches 329, Inliers: 81.76
Saved at vis/frame113.jpg
[[ 0.5985 -0.0597  0.7989 -1.473 ]
 [ 0.0712  0.9972  0.0211 -0.7767]
 [-0.798   0.0443  0.6011 62.3497]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00366
Mean Error Translation: 1.08476
== [Result] Frame: 114, Matches 335, Inliers: 86.87
Saved at vis/frame114.jpg
[[ 0.5545 -0.0576  0.8302 -1.2108]
 [ 0.0679  0.9974  0.0239 -0.7736]
 [-0.8294  0.0431  0.5569 62.4864]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00366
Mean Error Translation: 1.07609
== [Result] Frame: 115, Matches 331, Inliers: 87.31
Saved at vis/frame115.jpg
[[ 0.5119 -0.0559  0.8572 -0.9386]
 [ 0.0663  0.9975  0.0255 -0.7689]
 [-0.8565  0.0438  0.5143 62.6092]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00363
Mean Error Translation: 1.06755
== [Result] Frame: 116, Matches 338, Inliers: 86.09
Saved at vis/frame116.jpg
[[ 0.4721 -0.059   0.8796 -0.634 ]
 [ 0.073   0.9969  0.0277 -0.7575]
 [-0.8785  0.0511  0.4749 62.7161]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00363
Mean Error Translation: 1.05893
== [Result] Frame: 117, Matches 332, Inliers: 84.04
Saved at vis/frame117.jpg
[[ 0.4341 -0.0677  0.8983 -0.0988]
 [ 0.0875  0.9956  0.0328 -0.731 ]
 [-0.8966  0.0644  0.4381 62.8685]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00361
Mean Error Translation: 1.05141

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== [Result] Frame: 118, Matches 331, Inliers: 82.48
Saved at vis/frame118.jpg
[[ 0.4003 -0.0708  0.9137  0.4033]
 [ 0.0896  0.9953  0.0379 -0.7036]
 [-0.912   0.0667  0.4047  63.0251]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00360
Mean Error Translation: 1.04382
== [Result] Frame: 119, Matches 327, Inliers: 82.87
Saved at vis/frame119.jpg
[[ 0.3689 -0.0666  0.9271  1.0409]
 [ 0.086   0.9956  0.0373 -0.682 ]
 [-0.9255  0.066   0.373   63.2359]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00358
Mean Error Translation: 1.03754
== [Result] Frame: 120, Matches 327, Inliers: 76.76
Saved at vis/frame120.jpg
[[ 0.3387 -0.0582  0.9391  1.651 ]
 [ 0.0736  0.9967  0.0352 -0.6788]
 [-0.938   0.0571  0.3419  63.4657]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00356
Mean Error Translation: 1.03119
== [Result] Frame: 121, Matches 325, Inliers: 79.38
Saved at vis/frame121.jpg
[[ 0.3117 -0.0537  0.9487  2.3081]
 [ 0.0681  0.9971  0.0341 -0.6742]
 [-0.9477  0.054   0.3145  63.6655]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00355
Mean Error Translation: 1.02517
== [Result] Frame: 122, Matches 338, Inliers: 80.47
Saved at vis/frame122.jpg
[[ 0.2872 -0.0524  0.9564  2.9791]
 [ 0.0692  0.997   0.0338 -0.6617]
 [-0.9554  0.0565  0.29    63.8181]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00354
Mean Error Translation: 1.01917
== [Result] Frame: 123, Matches 330, Inliers: 81.52
Saved at vis/frame123.jpg
[[ 0.2644 -0.0517  0.963   3.6146]
 [ 0.0757  0.9966  0.0327 -0.6426]
 [-0.9614  0.0643  0.2674  63.9427]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00353
Mean Error Translation: 1.01290

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== [Result] Frame: 124, Matches 335, Inliers: 78.81
Saved at vis/frame124.jpg
[[ 0.2432 -0.0449  0.9689  4.4686]
 [ 0.0806  0.9964  0.0259 -0.5797]
 [-0.9666  0.0718  0.2459 64.1336]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00353
Mean Error Translation: 1.00848
== [Result] Frame: 125, Matches 346, Inliers: 78.32
Saved at vis/frame125.jpg
[[ 0.2236 -0.0384  0.9739  5.3762]
 [ 0.0817  0.9964  0.0206 -0.5317]
 [-0.9713  0.0749  0.2259 64.3267]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00352
Mean Error Translation: 1.00448
== [Result] Frame: 126, Matches 328, Inliers: 77.44
Saved at vis/frame126.jpg
[[ 0.206  -0.037   0.9779  6.4853]
 [ 0.0775  0.9968  0.0214 -0.4959]
 [-0.9755  0.0714  0.2082 64.5742]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00351
Mean Error Translation: 1.00202
== [Result] Frame: 127, Matches 332, Inliers: 79.52
Saved at vis/frame127.jpg
[[ 0.1901 -0.0412  0.9809  7.5231]
 [ 0.075   0.9968  0.0273 -0.489 ]
 [-0.9789  0.0683  0.1926 64.7861]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00350
Mean Error Translation: 0.99885
== [Result] Frame: 128, Matches 317, Inliers: 77.92
Saved at vis/frame128.jpg
[[ 0.1758 -0.0442  0.9834  7.8445]
 [ 0.0741  0.9968  0.0316 -0.4844]
 [-0.9816  0.0673  0.1786 64.8395]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00348
Mean Error Translation: 0.99231
== [Result] Frame: 129, Matches 320, Inliers: 80.94
Saved at vis/frame129.jpg
[[ 0.1627 -0.0464  0.9856  8.1854]
 [ 0.0756  0.9965  0.0345 -0.4735]
 [-0.9838  0.0689  0.1657 64.8914]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00345
Mean Error Translation: 0.98584

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== [Result] Frame: 130, Matches 315, Inliers: 80.63
Saved at vis/frame130.jpg
[[ 0.1514 -0.0475  0.9873  8.5447]
 [ 0.0794  0.9962  0.0357 -0.4614]
 [-0.9853  0.073   0.1546  64.936 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00344
Mean Error Translation: 0.97941
== [Result] Frame: 131, Matches 320, Inliers: 80.62
Saved at vis/frame131.jpg
[[ 0.1419 -0.0466  0.9888  8.9294]
 [ 0.0835  0.9959  0.035   -0.4447]
 [-0.9864  0.0776  0.1452  64.9797]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00343
Mean Error Translation: 0.97302
== [Result] Frame: 132, Matches 327, Inliers: 77.98
Saved at vis/frame132.jpg
[[ 0.1339 -0.0459  0.9899  9.311 ]
 [ 0.0851  0.9958  0.0347 -0.4326]
 [-0.9873  0.0796  0.1372  65.031 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00341
Mean Error Translation: 0.96687
== [Result] Frame: 133, Matches 321, Inliers: 83.49
Saved at vis/frame133.jpg
[[ 0.1288 -0.0453  0.9906  9.7101]
 [ 0.0867  0.9956  0.0342 -0.4179]
 [-0.9879  0.0815  0.1321  65.0792]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00340
Mean Error Translation: 0.96080
== [Result] Frame: 134, Matches 321, Inliers: 86.60
Saved at vis/frame134.jpg
[[ 0.1228 -0.0441  0.9915  10.1227]
 [ 0.086   0.9957  0.0336 -0.4071]
 [-0.9887  0.0811  0.1261  65.1364]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00339
Mean Error Translation: 0.95486
== [Result] Frame: 135, Matches 312, Inliers: 81.41
Saved at vis/frame135.jpg
[[ 0.1171 -0.0432  0.9922  10.5424]
 [ 0.0863  0.9957  0.0332 -0.3921]
 [-0.9894  0.0818  0.1203  65.1846]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00337
Mean Error Translation: 0.94909

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```

== [Result] Frame: 136, Matches 306, Inliers: 78.76
Saved at vis/frame136.jpg
[[ 0.1128 -0.043  0.9927 10.9882]
 [ 0.0884  0.9955  0.0331 -0.377 ]
 [-0.9897  0.084   0.1161 65.2331]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00335
Mean Error Translation: 0.94336
== [Result] Frame: 137, Matches 304, Inliers: 79.61
Saved at vis/frame137.jpg
[[ 0.1097 -0.043  0.993  11.4416]
 [ 0.0877  0.9956  0.0334 -0.3638]
 [-0.9901  0.0834  0.113  65.2863]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00335
Mean Error Translation: 0.93779
== [Result] Frame: 138, Matches 308, Inliers: 77.92
Saved at vis/frame138.jpg
[[ 0.1066 -0.0434 0.9934 11.9267]
 [ 0.0879  0.9955  0.0341 -0.3494]
 [-0.9904  0.0837  0.1099 65.3403]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00334
Mean Error Translation: 0.93222
== [Result] Frame: 139, Matches 320, Inliers: 76.87
Saved at vis/frame139.jpg
[[ 0.1041 -0.0442 0.9936 12.6769]
 [ 0.0909  0.9952  0.0348 -0.3277]
 [-0.9904  0.0867  0.1077 65.4148]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00333
Mean Error Translation: 0.92646
== [Result] Frame: 140, Matches 316, Inliers: 81.65
Saved at vis/frame140.jpg
[[ 0.1028 -0.0445 0.9937 13.1771]
 [ 0.094   0.995   0.0348 -0.311 ]
 [-0.9903  0.0899  0.1064 65.4729]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00332
Mean Error Translation: 0.92121
== [Result] Frame: 141, Matches 293, Inliers: 77.82
Saved at vis/frame141.jpg
[[ 0.1034 -0.0452 0.9936 13.6909]
 [ 0.0993  0.9944  0.0349 -0.2961]
 [-0.9897  0.0951  0.1073 65.5226]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00332
Mean Error Translation: 0.91601

```

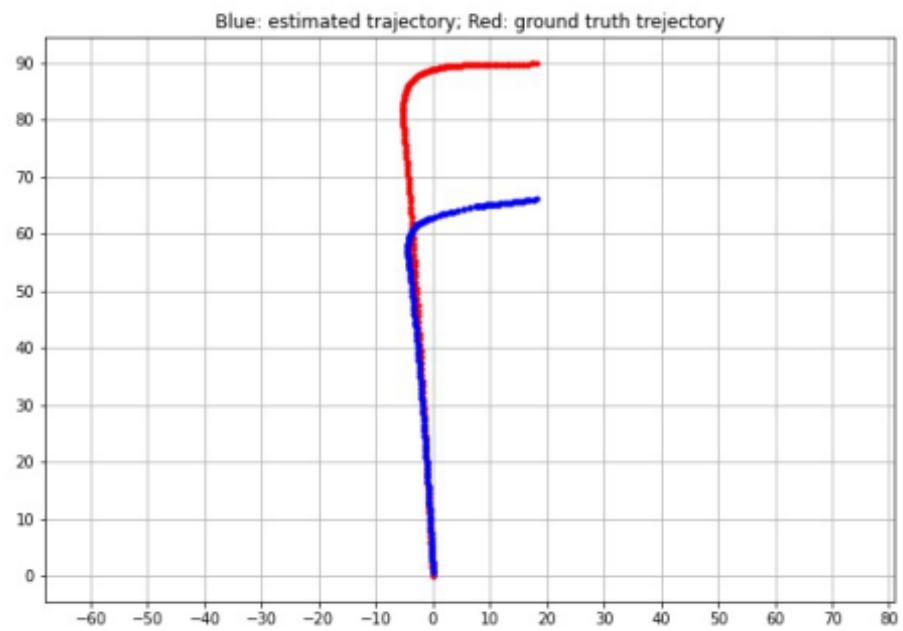
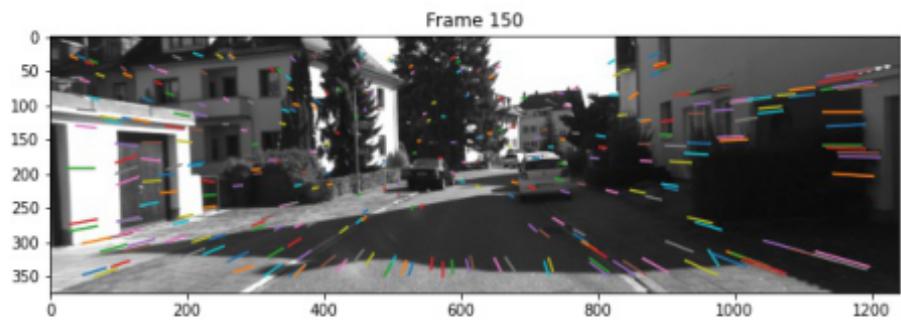
```

== [Result] Frame: 142, Matches 307, Inliers: 78.83
Saved at vis/frame142.jpg
[[ 0.1056 -0.0453  0.9934 14.2348]
 [ 0.1005  0.9943  0.0347 -0.2818]
 [-0.9893  0.0962  0.1095 65.5866]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00330
Mean Error Translation: 0.91083
== [Result] Frame: 143, Matches 315, Inliers: 78.41
Saved at vis/frame143.jpg
[[ 0.1085 -0.0451  0.9931 14.7833]
 [ 0.102   0.9942  0.034  -0.2631]
 [-0.9889  0.0976  0.1124 65.6588]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00329
Mean Error Translation: 0.90582
== [Result] Frame: 144, Matches 311, Inliers: 83.60
Saved at vis/frame144.jpg
[[ 0.111  -0.0444  0.9928 15.3322]
 [ 0.0984  0.9946  0.0335 -0.245 ]
 [-0.9889  0.094   0.1147 65.7474]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00331
Mean Error Translation: 0.90100
== [Result] Frame: 145, Matches 308, Inliers: 82.79
Saved at vis/frame145.jpg
[[ 0.1141 -0.0461  0.9924 15.8745]
 [ 0.0986  0.9945  0.0349 -0.2312]
 [-0.9886  0.0939  0.118   65.8226]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00331
Mean Error Translation: 0.89638
== [Result] Frame: 146, Matches 313, Inliers: 81.15
Saved at vis/frame146.jpg
[[ 0.1188 -0.0483  0.9917 16.4358]
 [ 0.1022  0.9941  0.0361 -0.2142]
 [-0.9876  0.097   0.1231 65.8841]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00332
Mean Error Translation: 0.89175
== [Result] Frame: 147, Matches 309, Inliers: 84.79
Saved at vis/frame147.jpg
[[ 0.1232 -0.05    0.9911 17.0117]
 [ 0.0993  0.9943  0.0378 -0.1972]
 [-0.9874  0.0938  0.1275 65.9618]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00330
Mean Error Translation: 0.88721

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```
== [Result] Frame: 148, Matches 298, Inliers: 84.23
Saved at vis/frame148.jpg
[[ 0.1296 -0.0519  0.9902 17.5967]
 [ 0.1029  0.9939  0.0386 -0.181 ]
 [-0.9862  0.0969  0.1341 66.0215]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00332
Mean Error Translation: 0.88269
== [Result] Frame: 149, Matches 299, Inliers: 84.28
Saved at vis/frame149.jpg
[[ 0.1344 -0.0508  0.9896 18.205 ]
 [ 0.1012  0.9942  0.0373 -0.1641]
 [-0.9857  0.0952  0.1388 66.1078]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00331
Mean Error Translation: 0.87815
== [Result] Frame: 150, Matches 296, Inliers: 81.42
Saved at vis/frame150.jpg

<Figure size 432x288 with 0 Axes>
```



```

[[ 0.1399 -0.047  0.989  18.8235]
 [ 0.1033  0.9941  0.0326 -0.1509]
 [-0.9848  0.0976  0.1439  66.1769]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00333
Mean Error Translation: 0.87360
== [Result] Frame: 151, Matches 264, Inliers: 78.03
Saved at vis/frame151.jpg
[[ 0.1423 -0.0418  0.9889  19.4104]
 [ 0.0981  0.9948  0.028   -0.1416]
 [-0.985   0.093   0.1456  66.2658]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00333
Mean Error Translation: 0.86935
== [Result] Frame: 152, Matches 271, Inliers: 78.60
Saved at vis/frame152.jpg
[[ 0.1431 -0.0385  0.989   19.993 ]
 [ 0.0964  0.995   0.0247 -0.1272]
 [-0.985   0.0918  0.1461  66.3498]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00332
Mean Error Translation: 0.86523
== [Result] Frame: 153, Matches 280, Inliers: 79.29
Saved at vis/frame153.jpg
[[ 0.146   -0.0391  0.9885  20.6106]
 [ 0.0977  0.9949  0.025   -0.1153]
 [-0.9845  0.0929  0.1491  66.4224]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00334
Mean Error Translation: 0.86096
== [Result] Frame: 154, Matches 301, Inliers: 73.75
Saved at vis/frame154.jpg
[[ 0.1457 -0.0396  0.9885  21.2119]
 [ 0.0953  0.9951  0.0258 -0.096 ]
 [-0.9847  0.0905  0.1487  66.5278]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00334
Mean Error Translation: 0.85690
== [Result] Frame: 155, Matches 308, Inliers: 79.22
Saved at vis/frame155.jpg
[[ 0.1461 -0.0406  0.9884  21.8579]
 [ 0.0969  0.9949  0.0265 -0.0824]
 [-0.9845  0.0919  0.1493  66.6231]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00332
Mean Error Translation: 0.85259

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== [Result] Frame: 156, Matches 318, Inliers: 82.39
Saved at vis/frame156.jpg
[[ 0.1476 -0.0408  0.9882 22.4883]
 [ 0.0954  0.9951  0.0269 -0.0695]
 [-0.9844  0.0903  0.1508 66.7122]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00332
Mean Error Translation: 0.84843
== [Result] Frame: 157, Matches 311, Inliers: 81.99
Saved at vis/frame157.jpg
[[ 0.1473 -0.0396  0.9883 23.1184]
 [ 0.0936  0.9953  0.026  -0.0573]
 [-0.9846  0.0887  0.1503 66.8209]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00331
Mean Error Translation: 0.84435
== [Result] Frame: 158, Matches 318, Inliers: 82.08
Saved at vis/frame158.jpg
[[ 0.1475 -0.0395  0.9883 23.7689]
 [ 0.091   0.9955  0.0262 -0.0576]
 [-0.9849  0.0861  0.1504 66.93  ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00329
Mean Error Translation: 0.84015
== [Result] Frame: 159, Matches 313, Inliers: 80.19
Saved at vis/frame159.jpg
[[ 0.1466 -0.0378  0.9885 24.4084]
 [ 0.0874  0.9959  0.0251 -0.0506]
 [-0.9853  0.0827  0.1493 67.0327]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00328
Mean Error Translation: 0.83606
== [Result] Frame: 160, Matches 297, Inliers: 83.16
Saved at vis/frame160.jpg
[[ 0.1457 -0.0379  0.9886 25.0439]
 [ 0.0862  0.996   0.0255 -0.0401]
 [-0.9856  0.0815  0.1483 67.1181]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00328
Mean Error Translation: 0.83203
== [Result] Frame: 161, Matches 311, Inliers: 83.60
Saved at vis/frame161.jpg
[[ 0.1414 -0.039   0.9892 25.6565]
 [ 0.082   0.9963  0.0275 -0.0346]
 [-0.9866  0.0772  0.1441 67.2166]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00327
Mean Error Translation: 0.82819

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```

== [Result] Frame: 162, Matches 327, Inliers: 78.29
Saved at vis/frame162.jpg
[[ 0.1364 -0.0408  0.9898 26.2894]
 [ 0.079   0.9964  0.0302 -0.0256]
 [-0.9875  0.0741  0.1392 67.3124]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00326
Mean Error Translation: 0.82430
== [Result] Frame: 163, Matches 322, Inliers: 77.33
Saved at vis/frame163.jpg
[[ 0.1295 -0.0423  0.9907 26.9715]
 [ 0.0741  0.9967  0.0328 -0.0167]
 [-0.9888  0.0691  0.1322 67.4195]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00326
Mean Error Translation: 0.82024
== [Result] Frame: 164, Matches 317, Inliers: 74.13
Saved at vis/frame164.jpg
[[ 0.1205 -0.0421  0.9918 27.6262]
 [ 0.0712  0.9969  0.0337 -0.0107]
 [-0.9902  0.0665  0.1231 67.5218]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00327
Mean Error Translation: 0.81634
== [Result] Frame: 165, Matches 322, Inliers: 74.22
Saved at vis/frame165.jpg
[[ 0.1117 -0.0413  0.9929 28.2632]
 [ 0.0697  0.997   0.0336  0.0006]
 [-0.9913  0.0655  0.1142 67.5975]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00325
Mean Error Translation: 0.81252
== [Result] Frame: 166, Matches 321, Inliers: 70.09
Saved at vis/frame166.jpg
[[ 0.1024 -0.0408  0.9939 28.8997]
 [ 0.07     0.997   0.0337  0.0157]
 [-0.9923  0.0661  0.105   67.66  ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.80875
== [Result] Frame: 167, Matches 312, Inliers: 70.51
Saved at vis/frame167.jpg
[[ 0.0935 -0.0422  0.9947 29.8546]
 [ 0.0719  0.9968  0.0356  0.0325]
 [-0.993   0.0682  0.0962 67.73  ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00323
Mean Error Translation: 0.80502

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== [Result] Frame: 168, Matches 317, Inliers: 74.45
Saved at vis/frame168.jpg
[[ 0.0811 -0.0429  0.9958 30.7904]
 [ 0.0673  0.997   0.0375  0.0466]
 [-0.9944  0.064   0.0837 67.8408]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.80141
== [Result] Frame: 169, Matches 316, Inliers: 73.42
Saved at vis/frame169.jpg
[[ 0.0696 -0.0436  0.9966 31.8878]
 [ 0.0674  0.997   0.0389  0.0762]
 [-0.9953  0.0644  0.0723 67.9277]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00323
Mean Error Translation: 0.79864
== [Result] Frame: 170, Matches 315, Inliers: 76.19
Saved at vis/frame170.jpg
[[ 0.0576 -0.0429  0.9974 33.0311]
 [ 0.0648  0.9971  0.0391  0.1045]
 [-0.9962  0.0624  0.0602 68.0128]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00323
Mean Error Translation: 0.79619
== [Result] Frame: 171, Matches 299, Inliers: 66.56
Saved at vis/frame171.jpg
[[ 0.0468 -0.0421  0.998  34.1973]
 [ 0.0648  0.9971  0.039   0.1313]
 [-0.9968  0.0629  0.0494 68.0582]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00322
Mean Error Translation: 0.79390
== [Result] Frame: 172, Matches 289, Inliers: 62.98
Saved at vis/frame172.jpg
[[ 0.0359 -0.0407  0.9985 36.2579]
 [ 0.064   0.9972  0.0384  0.1826]
 [-0.9973  0.0626  0.0384 68.1647]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00320
Mean Error Translation: 0.79681
== [Result] Frame: 173, Matches 270, Inliers: 71.48
Saved at vis/frame173.jpg
[[ 0.0243 -0.0405  0.9989 37.916 ]
 [ 0.066   0.9971  0.0389  0.1944]
 [-0.9975  0.0649  0.0269 68.2614]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00320
Mean Error Translation: 0.79743

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== [Result] Frame: 174, Matches 265, Inliers: 67.92
Saved at vis/frame174.jpg
[[ 0.0159 -0.0398  0.9991 39.2038]
 [ 0.0672  0.997   0.0386  0.2279]
 [-0.9976  0.0665  0.0185 68.2526]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00320
Mean Error Translation: 0.79593
== [Result] Frame: 175, Matches 263, Inliers: 74.14
Saved at vis/frame175.jpg
[[ 0.0063 -0.0392  0.9992 39.7777]
 [ 0.0675  0.997   0.0387  0.2408]
 [-0.9977  0.0672  0.0089 68.2566]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00318
Mean Error Translation: 0.79253
== [Result] Frame: 176, Matches 273, Inliers: 76.92
Saved at vis/frame176.jpg
[[ -0.0021 -0.0387  0.9992 40.3629]
 [ 0.0698  0.9968  0.0388  0.2555]
 [-0.9976  0.0698  0.0006 68.246 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00318
Mean Error Translation: 0.78905
== [Result] Frame: 177, Matches 304, Inliers: 79.61
Saved at vis/frame177.jpg
[[ -0.0096 -0.0396  0.9992 40.9534]
 [ 0.0726  0.9966  0.0402  0.2663]
 [-0.9973  0.0729 -0.0067 68.2259]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00318
Mean Error Translation: 0.78553
== [Result] Frame: 178, Matches 289, Inliers: 74.74
Saved at vis/frame178.jpg
[[ -0.0172 -0.0407  0.999  41.5013]
 [ 0.0737  0.9964  0.0418  0.2802]
 [-0.9971  0.0743 -0.0142 68.2214]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00317
Mean Error Translation: 0.78227
== [Result] Frame: 179, Matches 305, Inliers: 82.95
Saved at vis/frame179.jpg
[[ -0.0224 -0.0427  0.9988 42.0583]
 [ 0.0762  0.9961  0.0443  0.2923]
 [-0.9968  0.0771 -0.019  68.2074]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00316
Mean Error Translation: 0.77895

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== [Result] Frame: 180, Matches 318, Inliers: 81.45
Saved at vis/frame180.jpg
[[-0.0257 -0.0448  0.9987 42.5975]
 [ 0.0781  0.9959  0.0467  0.3067]
 [-0.9966  0.0792 -0.022  68.1875]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00315
Mean Error Translation: 0.77570
== [Result] Frame: 181, Matches 325, Inliers: 82.15
Saved at vis/frame181.jpg
[[-0.0275 -0.046   0.9986 43.1312]
 [ 0.081   0.9956  0.0481  0.3226]
 [-0.9963  0.0822 -0.0237 68.1632]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00314
Mean Error Translation: 0.77245
== [Result] Frame: 182, Matches 332, Inliers: 84.34
Saved at vis/frame182.jpg
[[-0.0285 -0.0464  0.9985 43.6548]
 [ 0.0826  0.9954  0.0487  0.341 ]
 [-0.9962  0.0839 -0.0246 68.1433]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00314
Mean Error Translation: 0.76921
== [Result] Frame: 183, Matches 324, Inliers: 85.80
Saved at vis/frame183.jpg
[[-0.0284 -0.0456  0.9986 44.1668]
 [ 0.0871  0.995   0.048   0.3581]
 [-0.9958  0.0883 -0.0243 68.1186]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00316
Mean Error Translation: 0.76599
== [Result] Frame: 184, Matches 321, Inliers: 82.24
Saved at vis/frame184.jpg
[[-0.0268 -0.0441  0.9987 44.6585]
 [ 0.0899  0.9949  0.0464  0.3753]
 [-0.9956  0.091   -0.0227 68.0984]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00315
Mean Error Translation: 0.76282
== [Result] Frame: 185, Matches 324, Inliers: 82.41
Saved at vis/frame185.jpg
[[-0.0223 -0.042   0.9989 45.1418]
 [ 0.0912  0.9949  0.0439  0.393 ]
 [-0.9956  0.0921 -0.0183 68.0788]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00315
Mean Error Translation: 0.75964

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== [Result] Frame: 186, Matches 321, Inliers: 86.60
Saved at vis/frame186.jpg
[[-0.0166 -0.0418  0.999  45.6023]
 [ 0.0925  0.9948  0.0432  0.4012]
 [-0.9956  0.0931 -0.0126 68.0717]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00315
Mean Error Translation: 0.75651
== [Result] Frame: 187, Matches 321, Inliers: 85.98
Saved at vis/frame187.jpg
[[-0.0074 -0.041   0.9991 46.0496]
 [ 0.0928  0.9948  0.0415  0.4107]
 [-0.9957  0.093  -0.0035 68.0682]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00314
Mean Error Translation: 0.75338
== [Result] Frame: 188, Matches 336, Inliers: 86.31
Saved at vis/frame188.jpg
[[ 0.0042 -0.0408  0.9992 46.4844]
 [ 0.0926  0.9949  0.0402  0.4212]
 [-0.9957  0.0924  0.0079 68.0744]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00313
Mean Error Translation: 0.75025
== [Result] Frame: 189, Matches 336, Inliers: 86.01
Saved at vis/frame189.jpg
[[ 0.0189 -0.0407  0.999  46.907 ]
 [ 0.0945  0.9948  0.0388  0.4272]
 [-0.9953  0.0937  0.0226 68.0828]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00313
Mean Error Translation: 0.74710
== [Result] Frame: 190, Matches 331, Inliers: 88.22
Saved at vis/frame190.jpg
[[ 0.0367 -0.0397  0.9985 47.3037]
 [ 0.0952  0.9948  0.036   0.4292]
 [-0.9948  0.0937  0.0402 68.1039]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00312
Mean Error Translation: 0.74400
== [Result] Frame: 191, Matches 333, Inliers: 81.68
Saved at vis/frame191.jpg
[[ 0.058  -0.0365  0.9977 47.6889]
 [ 0.0943  0.9951  0.0309  0.4383]
 [-0.9939  0.0923  0.0611 68.1383]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00311
Mean Error Translation: 0.74096

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== [Result] Frame: 192, Matches 320, Inliers: 81.87
Saved at vis/frame192.jpg
[[ 0.0818 -0.0324  0.9961 48.0648]
 [ 0.0925  0.9954  0.0248  0.4467]
 [-0.9923  0.0901  0.0844 68.1913]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00311
Mean Error Translation: 0.73796
== [Result] Frame: 193, Matches 322, Inliers: 85.71
Saved at vis/frame193.jpg
[[ 0.1102 -0.0303  0.9934 48.4359]
 [ 0.0922  0.9955  0.0201  0.4526]
 [-0.9896  0.0894  0.1125 68.2482]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00310
Mean Error Translation: 0.73498
== [Result] Frame: 194, Matches 324, Inliers: 80.86
Saved at vis/frame194.jpg
[[ 0.1422 -0.0305  0.9894 48.7886]
 [ 0.0901  0.9958  0.0177  0.4517]
 [-0.9857  0.0867  0.1443 68.3254]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00310
Mean Error Translation: 0.73211
== [Result] Frame: 195, Matches 327, Inliers: 78.29
Saved at vis/frame195.jpg
[[ 0.1798 -0.0328  0.9832 49.1466]
 [ 0.0913  0.9957  0.0165  0.4533]
 [-0.9795  0.0868  0.182   68.4073]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00309
Mean Error Translation: 0.72920
== [Result] Frame: 196, Matches 328, Inliers: 84.76
Saved at vis/frame196.jpg
[[ 0.2208 -0.0362  0.9747 49.4952]
 [ 0.0897  0.9958  0.0166  0.4489]
 [-0.9712  0.0837  0.2231 68.5099]
 [ 0.       0.       0.       1.      ]]

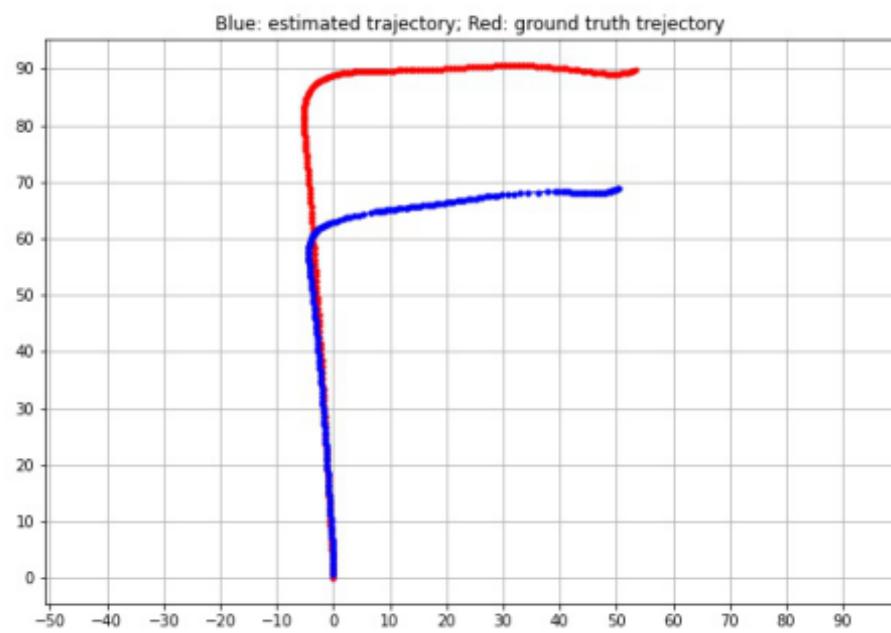
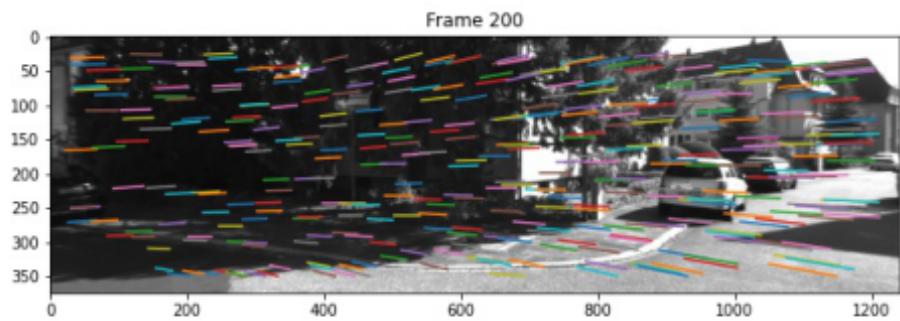
Mean Error Rotation: 0.00308
Mean Error Translation: 0.72632
== [Result] Frame: 197, Matches 328, Inliers: 85.37
Saved at vis/frame197.jpg
[[ 0.2653 -0.0401  0.9633 49.841 ]
 [ 0.0881  0.996   0.0172  0.4453]
 [-0.9601  0.0803  0.2677 68.6265]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00308
Mean Error Translation: 0.72344

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```
== [Result] Frame: 198, Matches 343, Inliers: 80.76
Saved at vis/frame198.jpg
[[ 0.311 -0.042  0.9495 50.1729]
 [ 0.0832  0.9964  0.0168  0.4414]
 [-0.9467  0.0738  0.3134  68.7765]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00308
Mean Error Translation: 0.72064
== [Result] Frame: 199, Matches 331, Inliers: 83.38
Saved at vis/frame199.jpg
[[ 0.3598 -0.0424  0.9321 50.4997]
 [ 0.0799  0.9967  0.0145  0.4392]
 [-0.9296  0.0692  0.362   68.9425]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00307
Mean Error Translation: 0.71777
== [Result] Frame: 200, Matches 332, Inliers: 84.04
Saved at vis/frame200.jpg

<Figure size 432x288 with 0 Axes>
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[[ 0.4111 -0.0419  0.9106 50.8244]
 [ 0.0793  0.9968  0.01     0.4341]
 [-0.9081  0.0681  0.4131 69.1304]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00306
Mean Error Translation: 0.71488
== [Result] Frame: 201, Matches 352, Inliers: 85.80
Saved at vis/frame201.jpg
[[ 0.4645 -0.0397  0.8847 51.128 ]
 [ 0.0805  0.9968  0.0025 0.4304]
 [-0.8819  0.07     0.4662 69.3399]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00307
Mean Error Translation: 0.71204
== [Result] Frame: 202, Matches 343, Inliers: 83.67
Saved at vis/frame202.jpg
[[ 0.5185 -0.0367  0.8543 51.4098]
 [ 0.0816  0.9966 -0.0067 0.4142]
 [-0.8512  0.0732  0.5198 69.5797]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00307
Mean Error Translation: 0.70916
== [Result] Frame: 203, Matches 332, Inliers: 75.60
Saved at vis/frame203.jpg
[[ 0.5714 -0.0312  0.8201 51.6674]
 [ 0.0803  0.9966 -0.0181 0.4021]
 [-0.8168  0.0762  0.5719 69.8464]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00309
Mean Error Translation: 0.70636
== [Result] Frame: 204, Matches 319, Inliers: 77.74
Saved at vis/frame204.jpg
[[ 0.6253 -0.0277  0.7799 51.9077]
 [ 0.0771  0.9967 -0.0264 0.3834]
 [-0.7766  0.0766  0.6254 70.0932]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00308
Mean Error Translation: 0.70351
== [Result] Frame: 205, Matches 309, Inliers: 82.85
Saved at vis/frame205.jpg
[[ 0.677  -0.0237  0.7356 52.1333]
 [ 0.0722  0.9968 -0.0343 0.3698]
 [-0.7325  0.0763  0.6765 70.3562]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00307
Mean Error Translation: 0.70076

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== [Result] Frame: 206, Matches 309, Inliers: 75.08
Saved at vis/frame206.jpg
[[ 0.725 -0.0218  0.6884 52.3242]
 [ 0.0697  0.9967 -0.0417  0.3573]
 [-0.6852  0.0782  0.7241 70.6271]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00307
Mean Error Translation: 0.69812
== [Result] Frame: 207, Matches 298, Inliers: 76.85
Saved at vis/frame207.jpg
[[ 0.7693 -0.0227  0.6385 52.4993]
 [ 0.0674  0.9967 -0.0458  0.3363]
 [-0.6353  0.0782  0.7683 70.8983]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00306
Mean Error Translation: 0.69542
== [Result] Frame: 208, Matches 289, Inliers: 76.47
Saved at vis/frame208.jpg
[[ 0.8102 -0.0249  0.5857 52.6546]
 [ 0.0637  0.9969 -0.0457  0.32   ]
 [-0.5827  0.0744  0.8093 71.185 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00305
Mean Error Translation: 0.69285
== [Result] Frame: 209, Matches 288, Inliers: 77.08
Saved at vis/frame209.jpg
[[ 0.8479 -0.031    0.5292 52.8101]
 [ 0.0638  0.997   -0.0438  0.3053]
 [-0.5263  0.0709  0.8473 71.4841]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00306
Mean Error Translation: 0.69023
== [Result] Frame: 210, Matches 296, Inliers: 79.05
Saved at vis/frame210.jpg
[[ 0.8802 -0.0313  0.4736 52.9296]
 [ 0.0583  0.9974 -0.0424  0.2863]
 [-0.4711  0.0649  0.8797 71.7975]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00306
Mean Error Translation: 0.68757
== [Result] Frame: 211, Matches 294, Inliers: 80.95
Saved at vis/frame211.jpg
[[ 0.9068 -0.0302  0.4206 53.0246]
 [ 0.0519  0.9978 -0.0402  0.268 ]
 [-0.4184  0.0583  0.9064 72.1389]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00308
Mean Error Translation: 0.68498

```

```

== [Result] Frame: 212, Matches 299, Inliers: 76.25
Saved at vis/frame212.jpg
[[ 0.9282 -0.0247  0.3712 53.0934]
 [ 0.0421  0.9984 -0.0389  0.2445]
 [-0.3696  0.0517  0.9277 72.4753]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00310
Mean Error Translation: 0.68249
== [Result] Frame: 213, Matches 295, Inliers: 83.39
Saved at vis/frame213.jpg
[[ 0.945   -0.0181  0.3266 53.1584]
 [ 0.0326   0.9987 -0.0391  0.2249]
 [-0.3255   0.0476  0.9444 72.8421]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00312
Mean Error Translation: 0.67982
== [Result] Frame: 214, Matches 313, Inliers: 80.19
Saved at vis/frame214.jpg
[[ 0.9578 -0.0101  0.2874 53.2213]
 [ 0.0224   0.999   -0.0395  0.2103]
 [-0.2867   0.0443  0.957   73.2175]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00312
Mean Error Translation: 0.67721
== [Result] Frame: 215, Matches 326, Inliers: 81.29
Saved at vis/frame215.jpg
[[ 0.9673 -0.0026  0.2536 53.2698]
 [ 0.0139   0.999   -0.043   0.1938]
 [-0.2533   0.0451  0.9663 73.5955]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00313
Mean Error Translation: 0.67458
== [Result] Frame: 216, Matches 336, Inliers: 82.74
Saved at vis/frame216.jpg
[[ 0.9746  0.0009  0.2239 53.3237]
 [ 0.0094   0.999   -0.0446  0.1759]
 [-0.2237   0.0456  0.9736 73.9782]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00313
Mean Error Translation: 0.67199
== [Result] Frame: 217, Matches 328, Inliers: 79.27
Saved at vis/frame217.jpg
[[ 0.9795 -0.0041  0.2016 53.3958]
 [ 0.0136   0.9989 -0.0456  0.1539]
 [-0.2012   0.0474  0.9784 74.3802]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00312
Mean Error Translation: 0.66932

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== [Result] Frame: 218, Matches 327, Inliers: 80.12
Saved at vis/frame218.jpg
[[ 0.9823 -0.0058  0.187  53.4716]
 [ 0.0147  0.9988 -0.0461  0.1257]
 [-0.1865  0.048   0.9813  74.9117]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00312
Mean Error Translation: 0.66656
== [Result] Frame: 219, Matches 316, Inliers: 78.48
Saved at vis/frame219.jpg
[[ 0.9846 -0.0012  0.1747  53.5218]
 [ 0.0095  0.9989 -0.0469  0.1031]
 [-0.1744  0.0478  0.9835  75.2902]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00311
Mean Error Translation: 0.66412
== [Result] Frame: 220, Matches 311, Inliers: 76.53
Saved at vis/frame220.jpg
[[ 0.9862  0.0052  0.1656  53.6056]
 [ 0.0026  0.9989 -0.047   0.0693]
 [-0.1657  0.0468  0.9851  76.0165]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00311
Mean Error Translation: 0.66212
== [Result] Frame: 221, Matches 299, Inliers: 76.25
Saved at vis/frame221.jpg
[[ 0.9871  0.0133  0.1597  53.6931]
 [-0.0057  0.9988 -0.0483  0.0289]
 [-0.1601  0.0468  0.986   76.6971]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00310
Mean Error Translation: 0.65989
== [Result] Frame: 222, Matches 310, Inliers: 81.29
Saved at vis/frame222.jpg
[[ 0.9875  0.0181  0.1567  53.7474]
 [-0.01    0.9986 -0.0521  0.0039]
 [-0.1574  0.0499  0.9863  77.0986]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00310
Mean Error Translation: 0.65754
== [Result] Frame: 223, Matches 312, Inliers: 76.92
Saved at vis/frame223.jpg
[[ 0.9876  0.0193  0.1556  53.8153]
 [-0.0109  0.9985 -0.0545 -0.0259]
 [-0.1564  0.0521  0.9863  77.5041]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00309
Mean Error Translation: 0.65521

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== [Result] Frame: 224, Matches 292, Inliers: 78.77
Saved at vis/frame224.jpg
[[ 0.9872  0.0188  0.1584 53.8828]
 [-0.0097  0.9983 -0.0582 -0.0533]
 [-0.1592  0.0559  0.9857 77.9235]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00308
Mean Error Translation: 0.65290
== [Result] Frame: 225, Matches 312, Inliers: 76.60
Saved at vis/frame225.jpg
[[ 0.9866  0.0171  0.1625 53.9576]
 [-0.0067  0.9979 -0.0649 -0.0768]
 [-0.1632  0.0629  0.9846 78.349 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00307
Mean Error Translation: 0.65061
== [Result] Frame: 226, Matches 305, Inliers: 79.34
Saved at vis/frame226.jpg
[[ 0.9861  0.0151  0.1657 54.0388]
 [-0.0035  0.9975 -0.07    -0.0996]
 [-0.1663  0.0684  0.9837 78.7749]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00307
Mean Error Translation: 0.64839
== [Result] Frame: 227, Matches 308, Inliers: 78.25
Saved at vis/frame227.jpg
[[ 0.985   0.0212  0.1713 54.0898]
 [-0.0094  0.9975 -0.0696 -0.129 ]
 [-0.1723  0.0669  0.9828 79.1803]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00307
Mean Error Translation: 0.64640
== [Result] Frame: 228, Matches 311, Inliers: 77.81
Saved at vis/frame228.jpg
[[ 0.9837  0.0259  0.178  54.1479]
 [-0.0144  0.9977 -0.0657 -0.1577]
 [-0.1793  0.0621  0.9818 79.606 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00306
Mean Error Translation: 0.64438
== [Result] Frame: 229, Matches 306, Inliers: 81.37
Saved at vis/frame229.jpg
[[ 0.9826  0.025   0.1839 54.2192]
 [-0.014   0.998  -0.0609 -0.1923]
 [-0.185   0.0572  0.9811 80.0458]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00306
Mean Error Translation: 0.64238

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== [Result] Frame: 230, Matches 295, Inliers: 82.03
Saved at vis/frame230.jpg
[[ 0.9819  0.0211  0.1881  54.3075]
 [-0.0109  0.9984 -0.0553 -0.2249]
 [-0.189   0.0523  0.9806  80.5206]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00305
Mean Error Translation: 0.64027
== [Result] Frame: 231, Matches 281, Inliers: 80.78
Saved at vis/frame231.jpg
[[ 0.981   0.0194  0.1929  54.3972]
 [-0.0097  0.9987 -0.0509 -0.2564]
 [-0.1936  0.0481  0.9799  81.0354]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00305
Mean Error Translation: 0.63809
== [Result] Frame: 232, Matches 308, Inliers: 86.04
Saved at vis/frame232.jpg
[[ 0.9803  0.0159  0.1967  54.4956]
 [-0.006   0.9987 -0.0507 -0.2853]
 [-0.1972  0.0485  0.9792  81.5656]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.63588
== [Result] Frame: 233, Matches 313, Inliers: 82.75
Saved at vis/frame233.jpg
[[ 0.9801  0.0143  0.1979  54.6395]
 [-0.0037  0.9986 -0.0537 -0.3372]
 [-0.1984  0.0519  0.9787  82.3233]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.63370
== [Result] Frame: 234, Matches 309, Inliers: 85.44
Saved at vis/frame234.jpg
[[ 0.9801  0.0139  0.1981  54.7792]
 [-0.0019  0.9982 -0.0606 -0.3885]
 [-0.1986  0.059   0.9783  83.0481]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.63140
== [Result] Frame: 235, Matches 301, Inliers: 82.06
Saved at vis/frame235.jpg
[[ 0.9801  0.0173  0.198   54.9264]
 [-0.004   0.9977 -0.0673 -0.445 ]
 [-0.1987  0.0652  0.9779  83.8837]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.62950

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== [Result] Frame: 236, Matches 304, Inliers: 79.61
Saved at vis/frame236.jpg
[[ 0.9803  0.0223  0.1961  55.0277]
 [-0.0084  0.9974 -0.0714 -0.4805]
 [-0.1972  0.0684  0.978   84.4789]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.62727
== [Result] Frame: 237, Matches 290, Inliers: 73.45
Saved at vis/frame237.jpg
[[ 0.9807  0.0216  0.1943  55.1706]
 [-0.0085  0.9977 -0.0676 -0.5298]
 [-0.1953  0.0646  0.9786  85.2601]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00303
Mean Error Translation: 0.62505
== [Result] Frame: 238, Matches 266, Inliers: 74.44
Saved at vis/frame238.jpg
[[ 0.9812  0.0163  0.1921  55.2923]
 [-0.0047  0.9982 -0.0605 -0.5674]
 [-0.1928  0.0585  0.9795  85.8295]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00303
Mean Error Translation: 0.62306
== [Result] Frame: 239, Matches 279, Inliers: 75.63
Saved at vis/frame239.jpg
[[ 0.9815  0.0186  0.1905  55.3902]
 [-0.0083  0.9985 -0.055   -0.6096]
 [-0.1912  0.0524  0.9802  86.406 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00303
Mean Error Translation: 0.62114
== [Result] Frame: 240, Matches 282, Inliers: 78.37
Saved at vis/frame240.jpg
[[ 0.9815  0.0257  0.1898  55.5419]
 [-0.0153  0.9983 -0.0561 -0.6752]
 [-0.1909  0.0522  0.9802  87.3896]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.61966
== [Result] Frame: 241, Matches 277, Inliers: 71.12
Saved at vis/frame241.jpg
[[ 0.9818  0.0301  0.1873  55.7324]
 [-0.0189  0.998   -0.0608 -0.7478]
 [-0.1888  0.0561  0.9804  88.4665]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00303
Mean Error Translation: 0.61855

```

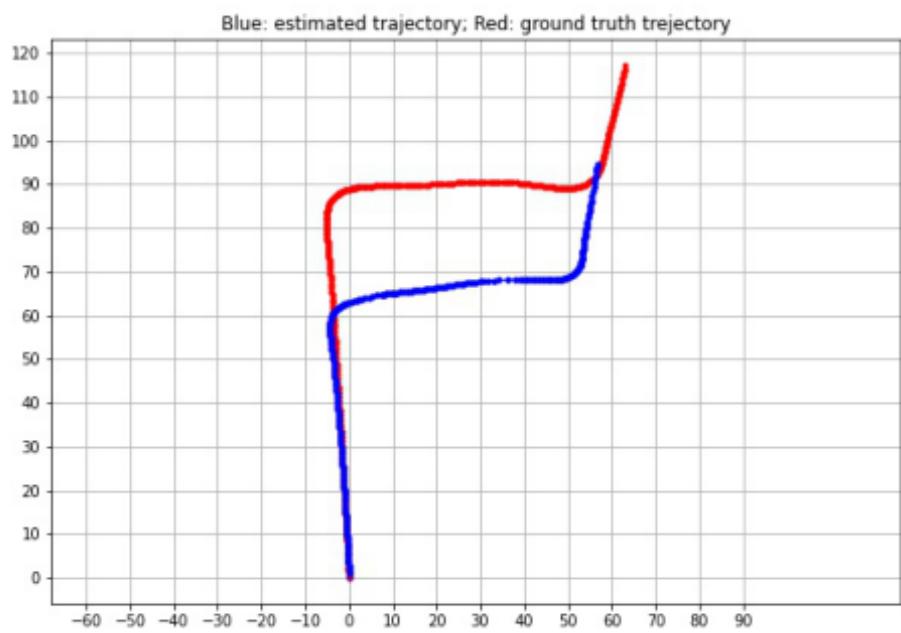
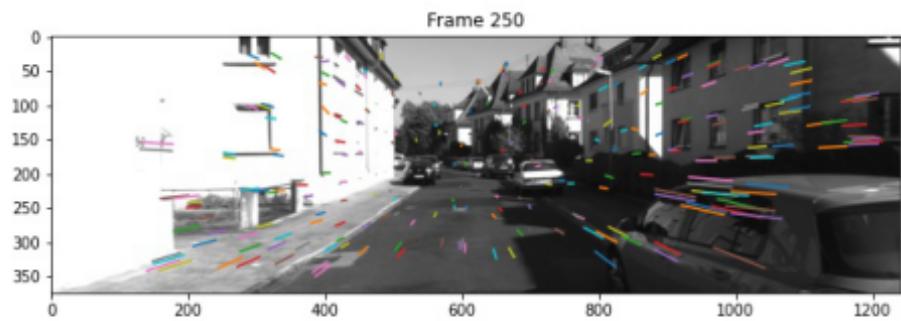
```

== [Result] Frame: 242, Matches 271, Inliers: 78.23
Saved at vis/frame242.jpg
[[ 0.9825  0.031   0.1836  55.9301]
 [-0.0191  0.9976 -0.0664 -0.817 ]
 [-0.1852  0.0618  0.9808  89.5876]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00302
Mean Error Translation: 0.61759
== [Result] Frame: 243, Matches 278, Inliers: 71.22
Saved at vis/frame243.jpg
[[ 0.983   0.0319  0.181   56.0727]
 [-0.0194  0.9974 -0.0701 -0.8807]
 [-0.1827  0.0654  0.981   90.5466]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00302
Mean Error Translation: 0.61593
== [Result] Frame: 244, Matches 272, Inliers: 74.26
Saved at vis/frame244.jpg
[[ 0.9835  0.0311  0.1783  56.195 ]
 [-0.0191  0.9974 -0.069   -0.9361]
 [-0.18    0.0645  0.9816  91.3467]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00302
Mean Error Translation: 0.61370
== [Result] Frame: 245, Matches 253, Inliers: 69.17
Saved at vis/frame245.jpg
[[ 0.9841  0.028   0.1752  56.3003]
 [-0.0164  0.9976 -0.0675 -0.9809]
 [-0.1767  0.0635  0.9822  91.9632]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00302
Mean Error Translation: 0.61193
== [Result] Frame: 246, Matches 255, Inliers: 81.57
Saved at vis/frame246.jpg
[[ 0.9844  0.0279  0.1739  56.4565]
 [-0.0168  0.9977 -0.065   -1.0532]
 [-0.1753  0.061   0.9826  92.9136]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00301
Mean Error Translation: 0.61012
== [Result] Frame: 247, Matches 265, Inliers: 83.02
Saved at vis/frame247.jpg
[[ 0.9848  0.0239  0.1719  56.5738]
 [-0.0133  0.9979 -0.0627 -1.0964]
 [-0.173   0.0595  0.9831  93.5313]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00301
Mean Error Translation: 0.60848

```

```
== [Result] Frame: 248, Matches 279, Inliers: 80.29
Saved at vis/frame248.jpg
[[ 0.9848  0.0203  0.1724 56.666 ]
 [-0.0098  0.9981 -0.0615 -1.1401]
 [-0.1733  0.0589  0.9831 94.1038]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00301
Mean Error Translation: 0.60707
== [Result] Frame: 249, Matches 256, Inliers: 73.83
Saved at vis/frame249.jpg
[[ 0.9846  0.0233  0.1735 56.7467]
 [-0.0129  0.9981 -0.0604 -1.1774]
 [-0.1746  0.0572  0.983  94.6938]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00301
Mean Error Translation: 0.60564
== [Result] Frame: 250, Matches 248, Inliers: 72.18
Saved at vis/frame250.jpg

<Figure size 432x288 with 0 Axes>
```



```

[[ 0.9841  0.0298  0.175  56.833 ]
 [-0.0191  0.9978 -0.0629 -1.2136]
 [-0.1765  0.0586  0.9826  95.2742]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00301
Mean Error Translation: 0.60425
== [Result] Frame: 251, Matches 255, Inliers: 72.94
Saved at vis/frame251.jpg
[[ 0.9841  0.034   0.1743  56.9356]
 [-0.0228  0.9976 -0.0654 -1.2622]
 [-0.1761  0.0604  0.9825  95.835 ]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00301
Mean Error Translation: 0.60294
== [Result] Frame: 252, Matches 276, Inliers: 76.09
Saved at vis/frame252.jpg
[[ 0.9838  0.0417  0.1743  57.0388]
 [-0.0304  0.9973 -0.067   -1.3059]
 [-0.1766  0.0606  0.9824  96.4172]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00300
Mean Error Translation: 0.60158
== [Result] Frame: 253, Matches 274, Inliers: 81.02
Saved at vis/frame253.jpg
[[ 0.9829  0.0482  0.1776  57.1305]
 [-0.0369  0.9971 -0.0666 -1.3494]
 [-0.1803  0.0589  0.9819  97.0097]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00300
Mean Error Translation: 0.60024
== [Result] Frame: 254, Matches 276, Inliers: 78.99
Saved at vis/frame254.jpg
[[ 0.9821  0.051   0.1812  57.2256]
 [-0.0398  0.9971 -0.0647 -1.3952]
 [-0.1839  0.0563  0.9813  97.6057]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00299
Mean Error Translation: 0.59890
== [Result] Frame: 255, Matches 256, Inliers: 75.39
Saved at vis/frame255.jpg
[[ 0.9815  0.0523  0.1839  57.3321]
 [-0.0409  0.997   -0.0656 -1.4431]
 [-0.1868  0.0569  0.9807  98.2275]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00298
Mean Error Translation: 0.59748

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```

== [Result] Frame: 256, Matches 264, Inliers: 80.68
Saved at vis/frame256.jpg
[[ 0.9811  0.0517  0.1863  57.4389]
 [-0.0395  0.9969 -0.0686 -1.489 ]
 [-0.1892  0.0599  0.9801  98.8411]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00298
Mean Error Translation: 0.59611
== [Result] Frame: 257, Matches 278, Inliers: 80.22
Saved at vis/frame257.jpg
[[ 0.9811  0.0472  0.1877  57.5554]
 [-0.0351  0.9971 -0.0673 -1.535 ]
 [-0.1903  0.0594  0.9799  99.446 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00298
Mean Error Translation: 0.59483
== [Result] Frame: 258, Matches 268, Inliers: 83.96
Saved at vis/frame258.jpg
[[ 0.9814  0.0407  0.1877  57.6818]
 [-0.0282  0.9972 -0.0689 -1.5885]
 [-0.19      0.0623  0.9798  100.0589]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00298
Mean Error Translation: 0.59350
== [Result] Frame: 259, Matches 258, Inliers: 81.40
Saved at vis/frame259.jpg
[[ 0.9811  0.0405  0.1893  57.7943]
 [-0.028    0.9972 -0.0687 -1.6419]
 [-0.1916   0.0621  0.9795  100.6786]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00297
Mean Error Translation: 0.59216
== [Result] Frame: 260, Matches 259, Inliers: 78.38
Saved at vis/frame260.jpg
[[ 0.9809  0.0411  0.1902  57.9166]
 [-0.029    0.9974 -0.066   -1.6895]
 [-0.1924   0.0592  0.9795  101.2924]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00298
Mean Error Translation: 0.59084
== [Result] Frame: 261, Matches 264, Inliers: 76.89
Saved at vis/frame261.jpg
[[ 0.9806  0.0429  0.1914  58.0307]
 [-0.0318  0.9977 -0.0605 -1.7345]
 [-0.1936   0.0532  0.9796  101.9098]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00297
Mean Error Translation: 0.58954

```

```

== [Result] Frame: 262, Matches 269, Inliers: 81.04
Saved at vis/frame262.jpg
[[ 0.9803  0.0452  0.1923  58.1519]
 [-0.035   0.9978  -0.0565  -1.7841]
 [-0.1945  0.0487  0.9797  102.5509]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00297
Mean Error Translation: 0.58813
== [Result] Frame: 263, Matches 258, Inliers: 74.81
Saved at vis/frame263.jpg
[[ 0.98     0.0449  0.1937  58.2811]
 [-0.0331  0.9974  -0.0634  -1.8378]
 [-0.196   0.0557  0.979   103.2557]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00296
Mean Error Translation: 0.58643
== [Result] Frame: 264, Matches 264, Inliers: 77.27
Saved at vis/frame264.jpg
[[ 0.9804  0.0392  0.1932  58.4091]
 [-0.0246  0.9967  -0.0774  -1.8959]
 [-0.1956  0.0711  0.9781  103.8914]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00296
Mean Error Translation: 0.58495
== [Result] Frame: 265, Matches 265, Inliers: 79.62
Saved at vis/frame265.jpg
[[ 0.9802  0.0394  0.1942  58.5684]
 [-0.0228  0.996   -0.0867  -1.9733]
 [-0.1969  0.0805  0.9771  104.8312]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00298
Mean Error Translation: 0.58330
== [Result] Frame: 266, Matches 271, Inliers: 76.01
Saved at vis/frame266.jpg
[[ 0.9805  0.0365  0.1933  58.7754]
 [-0.0217  0.9967  -0.078   -2.0518]
 [-0.1955  0.0723  0.978   105.8445]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00298
Mean Error Translation: 0.58183
== [Result] Frame: 267, Matches 279, Inliers: 77.42
Saved at vis/frame267.jpg
[[ 0.9807  0.0304  0.1933  59.0118]
 [-0.0197  0.9982  -0.0574  -2.16  ]
 [-0.1947  0.0525  0.9795  107.1396]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00299
Mean Error Translation: 0.58137

```

```

== [Result] Frame: 268, Matches 289, Inliers: 81.66
Saved at vis/frame268.jpg
[[ 0.9809  0.0276  0.1924  59.1494]
 [-0.0198  0.9989 -0.0424 -2.218 ]
 [-0.1933  0.0378  0.9804 107.8411]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00299
Mean Error Translation: 0.57977
== [Result] Frame: 269, Matches 275, Inliers: 74.18
Saved at vis/frame269.jpg
[[ 0.9805  0.0359  0.1935  59.2557]
 [-0.0271  0.9985 -0.0477 -2.2782]
 [-0.1949  0.0416  0.9799 108.5614]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00302
Mean Error Translation: 0.57813
== [Result] Frame: 270, Matches 272, Inliers: 80.15
Saved at vis/frame270.jpg
[[ 0.9804  0.0447  0.1917  59.3903]
 [-0.033   0.9974 -0.0638 -2.3316]
 [-0.194   0.0562  0.9794 109.3689]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00301
Mean Error Translation: 0.57627
== [Result] Frame: 271, Matches 269, Inliers: 81.41
Saved at vis/frame271.jpg
[[ 0.9809  0.0435  0.1897  59.5319]
 [-0.0302  0.9969 -0.0721 -2.3765]
 [-0.1923  0.065   0.9792 110.0822]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00301
Mean Error Translation: 0.57455
== [Result] Frame: 272, Matches 258, Inliers: 81.78
Saved at vis/frame272.jpg
[[ 0.9811  0.0416  0.189   59.6578]
 [-0.0282  0.9969 -0.073   -2.44  ]
 [-0.1914  0.0663  0.9793 110.8372]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00302
Mean Error Translation: 0.57281
== [Result] Frame: 273, Matches 261, Inliers: 83.14
Saved at vis/frame273.jpg
[[ 0.981   0.0461  0.1883  59.7828]
 [-0.0331  0.9969 -0.0715 -2.5159]
 [-0.191   0.0639  0.9795 111.6702]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00303
Mean Error Translation: 0.57102

```

```

== [Result] Frame: 274, Matches 271, Inliers: 78.97
Saved at vis/frame274.jpg
[[ 0.9815  0.0473  0.1858  59.9121]
 [-0.0343  0.9968 -0.0729 -2.5812]
 [-0.1886  0.0651  0.9799 112.4841]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00303
Mean Error Translation: 0.56921
== [Result] Frame: 275, Matches 270, Inliers: 80.74
Saved at vis/frame275.jpg
[[ 0.9819  0.0498  0.1825  60.0504]
 [-0.0366  0.9965 -0.075   -2.6529]
 [-0.1856  0.067   0.9803 113.4099]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.56768
== [Result] Frame: 276, Matches 269, Inliers: 73.23
Saved at vis/frame276.jpg
[[ 0.9823  0.0549  0.179   60.1975]
 [-0.0418  0.9963 -0.0757 -2.7172]
 [-0.1825  0.0669  0.9809 114.2147]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00303
Mean Error Translation: 0.56580
== [Result] Frame: 277, Matches 258, Inliers: 68.60
Saved at vis/frame277.jpg
[[ 0.9821  0.0626  0.1775  60.3188]
 [-0.0497  0.9959 -0.0762 -2.7897]
 [-0.1815  0.066   0.9812 115.0758]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.56413
== [Result] Frame: 278, Matches 269, Inliers: 68.03
Saved at vis/frame278.jpg
[[ 0.9825  0.0632  0.1753  60.4814]
 [-0.0507  0.9959 -0.0749 -2.8632]
 [-0.1793  0.0647  0.9817 116.0109]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.56262
== [Result] Frame: 279, Matches 275, Inliers: 64.00
Saved at vis/frame279.jpg
[[ 0.9825  0.0634  0.1754  60.6165]
 [-0.0517  0.9962 -0.0706 -2.9342]
 [-0.1792  0.0603  0.982   116.8903]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 0.56097

```

```

== [Result] Frame: 280, Matches 293, Inliers: 70.99
Saved at vis/frame280.jpg
[[ 0.9825  0.0631  0.175   60.7642]
 [-0.0514  0.9962  -0.0708  -3.0184]
 [-0.1788  0.0606  0.982   117.8468]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00303
Mean Error Translation: 0.55959
== [Result] Frame: 281, Matches 283, Inliers: 73.50
Saved at vis/frame281.jpg
[[ 0.9831  0.0607  0.1726  60.938 ]
 [-0.0485  0.9961  -0.0739  -3.1086]
 [-0.1764  0.0643  0.9822  118.8471]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00303
Mean Error Translation: 0.55838
== [Result] Frame: 282, Matches 290, Inliers: 71.03
Saved at vis/frame282.jpg
[[ 0.9845  0.0523  0.1671  61.1301]
 [-0.0398  0.9962  -0.0774  -3.2079]
 [-0.1705  0.0696  0.9829  119.88 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00304
Mean Error Translation: 0.55733
== [Result] Frame: 283, Matches 273, Inliers: 65.57
Saved at vis/frame283.jpg
[[ 0.9857  0.0505  0.1607  61.3093]
 [-0.0384  0.9962  -0.0776  -3.3164]
 [-0.164   0.0703  0.984   120.9885]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00304
Mean Error Translation: 0.55651
== [Result] Frame: 284, Matches 276, Inliers: 64.86
Saved at vis/frame284.jpg
[[ 0.9868  0.0487  0.1544  61.4585]
 [-0.0378  0.9966  -0.0727  -3.3906]
 [-0.1574  0.0659  0.9853  121.9592]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00303
Mean Error Translation: 0.55517
== [Result] Frame: 285, Matches 254, Inliers: 66.93
Saved at vis/frame285.jpg
[[ 0.9878  0.047   0.1488  61.6079]
 [-0.0378  0.9972  -0.0643  -3.4826]
 [-0.1514  0.0579  0.9868  123.0604]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00303
Mean Error Translation: 0.55428

```

```

== [Result] Frame: 286, Matches 248, Inliers: 72.58
Saved at vis/frame286.jpg
[[ 0.9885  0.0433  0.1446  61.7312]
 [-0.0357  0.9979  -0.0548  -3.5463]
 [-0.1467  0.049   0.988   123.8474]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00302
Mean Error Translation: 0.55252
== [Result] Frame: 287, Matches 269, Inliers: 76.21
Saved at vis/frame287.jpg
[[ 0.9886  0.0508  0.1417  61.7961]
 [-0.0438  0.9977  -0.0519  -3.5915]
 [-0.1441  0.0451  0.9885  124.4763]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00302
Mean Error Translation: 0.55124
== [Result] Frame: 288, Matches 259, Inliers: 79.54
Saved at vis/frame288.jpg
[[ 0.989   0.0554  0.137   61.8675]
 [-0.048   0.9972  -0.0566  -3.6333]
 [-0.1398  0.0494  0.989   125.0862]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00302
Mean Error Translation: 0.54999
== [Result] Frame: 289, Matches 275, Inliers: 78.91
Saved at vis/frame289.jpg
[[ 0.9899  0.057   0.1301  61.9325]
 [-0.0487  0.9966  -0.0664  -3.6778]
 [-0.1334  0.0594  0.9893  125.6556]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00302
Mean Error Translation: 0.54888
== [Result] Frame: 290, Matches 294, Inliers: 85.03
Saved at vis/frame290.jpg
[[ 0.9911  0.0518  0.1226  62.0087]
 [-0.0432  0.9964  -0.0725  -3.7112]
 [-0.1259  0.0666  0.9898  126.2065]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00302
Mean Error Translation: 0.54785
== [Result] Frame: 291, Matches 311, Inliers: 82.32
Saved at vis/frame291.jpg
[[ 0.992   0.0499  0.116   62.0712]
 [-0.0417  0.9965  -0.0719  -3.7505]
 [-0.1192  0.0665  0.9906  126.763 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00301
Mean Error Translation: 0.54685

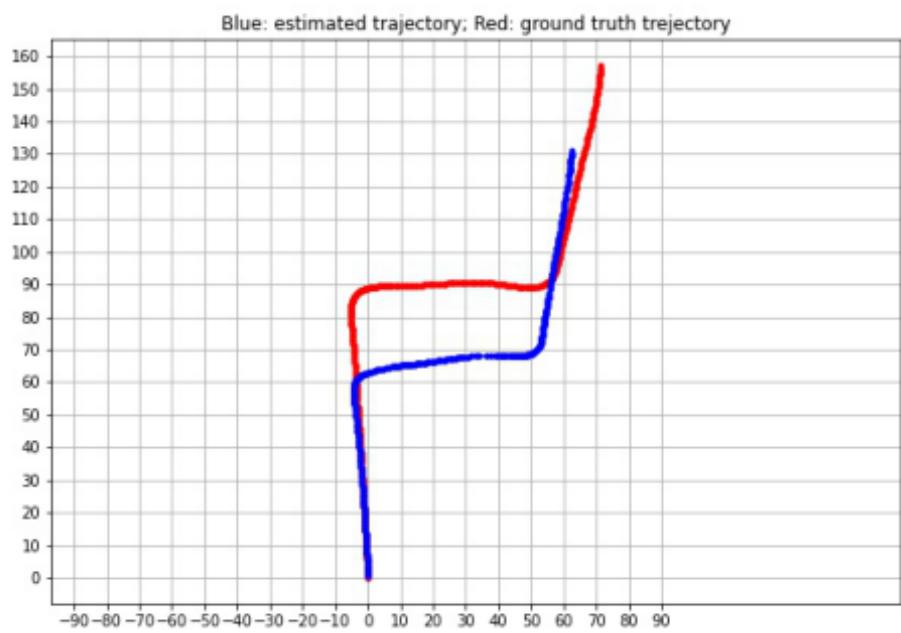
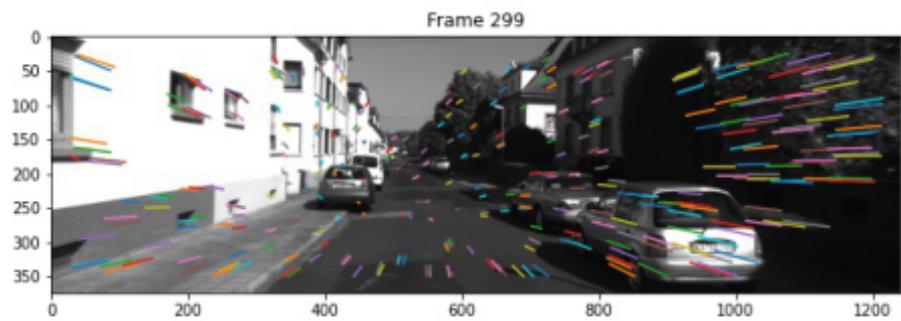
```

```

== [Result] Frame: 292, Matches 298, Inliers: 83.56
Saved at vis/frame292.jpg
[[ 0.9923  0.0579  0.1099  62.106 ]
 [-0.0505  0.9963  -0.0691  -3.7928]
 [-0.1135  0.063   0.9915  127.3458]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00301
Mean Error Translation: 0.54581
== [Result] Frame: 293, Matches 294, Inliers: 80.95
Saved at vis/frame293.jpg
[[ 0.9927  0.064   0.1025  62.1448]
 [-0.0569  0.9959  -0.0708  -3.838 ]
 [-0.1066  0.0645  0.9922  127.9267]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00301
Mean Error Translation: 0.54477
== [Result] Frame: 294, Matches 291, Inliers: 83.51
Saved at vis/frame294.jpg
[[ 0.9934  0.0675  0.0925  62.1899]
 [-0.0606  0.9952  -0.0763  -3.888 ]
 [-0.0972  0.0702  0.9928  128.5138]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00300
Mean Error Translation: 0.54369
== [Result] Frame: 295, Matches 293, Inliers: 82.94
Saved at vis/frame295.jpg
[[ 0.994   0.0684  0.0851  62.225 ]
 [-0.0617  0.995   -0.0788  -3.9328]
 [-0.0901  0.0731  0.9932  129.0885]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00300
Mean Error Translation: 0.54268
== [Result] Frame: 296, Matches 314, Inliers: 84.39
Saved at vis/frame296.jpg
[[ 0.9946  0.0687  0.0774  62.2651]
 [-0.0628  0.9951  -0.0759  -3.9833]
 [-0.0822  0.0707  0.9941  129.6939]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00300
Mean Error Translation: 0.54159
== [Result] Frame: 297, Matches 301, Inliers: 86.05
Saved at vis/frame297.jpg
[[ 0.9951  0.0696  0.0696  62.3038]
 [-0.0649  0.9956  -0.0683  -4.0386]
 [-0.074   0.0635  0.9952  130.3048]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00300
Mean Error Translation: 0.54051

```

```
== [Result] Frame: 298, Matches 292, Inliers: 83.22
Saved at vis/frame298.jpg
[[ 0.9954  0.0729  0.0619  62.3266]
 [-0.0691  0.9957 -0.0621 -4.0871]
 [-0.0661  0.0575  0.9962 130.9027]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00299
Mean Error Translation: 0.53948
== [Result] Frame: 299, Matches 295, Inliers: 85.42
Saved at vis/frame299.jpg
<Figure size 432x288 with 0 Axes>
```



1. Report the final rotation and translation error. (**2 points**)

Mean Error Rotation: 0.00299

Mean Error Translation: 0.53948

Then answer the questions below

2. In `libviso2`, the feature points are “bucketed” (`src/matcher.cpp` : Line285 – 326), which means in a certain area of region, the number of detected keypoint pairs should be within certain bounds. Why? (**3 points**)

As discussed in the paper, this has two effects:

- It reduces the computational complexity since the number of points are upper-bounded. This allows for real-time SfM.
 - The feature points are more evenly distributed over the image, instead of being concentrated in regions with diverse features, such as objects. This will remove drift over time.
3. We have run SFM on a single camera, which means the scale of translation is unknown. However, as you may have observed, the predicted trajectory is still somehow similar to the ground-truth trajectory. How does `libviso2` handle this ambiguity (`viso_mono.cpp` : Line245)? (**5 points**)

In this question, we are given frames taken by the same camera. We then obtain matches in both frames and then estimate the fundamental matrix and the translation and rotation of the camera between the two frames. This leads to scale ambiguity in the translation.

The way `libviso2` handles this is by normalizing t : $t = t * \text{param.height} / d.\text{val}[0][\text{best_idx}]$;

From the code, `param.height` seems to be a pre-defined value (1.6). This is supposed to be the height of the camera.

d is a $(1, X_{\text{plane}}.n)$ matrix where $X_{\text{plane}}.n$ is the number of matched points.

From the c++ code, it seems they first project the feature points into a 2d plane that passes through at least one feature point. They pick the best plane to be the plane that minimizes the sum of exponential of negative difference.

It is most likely that this plane is the ground plane.

Thus, to normalize t , they multiply t by the height of the camera and divide by the height of the ground.

4. Briefly explain the RANSAC algorithm used in `libviso2` (`viso_mono.cpp` : Line113 – 129). (**5 points**)

The algorithm runs for `param.ransac_iters` iteration. In each iteration, 8 correspondences are sampled out of the N available correspondences. A fundamental matrix is estimated from these 8 points and the number of inliers (correspondences satisfying the homogenous constraints for a given fundamental matrix) is computed.

In each iteration, we keep track of the maximum number of inliers that fit a particular estimate of the fundamental matrix.

1.3 Question 2: Using SIFT [4] for SFM

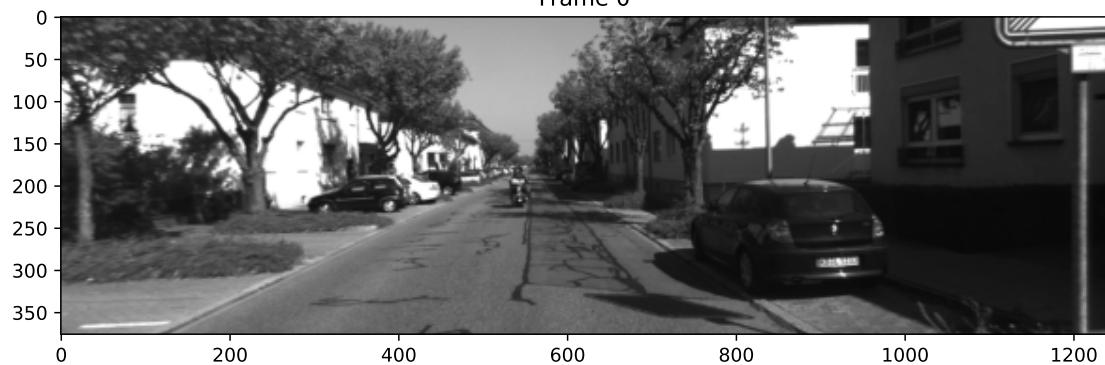
In the second task, you are required to use keypoints and feature descriptors from SIFT for SFM. The SIFT implementation can be found in directory `SIFT`.

- (A) Go to SIFT directory and run `runSIFT.py` (e.g. `python runSIFT.py --input /datasets/cse152-252-sp20-public/dataset_SfM/sequences/00/image_0/`). You will save the detected keypoints and feature descriptors under the directory `SIFT`. For image `000abc.png`, the pre-computed features and keypoints should be saved in a `.npy` file named as `000abc_feature.npy`. The variable should be a $130 \times N$ matrix with `single` precision, where N is the number of feature points being detected. For each 130-dimensional feature vector, the first two dimensions are the location of the keypoints (column number first and then row number) on the image plane and the last 128 dimensions are the feature descriptor.
- (B) Run the following script

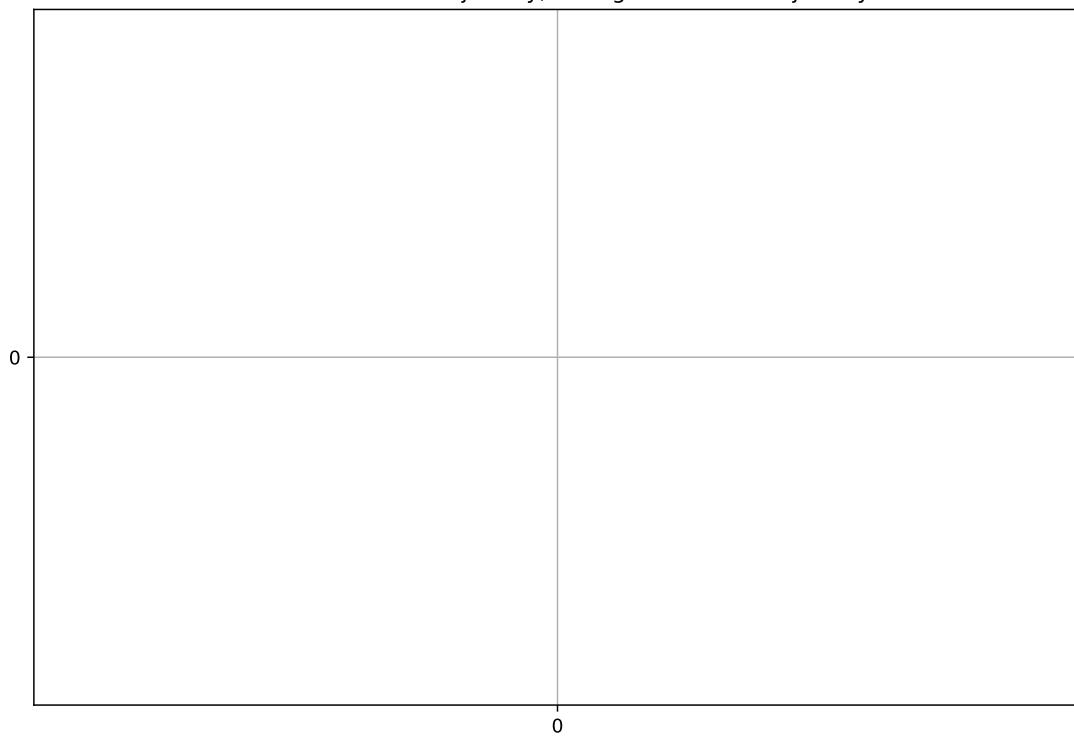
```
[10]: import runFeature  
dataset_path = '/Users/QV/code-project/datasets/dataset_SfM/'  
feature_dir = 'SIFT'  
runFeature.runSFM(dataset_path, feature_dir )
```

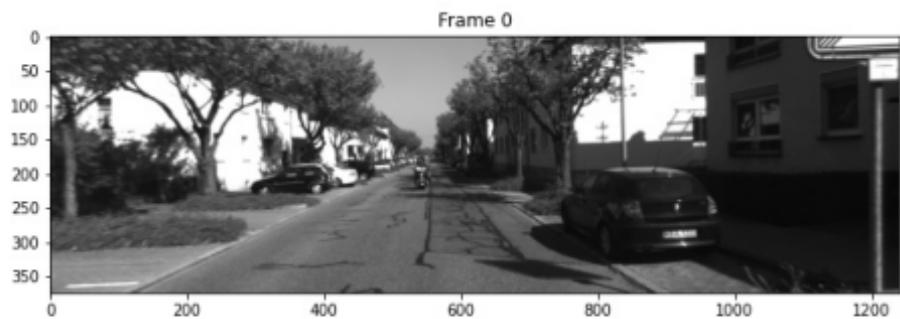
```
Mean Error Rotation: inf  
Mean Error Translation: inf  
== [Result] Frame: 0, Matches 0, Inliers: 0.00  
Saved at vis_preFeature/frame000.jpg
```

Frame 0

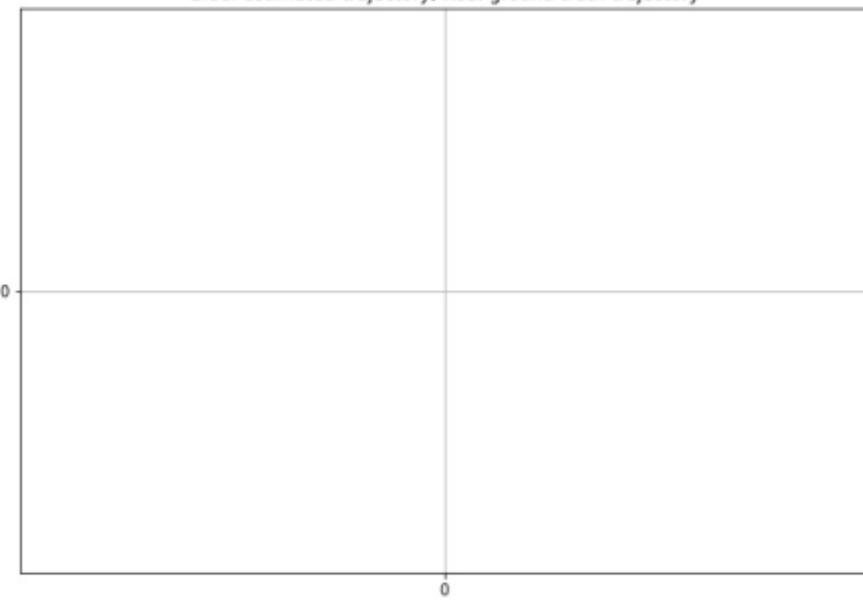


Blue: estimated trajectory; Red: ground truth trajectory





Blue: estimated trajectory; Red: ground truth trajectory



```

[[ 1.      -0.0044 -0.0041  0.0058]
 [ 0.0044   1.      -0.0021 -0.0028]
 [ 0.0041   0.0021   1.      0.464 ]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.07711
Mean Error Translation: 97.58649
== [Result] Frame: 1, Matches 282, Inliers: 74.82
Saved at vis_preFeature/frame001.jpg
[[ 1.      -0.0038 -0.009   0.0047]
 [ 0.0037   1.      -0.0035 -0.0058]
 [ 0.009    0.0035   1.      0.9229]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.04056
Mean Error Translation: 48.99429
== [Result] Frame: 2, Matches 281, Inliers: 77.22
Saved at vis_preFeature/frame002.jpg
[[ 0.9999 -0.0042 -0.013  -0.004 ]
 [ 0.0041   1.      -0.005  -0.0084]
 [ 0.013    0.0049   0.9999  1.3977]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.02805
Mean Error Translation: 32.79175
== [Result] Frame: 3, Matches 292, Inliers: 76.71
Saved at vis_preFeature/frame003.jpg
[[ 0.9998 -0.0021 -0.0177 -0.0197]
 [ 0.002    1.      -0.0057 -0.0132]
 [ 0.0177   0.0056   0.9998  1.8773]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.02213
Mean Error Translation: 24.68885
== [Result] Frame: 4, Matches 304, Inliers: 77.63
Saved at vis_preFeature/frame004.jpg
[[ 0.9997 -0.0038 -0.0225 -0.0304]
 [ 0.0037   1.      -0.0057 -0.0204]
 [ 0.0225   0.0056   0.9997  2.3848]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.01875
Mean Error Translation: 19.82181
== [Result] Frame: 5, Matches 301, Inliers: 75.75
Saved at vis_preFeature/frame005.jpg
[[ 0.9997 -0.0021 -0.0262 -0.0525]
 [ 0.0019   1.      -0.0071 -0.0241]
 [ 0.0263   0.0071   0.9996  2.8914]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.01613
Mean Error Translation: 16.57697

```

```

== [Result] Frame: 6, Matches 294, Inliers: 76.53
Saved at vis_preFeature/frame006.jpg
[[ 0.9995  0.0014 -0.0305 -0.0784]
 [-0.0017  1.       -0.0081 -0.0273]
 [ 0.0305  0.0082  0.9995  3.4069]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01458
Mean Error Translation: 14.25809
== [Result] Frame: 7, Matches 301, Inliers: 74.75
Saved at vis_preFeature/frame007.jpg
[[ 0.9994  0.0024 -0.0346 -0.1021]
 [-0.0027  1.       -0.0064 -0.0333]
 [ 0.0346  0.0065  0.9994  3.9223]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01338
Mean Error Translation: 12.51881
== [Result] Frame: 8, Matches 309, Inliers: 73.14
Saved at vis_preFeature/frame008.jpg
[[ 0.9992  0.0019 -0.0393 -0.1243]
 [-0.002   1.       -0.0037 -0.0394]
 [ 0.0393  0.0038  0.9992  4.4716]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01266
Mean Error Translation: 11.16239
== [Result] Frame: 9, Matches 322, Inliers: 78.26
Saved at vis_preFeature/frame009.jpg
[[ 0.9991  0.0019 -0.042  -0.1567]
 [-0.0019  1.       -0.0012 -0.045 ]
 [ 0.042   0.0013  0.9991  5.038 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01193
Mean Error Translation: 10.07553
== [Result] Frame: 10, Matches 319, Inliers: 77.74
Saved at vis_preFeature/frame010.jpg
[[ 0.999   0.0038 -0.0442 -0.1911]
 [-0.0039  1.       -0.0017 -0.0529]
 [ 0.0442  0.0019  0.999   5.6204]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01104
Mean Error Translation: 9.18466
== [Result] Frame: 11, Matches 312, Inliers: 78.21
Saved at vis_preFeature/frame011.jpg
[[ 0.9989  0.0027 -0.0469 -0.217 ]
 [-0.0028  1.       -0.0017 -0.0599]
 [ 0.0469  0.0018  0.9989  6.1915]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01037
Mean Error Translation: 8.44337

```

```

== [Result] Frame: 12, Matches 313, Inliers: 79.55
Saved at vis_preFeature/frame012.jpg
[[ 0.9988  0.0001 -0.0482 -0.2474]
 [-0.0002  1.      -0.0025 -0.0629]
 [ 0.0482  0.0025  0.9988  6.7674]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.00991
Mean Error Translation: 7.81575
== [Result] Frame: 13, Matches 305, Inliers: 75.41
Saved at vis_preFeature/frame013.jpg
[[ 0.9988  0.0007 -0.0486 -0.2891]
 [-0.0008  1.      -0.0017 -0.0685]
 [ 0.0486  0.0017  0.9988  7.3469]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.00947
Mean Error Translation: 7.27743
== [Result] Frame: 14, Matches 289, Inliers: 77.85
Saved at vis_preFeature/frame014.jpg
[[ 0.9987 -0.0021 -0.0507 -0.3137]
 [ 0.002   1.      -0.0016 -0.078 ]
 [ 0.0507  0.0015  0.9987  7.9493]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.00897
Mean Error Translation: 6.80915
== [Result] Frame: 15, Matches 261, Inliers: 79.31
Saved at vis_preFeature/frame015.jpg
[[ 0.9987 -0.      -0.0519 -0.3527]
 [-0.0002  1.      -0.0039 -0.0848]
 [ 0.0519  0.0039  0.9986  8.5507]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.00850
Mean Error Translation: 6.39994
== [Result] Frame: 16, Matches 252, Inliers: 84.92
Saved at vis_preFeature/frame016.jpg
[[ 0.9986  0.0002 -0.0536 -0.3871]
 [-0.0005  1.      -0.0065 -0.0918]
 [ 0.0536  0.0066  0.9985  9.1701]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.00805
Mean Error Translation: 6.03823
== [Result] Frame: 17, Matches 252, Inliers: 83.33
Saved at vis_preFeature/frame017.jpg
[[ 0.9985  0.0036 -0.0555 -0.4257]
 [-0.0041  1.      -0.0083 -0.0988]
 [ 0.0554  0.0085  0.9984  9.7835]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.00762
Mean Error Translation: 5.71764

```

```

== [Result] Frame: 18, Matches 255, Inliers: 82.35
Saved at vis_preFeature/frame018.jpg
[[ 0.9984  0.004 -0.0562 -0.4681]
 [-0.0045  1.     -0.0083 -0.1061]
 [ 0.0562  0.0085  0.9984 10.4268]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00730
Mean Error Translation: 5.42975
== [Result] Frame: 19, Matches 276, Inliers: 81.16
Saved at vis_preFeature/frame019.jpg
[[ 0.9983  0.0027 -0.0577 -0.5051]
 [-0.0031  1.     -0.0067 -0.1176]
 [ 0.0577  0.0069  0.9983 11.0612]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00702
Mean Error Translation: 5.17159
== [Result] Frame: 20, Matches 275, Inliers: 78.55
Saved at vis_preFeature/frame020.jpg
[[ 0.9982  0.0025 -0.0594 -0.5457]
 [-0.0028  1.     -0.0053 -0.1259]
 [ 0.0594  0.0055  0.9982 11.7379]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00671
Mean Error Translation: 4.93622
== [Result] Frame: 21, Matches 292, Inliers: 74.32
Saved at vis_preFeature/frame021.jpg
[[ 0.9982  0.0036 -0.06   -0.592 ]
 [-0.0039  1.     -0.0055 -0.1345]
 [ 0.06   0.0057  0.9982 12.3772]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00652
Mean Error Translation: 4.72424
== [Result] Frame: 22, Matches 291, Inliers: 82.13
Saved at vis_preFeature/frame022.jpg
[[ 0.998   0.003 -0.0623 -0.6279]
 [-0.0034  1.     -0.0061 -0.1455]
 [ 0.0623  0.0063  0.998  13.0154]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00630
Mean Error Translation: 4.53084
== [Result] Frame: 23, Matches 294, Inliers: 71.77
Saved at vis_preFeature/frame023.jpg
[[ 0.9979  0.0008 -0.0641 -0.6639]
 [-0.0012  1.     -0.0067 -0.156 ]
 [ 0.0641  0.0068  0.9979 13.6624]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00610
Mean Error Translation: 4.35333

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== [Result] Frame: 24, Matches 281, Inliers: 71.17
Saved at vis_preFeature/frame024.jpg
[[ 0.9979  0.001 -0.0648 -0.7074]
 [-0.0014  1.     -0.0052 -0.1614]
 [ 0.0648  0.0053  0.9979 14.3057]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00588
Mean Error Translation: 4.19058
== [Result] Frame: 25, Matches 265, Inliers: 66.42
Saved at vis_preFeature/frame025.jpg
[[ 0.9979  0.0014 -0.0652 -0.7489]
 [-0.0016  1.     -0.0018 -0.1715]
 [ 0.0652  0.0019  0.9979 14.9533]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00574
Mean Error Translation: 4.04046
== [Result] Frame: 26, Matches 253, Inliers: 70.36
Saved at vis_preFeature/frame026.jpg
[[ 0.9979  0.0026 -0.0647 -0.7927]
 [-0.0024  1.     0.0018 -0.1767]
 [ 0.0648 -0.0016  0.9979 15.6059]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00555
Mean Error Translation: 3.90134
== [Result] Frame: 27, Matches 254, Inliers: 70.87
Saved at vis_preFeature/frame027.jpg
[[ 0.998   0.0018 -0.0629 -0.8401]
 [-0.0015  1.     0.0049 -0.1824]
 [ 0.0629 -0.0048  0.998  16.2932]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00538
Mean Error Translation: 3.77115
== [Result] Frame: 28, Matches 250, Inliers: 72.80
Saved at vis_preFeature/frame028.jpg
[[ 0.9981  0.0006 -0.0624 -0.875 ]
 [-0.0003  1.     0.0056 -0.188 ]
 [ 0.0624 -0.0055  0.998  16.9715]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00527
Mean Error Translation: 3.65035
== [Result] Frame: 29, Matches 251, Inliers: 70.92
Saved at vis_preFeature/frame029.jpg
[[ 0.9981  0.0005 -0.0612 -0.917 ]
 [-0.0003  1.     0.0026 -0.1936]
 [ 0.0612 -0.0026  0.9981 17.6609]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00512
Mean Error Translation: 3.53731

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== [Result] Frame: 30, Matches 247, Inliers: 75.30
Saved at vis_preFeature/frame030.jpg
[[ 0.9982  0.0021 -0.0598 -0.9649]
 [-0.0023  1.       -0.0024 -0.1988]
 [ 0.0598  0.0025  0.9982 18.3394]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00499
Mean Error Translation: 3.43204
== [Result] Frame: 31, Matches 236, Inliers: 70.76
Saved at vis_preFeature/frame031.jpg
[[ 0.9983  0.0008 -0.0585 -1.005 ]
 [-0.0011  1.       -0.0053 -0.2055]
 [ 0.0585  0.0053  0.9983 18.9958]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00488
Mean Error Translation: 3.33426
== [Result] Frame: 32, Matches 233, Inliers: 72.96
Saved at vis_preFeature/frame032.jpg
[[ 0.9983 -0.0017 -0.0582 -1.0381]
 [ 0.0015  1.       -0.0041 -0.214 ]
 [ 0.0582  0.0041  0.9983 19.6247]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00475
Mean Error Translation: 3.24353
== [Result] Frame: 33, Matches 229, Inliers: 71.62
Saved at vis_preFeature/frame033.jpg
[[ 0.9983 -0.0038 -0.0589 -1.0747]
 [ 0.0038  1.       0.0009 -0.2218]
 [ 0.0589 -0.0011  0.9983 20.3011]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00463
Mean Error Translation: 3.15696
== [Result] Frame: 34, Matches 233, Inliers: 65.67
Saved at vis_preFeature/frame034.jpg
[[ 0.9982 -0.0063 -0.059  -1.1194]
 [ 0.0065  1.       0.0044 -0.2307]
 [ 0.059  -0.0047  0.9982 20.9677]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00455
Mean Error Translation: 3.07571
== [Result] Frame: 35, Matches 239, Inliers: 72.38
Saved at vis_preFeature/frame035.jpg
[[ 0.9981 -0.0138 -0.06   -1.1543]
 [ 0.0141  0.9999  0.0036 -0.2371]
 [ 0.06   -0.0045  0.9982 21.647 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00444
Mean Error Translation: 2.99863

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== [Result] Frame: 36, Matches 237, Inliers: 71.31
Saved at vis_preFeature/frame036.jpg
[[ 0.9979 -0.0168 -0.0619 -1.1879]
 [ 0.0169  0.9999 -0.0002 -0.2412]
 [ 0.0619 -0.0008  0.9981 22.2916]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00433
Mean Error Translation: 2.92665
== [Result] Frame: 37, Matches 244, Inliers: 76.64
Saved at vis_preFeature/frame037.jpg
[[ 0.9979 -0.0165 -0.0627 -1.2369]
 [ 0.0162  0.9999 -0.0045 -0.246 ]
 [ 0.0628  0.0034  0.998  22.9448]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00425
Mean Error Translation: 2.85836
== [Result] Frame: 38, Matches 250, Inliers: 71.20
Saved at vis_preFeature/frame038.jpg
[[ 0.9977 -0.0164 -0.0657 -1.2732]
 [ 0.0161  0.9999 -0.0049 -0.2547]
 [ 0.0658  0.0039  0.9978 23.5601]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00419
Mean Error Translation: 2.79526
== [Result] Frame: 39, Matches 254, Inliers: 74.80
Saved at vis_preFeature/frame039.jpg
[[ 0.9976 -0.0173 -0.0672 -1.3135]
 [ 0.0171  0.9998 -0.004  -0.2607]
 [ 0.0673  0.0028  0.9977 24.2062]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00414
Mean Error Translation: 2.73576
== [Result] Frame: 40, Matches 260, Inliers: 76.92
Saved at vis_preFeature/frame040.jpg
[[ 0.9975 -0.016  -0.0694 -1.3518]
 [ 0.0159  0.9999 -0.0011 -0.2718]
 [ 0.0694  0.       0.9976 24.8444]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00412
Mean Error Translation: 2.67894
== [Result] Frame: 41, Matches 258, Inliers: 77.13
Saved at vis_preFeature/frame041.jpg
[[ 0.9973 -0.0162 -0.0711 -1.4003]
 [ 0.0163  0.9999 -0.0002 -0.2762]
 [ 0.0711 -0.0009  0.9975 25.4999]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00405
Mean Error Translation: 2.62447

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== [Result] Frame: 42, Matches 256, Inliers: 79.69
Saved at vis_preFeature/frame042.jpg
[[ 0.9973 -0.0149 -0.0719 -1.451 ]
 [ 0.0151  0.9999  0.0024 -0.2833]
 [ 0.0719 -0.0035  0.9974 26.1616]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00397
Mean Error Translation: 2.57210
== [Result] Frame: 43, Matches 235, Inliers: 76.17
Saved at vis_preFeature/frame043.jpg
[[ 0.9973 -0.0151 -0.0719 -1.4989]
 [ 0.0156  0.9999  0.0053 -0.2892]
 [ 0.0718 -0.0064  0.9974 26.8135]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00391
Mean Error Translation: 2.52240
== [Result] Frame: 44, Matches 226, Inliers: 77.43
Saved at vis_preFeature/frame044.jpg
[[ 0.9974 -0.0088 -0.072  -1.5597]
 [ 0.0094  0.9999  0.0074 -0.2909]
 [ 0.072   -0.0081  0.9974 27.4907]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00384
Mean Error Translation: 2.47406
== [Result] Frame: 45, Matches 220, Inliers: 78.18
Saved at vis_preFeature/frame045.jpg
[[ 0.9974 -0.0073 -0.0717 -1.6147]
 [ 0.0078  0.9999  0.0068 -0.2991]
 [ 0.0716 -0.0073  0.9974 28.1598]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00381
Mean Error Translation: 2.42797
== [Result] Frame: 46, Matches 220, Inliers: 79.09
Saved at vis_preFeature/frame046.jpg
[[ 0.9974 -0.0065 -0.0715 -1.662 ]
 [ 0.0068  1.       0.005  -0.3073]
 [ 0.0715 -0.0055  0.9974 28.8264]
 [ 0.       0.       0.       1.      ]]

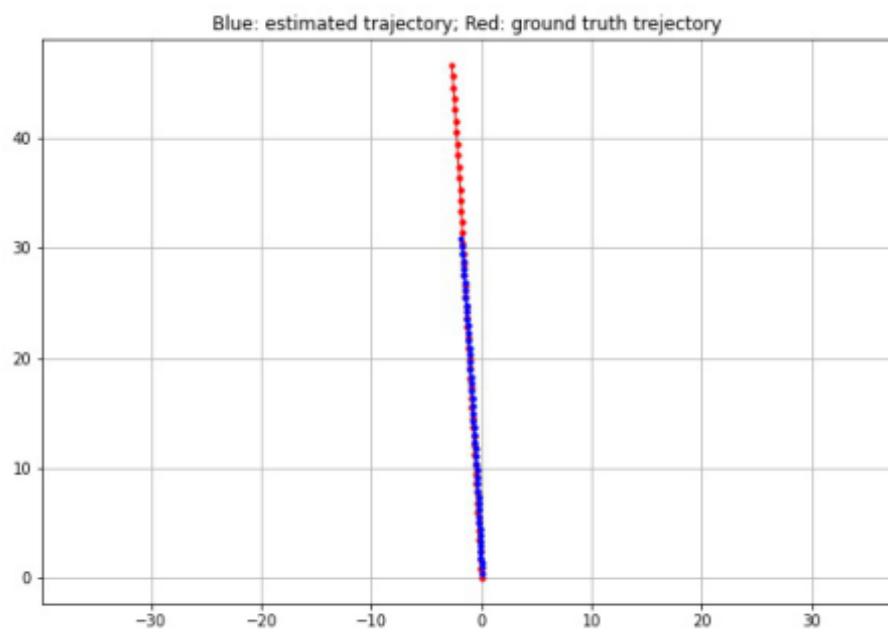
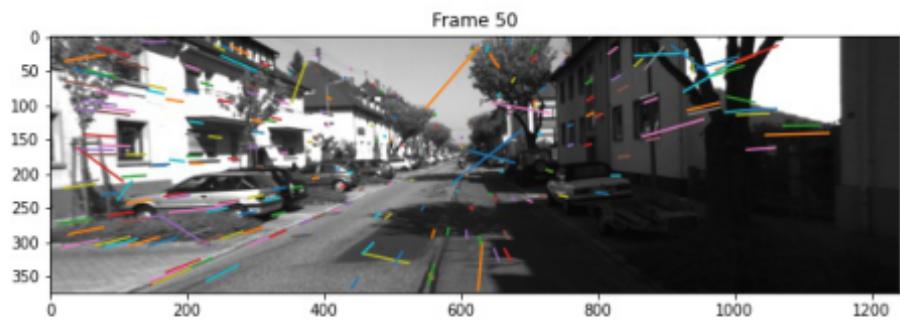
Mean Error Rotation: 0.00376
Mean Error Translation: 2.38364
== [Result] Frame: 47, Matches 224, Inliers: 81.25
Saved at vis_preFeature/frame047.jpg
[[ 0.9975 -0.0029 -0.0709 -1.7178]
 [ 0.0031  1.       0.0031 -0.3171]
 [ 0.0709 -0.0034  0.9975 29.4891]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00373
Mean Error Translation: 2.34114

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== [Result] Frame: 48, Matches 235, Inliers: 77.02
Saved at vis_preFeature/frame048.jpg
[[ 0.9974 -0.0034 -0.072 -1.767 ]
 [ 0.0037 1. 0.0031 -0.3247]
 [ 0.072 -0.0033 0.9974 30.18 ]
 [ 0. 0. 0. 1. ]]
Mean Error Rotation: 0.00366
Mean Error Translation: 2.29972
== [Result] Frame: 49, Matches 233, Inliers: 79.83
Saved at vis_preFeature/frame049.jpg
[[ 0.9973 -0.0062 -0.0735 -1.8157]
 [ 0.0065 1. 0.0041 -0.3293]
 [ 0.0735 -0.0046 0.9973 30.8735]
 [ 0. 0. 0. 1. ]]
Mean Error Rotation: 0.00362
Mean Error Translation: 2.25987
== [Result] Frame: 50, Matches 233, Inliers: 81.55
Saved at vis_preFeature/frame050.jpg

<Figure size 432x288 with 0 Axes>
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[[ 0.9973 -0.0035 -0.0733 -1.8813]
 [ 0.0039  1.       0.005  -0.3347]
 [ 0.0733 -0.0053  0.9973 31.5759]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00362
Mean Error Translation: 2.22132
== [Result] Frame: 51, Matches 247, Inliers: 76.52
Saved at vis_preFeature/frame051.jpg
[[ 0.9972 -0.0024 -0.0746 -1.9274]
 [ 0.0025  1.       0.0013 -0.3451]
 [ 0.0746 -0.0015  0.9972 32.2956]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00361
Mean Error Translation: 2.18377
== [Result] Frame: 52, Matches 242, Inliers: 75.62
Saved at vis_preFeature/frame052.jpg
[[ 0.9971 -0.0019 -0.0755 -1.9887]
 [ 0.0017  1.       -0.0027 -0.3534]
 [ 0.0755  0.0026  0.9971 33.0334]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00358
Mean Error Translation: 2.14711
== [Result] Frame: 53, Matches 257, Inliers: 78.60
Saved at vis_preFeature/frame053.jpg
[[ 0.9971 -0.0021 -0.0766 -2.0474]
 [ 0.0018  1.       -0.0044 -0.359 ]
 [ 0.0766  0.0043  0.9971 33.7851]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00355
Mean Error Translation: 2.11164
== [Result] Frame: 54, Matches 241, Inliers: 80.08
Saved at vis_preFeature/frame054.jpg
[[ 0.997 -0.0048 -0.0771 -2.1001]
 [ 0.0047  1.       -0.0011 -0.3679]
 [ 0.0771  0.0007  0.997  34.4927]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00355
Mean Error Translation: 2.07825
== [Result] Frame: 55, Matches 247, Inliers: 75.30
Saved at vis_preFeature/frame055.jpg
[[ 0.997 -0.0063 -0.0767 -2.166 ]
 [ 0.0064  1.       0.0018 -0.3779]
 [ 0.0767 -0.0023  0.9971 35.2638]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00352
Mean Error Translation: 2.04483

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== [Result] Frame: 56, Matches 256, Inliers: 78.12
Saved at vis_preFeature/frame056.jpg
[[ 0.997 -0.008 -0.0772 -2.2162]
 [ 0.0082 1. 0.002 -0.3843]
 [ 0.0772 -0.0027 0.997 35.9503]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00348
Mean Error Translation: 2.01395
== [Result] Frame: 57, Matches 271, Inliers: 79.34
Saved at vis_preFeature/frame057.jpg
[[ 0.997 -0.0099 -0.0764 -2.2736]
 [ 0.01 1. 0.0007 -0.3933]
 [ 0.0764 -0.0015 0.9971 36.6021]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00346
Mean Error Translation: 1.98461
== [Result] Frame: 58, Matches 271, Inliers: 79.70
Saved at vis_preFeature/frame058.jpg
[[ 0.9969 -0.0139 -0.077 -2.3216]
 [ 0.0138 0.9999 -0.0007 -0.4021]
 [ 0.077 -0.0004 0.997 37.2784]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00342
Mean Error Translation: 1.95585
== [Result] Frame: 59, Matches 267, Inliers: 76.03
Saved at vis_preFeature/frame059.jpg
[[ 0.9969 -0.0145 -0.0778 -2.3782]
 [ 0.0145 0.9999 0.0003 -0.4112]
 [ 0.0777 -0.0014 0.997 37.9567]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00338
Mean Error Translation: 1.92794
== [Result] Frame: 60, Matches 259, Inliers: 78.38
Saved at vis_preFeature/frame060.jpg
[[ 0.9967 -0.017 -0.0787 -2.4333]
 [ 0.0174 0.9998 0.0042 -0.4157]
 [ 0.0787 -0.0055 0.9969 38.6417]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00334
Mean Error Translation: 1.90089
== [Result] Frame: 61, Matches 257, Inliers: 82.10
Saved at vis_preFeature/frame061.jpg
[[ 0.9967 -0.0186 -0.0793 -2.4884]
 [ 0.0193 0.9998 0.0092 -0.4204]
 [ 0.0792 -0.0107 0.9968 39.338 ]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00330
Mean Error Translation: 1.87452

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== [Result] Frame: 62, Matches 263, Inliers: 79.47
Saved at vis_preFeature/frame062.jpg
[[ 0.9967 -0.0172 -0.0797 -2.5504]
 [ 0.0181  0.9998  0.0111 -0.4211]
 [ 0.0795 -0.0125  0.9968 40.0493]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00325
Mean Error Translation: 1.84859
== [Result] Frame: 63, Matches 258, Inliers: 76.74
Saved at vis_preFeature/frame063.jpg
[[ 0.9966 -0.0169 -0.0812 -2.6113]
 [ 0.0176  0.9998  0.0071 -0.426 ]
 [ 0.0811 -0.0085  0.9967 40.7668]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 1.82321
== [Result] Frame: 64, Matches 242, Inliers: 75.62
Saved at vis_preFeature/frame064.jpg
[[ 0.9965 -0.0153 -0.0822 -2.6738]
 [ 0.0153  0.9999 -0.0008 -0.4323]
 [ 0.0822 -0.0004  0.9966 41.4575]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00321
Mean Error Translation: 1.79877
== [Result] Frame: 65, Matches 237, Inliers: 78.48
Saved at vis_preFeature/frame065.jpg
[[ 0.9964 -0.0141 -0.0831 -2.7333]
 [ 0.0136  0.9999 -0.0057 -0.44  ]
 [ 0.0832  0.0045  0.9965 42.1188]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00318
Mean Error Translation: 1.77537
== [Result] Frame: 66, Matches 234, Inliers: 70.94
Saved at vis_preFeature/frame066.jpg
[[ 0.9964 -0.0097 -0.0845 -2.7914]
 [ 0.0094  0.9999 -0.0049 -0.4519]
 [ 0.0845  0.0041  0.9964 42.7805]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00316
Mean Error Translation: 1.75260
== [Result] Frame: 67, Matches 233, Inliers: 71.24
Saved at vis_preFeature/frame067.jpg
[[ 0.9962 -0.0082 -0.0862 -2.8476]
 [ 0.008   1.       -0.0026 -0.4665]
 [ 0.0862  0.0019  0.9963 43.4514]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00315
Mean Error Translation: 1.73019

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== [Result] Frame: 68, Matches 242, Inliers: 73.55
Saved at vis_preFeature/frame068.jpg
[[ 0.9962 -0.0046 -0.0873 -2.9095]
 [ 0.0045  1.       -0.0011 -0.481 ]
 [ 0.0873  0.0007  0.9962 44.0903]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00313
Mean Error Translation: 1.70866
== [Result] Frame: 69, Matches 251, Inliers: 75.30
Saved at vis_preFeature/frame069.jpg
[[ 0.996  -0.0053 -0.0892 -2.9655]
 [ 0.0052  1.       -0.0015 -0.4901]
 [ 0.0892  0.001   0.996  44.7544]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00311
Mean Error Translation: 1.68719
== [Result] Frame: 70, Matches 247, Inliers: 73.68
Saved at vis_preFeature/frame070.jpg
[[ 0.9959 -0.0035 -0.0908 -3.0277]
 [ 0.0035  1.       -0.0007 -0.502 ]
 [ 0.0908  0.0004  0.9959 45.3991]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00307
Mean Error Translation: 1.66640
== [Result] Frame: 71, Matches 249, Inliers: 78.71
Saved at vis_preFeature/frame071.jpg
[[ 0.9956 -0.0046 -0.0932 -3.0814]
 [ 0.0046  1.       -0.0003 -0.5113]
 [ 0.0932 -0.0001  0.9956 46.0369]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00308
Mean Error Translation: 1.64612
== [Result] Frame: 72, Matches 251, Inliers: 77.69
Saved at vis_preFeature/frame072.jpg
[[ 0.9955 -0.0046 -0.095  -3.1384]
 [ 0.0047  1.       0.0002 -0.5271]
 [ 0.095  -0.0007  0.9955 46.6521]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00305
Mean Error Translation: 1.62651
== [Result] Frame: 73, Matches 250, Inliers: 72.40
Saved at vis_preFeature/frame073.jpg
[[ 0.9954 -0.0034 -0.096  -3.2022]
 [ 0.0036  1.       0.0015 -0.5422]
 [ 0.096  -0.0019  0.9954 47.2678]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00304
Mean Error Translation: 1.60725

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== [Result] Frame: 74, Matches 248, Inliers: 80.65
Saved at vis_preFeature/frame074.jpg
[[ 0.9953  0.0004 -0.0973 -3.2697]
 [ 0.       1.       0.0039 -0.549 ]
 [ 0.0973 -0.0039  0.9952 47.8835]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00302
Mean Error Translation: 1.58834
== [Result] Frame: 75, Matches 254, Inliers: 79.92
Saved at vis_preFeature/frame075.jpg
[[ 0.9951  0.0014 -0.0985 -3.3382]
 [-0.0007  1.       0.0077 -0.5536]
 [ 0.0985 -0.0076  0.9951 48.5209]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00301
Mean Error Translation: 1.56951
== [Result] Frame: 76, Matches 260, Inliers: 79.62
Saved at vis_preFeature/frame076.jpg
[[ 0.995   0.0058 -0.0997 -3.4122]
 [-0.0049  0.9999  0.0093 -0.559 ]
 [ 0.0998 -0.0088  0.995   49.1303]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00300
Mean Error Translation: 1.55132
== [Result] Frame: 77, Matches 272, Inliers: 79.04
Saved at vis_preFeature/frame077.jpg
[[ 0.9949  0.0083 -0.1008 -3.485 ]
 [-0.0078  1.       0.0052 -0.5687]
 [ 0.1009 -0.0044  0.9949 49.7525]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00298
Mean Error Translation: 1.53312
== [Result] Frame: 78, Matches 261, Inliers: 86.97
Saved at vis_preFeature/frame078.jpg
[[ 0.9947  0.0082 -0.1021 -3.5497]
 [-0.0085  1.       -0.0022 -0.5776]
 [ 0.1021  0.003   0.9948 50.3369]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00295
Mean Error Translation: 1.51558
== [Result] Frame: 79, Matches 273, Inliers: 83.15
Saved at vis_preFeature/frame079.jpg
[[ 0.9945  0.0055 -0.1045 -3.598 ]
 [-0.0064  0.9999 -0.0082 -0.5845]
 [ 0.1044  0.0088  0.9945 50.8893]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00295
Mean Error Translation: 1.49866

```

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== [Result] Frame: 80, Matches 287, Inliers: 84.32
Saved at vis_preFeature/frame080.jpg
[[ 0.9944  0.0062 -0.1051 -3.6562]
 [-0.0072  0.9999 -0.0095 -0.5914]
 [ 0.105   0.0102  0.9944 51.3988]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00293
Mean Error Translation: 1.48246
== [Result] Frame: 81, Matches 293, Inliers: 84.30
Saved at vis_preFeature/frame081.jpg
[[ 0.9943  0.0084 -0.1064 -3.7075]
 [-0.0091  0.9999 -0.0058 -0.6051]
 [ 0.1063  0.0067  0.9943 51.8894]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00290
Mean Error Translation: 1.46666
== [Result] Frame: 82, Matches 302, Inliers: 84.77
Saved at vis_preFeature/frame082.jpg
[[ 0.9941  0.0077 -0.1082 -3.7546]
 [-0.0081  1.       -0.0034 -0.6197]
 [ 0.1082  0.0043  0.9941 52.3391]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00291
Mean Error Translation: 1.45149
== [Result] Frame: 83, Matches 296, Inliers: 88.51
Saved at vis_preFeature/frame083.jpg
[[ 0.9941  0.0053 -0.1084 -3.8122]
 [-0.0061  1.       -0.0071 -0.6277]
 [ 0.1083  0.0077  0.9941 52.7852]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00290
Mean Error Translation: 1.43643
== [Result] Frame: 84, Matches 303, Inliers: 85.48
Saved at vis_preFeature/frame084.jpg
[[ 0.9941 -0.003  -0.1082 -3.851 ]
 [ 0.0016  0.9999 -0.0124 -0.638 ]
 [ 0.1083  0.0121  0.994   53.2011]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00287
Mean Error Translation: 1.42185
== [Result] Frame: 85, Matches 306, Inliers: 89.54
Saved at vis_preFeature/frame085.jpg
[[ 0.9941 -0.008  -0.1082 -3.8788]
 [ 0.0062  0.9998 -0.017  -0.651 ]
 [ 0.1083  0.0163  0.994   53.5879]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00286
Mean Error Translation: 1.40774

```

```

== [Result] Frame: 86, Matches 295, Inliers: 89.15
Saved at vis_preFeature/frame086.jpg
[[ 0.9945 -0.0049 -0.1046 -3.9259]
 [ 0.0031  0.9998 -0.0176 -0.6572]
 [ 0.1046  0.0172  0.9944 53.9714]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00286
Mean Error Translation: 1.39385
== [Result] Frame: 87, Matches 290, Inliers: 89.66
Saved at vis_preFeature/frame087.jpg
[[ 0.9949 -0.0011 -0.1011 -3.9665]
 [-0.0004  0.9999 -0.0147 -0.6667]
 [ 0.1011  0.0147  0.9948 54.3498]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00286
Mean Error Translation: 1.38020
== [Result] Frame: 88, Matches 295, Inliers: 88.81
Saved at vis_preFeature/frame088.jpg
[[ 0.9953 -0.0041 -0.0972 -3.9938]
 [ 0.003   0.9999 -0.0119 -0.673 ]
 [ 0.0972  0.0116  0.9952 54.7143]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00286
Mean Error Translation: 1.36685
== [Result] Frame: 89, Matches 284, Inliers: 87.68
Saved at vis_preFeature/frame089.jpg
[[ 0.9958 -0.0071 -0.0909 -4.0251]
 [ 0.0064  0.9999 -0.0079 -0.6806]
 [ 0.091   0.0073  0.9958 55.0806]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00285
Mean Error Translation: 1.35363
== [Result] Frame: 90, Matches 285, Inliers: 89.12
Saved at vis_preFeature/frame090.jpg
[[ 0.9963 -0.0137 -0.0844 -4.035 ]
 [ 0.0133  0.9999 -0.0047 -0.6897]
 [ 0.0844  0.0036  0.9964 55.4393]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00286
Mean Error Translation: 1.34067
== [Result] Frame: 91, Matches 292, Inliers: 91.78
Saved at vis_preFeature/frame091.jpg
[[ 0.9972 -0.01   -0.0735 -4.0625]
 [ 0.0097  0.9999 -0.0047 -0.6989]
 [ 0.0735  0.0039  0.9973 55.8054]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00285
Mean Error Translation: 1.32768

```

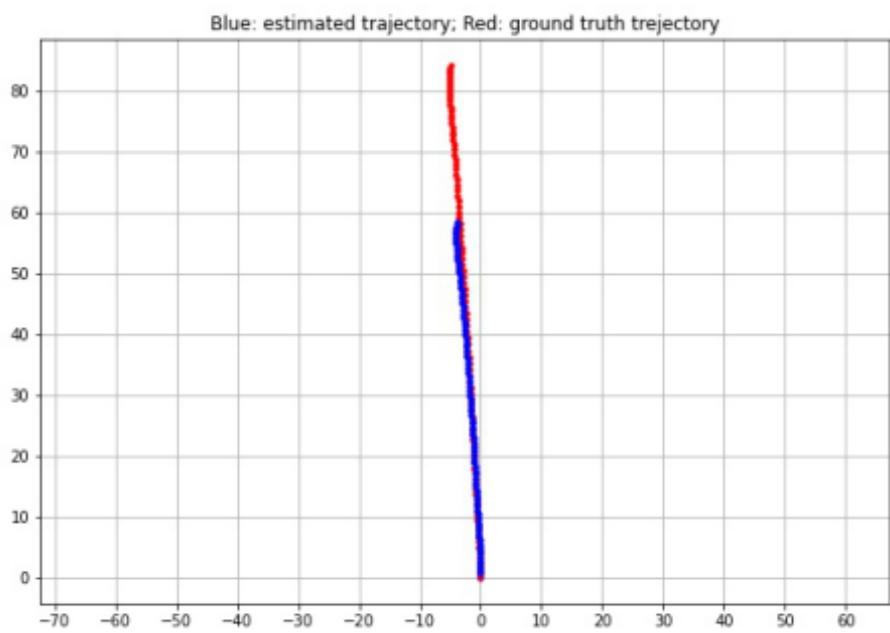
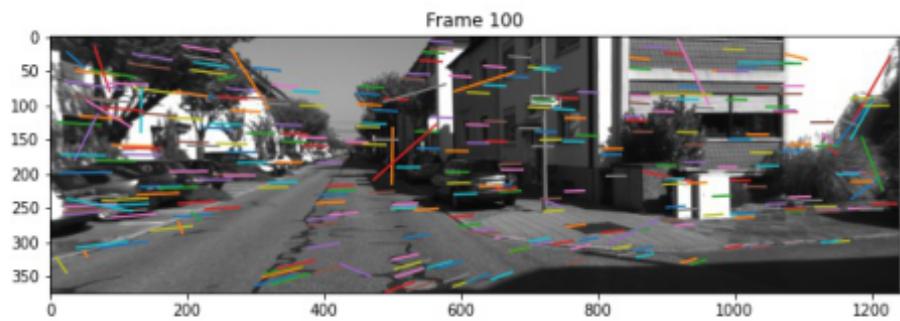
```

== [Result] Frame: 92, Matches 294, Inliers: 88.78
Saved at vis_preFeature/frame092.jpg
[[ 0.9983 -0.0054 -0.0588 -4.0844]
 [ 0.0051  1.       -0.0058 -0.6987]
 [ 0.0588  0.0055  0.9983 56.1723]
 [ 0.       0.       0.       1.       ]]
Mean Error Rotation: 0.00284
Mean Error Translation: 1.31487
== [Result] Frame: 93, Matches 283, Inliers: 86.57
Saved at vis_preFeature/frame093.jpg
[[ 0.9991 -0.0019 -0.0419 -4.0861]
 [ 0.0017  1.       -0.0048 -0.7078]
 [ 0.0419  0.0047  0.9991 56.5208]
 [ 0.       0.       0.       1.       ]]
Mean Error Rotation: 0.00284
Mean Error Translation: 1.30237
== [Result] Frame: 94, Matches 290, Inliers: 89.66
Saved at vis_preFeature/frame094.jpg
[[ 0.9998 -0.0053 -0.0207 -4.0769]
 [ 0.0052  1.       -0.0047 -0.7059]
 [ 0.0207  0.0046  0.9998 56.8642]
 [ 0.       0.       0.       1.       ]]
Mean Error Rotation: 0.00284
Mean Error Translation: 1.29005
== [Result] Frame: 95, Matches 299, Inliers: 89.30
Saved at vis_preFeature/frame095.jpg
[[ 0.9999 -0.0084  0.0058 -4.0623]
 [ 0.0084  1.       -0.0029 -0.7167]
 [-0.0058  0.0029  1.       57.203 ]
 [ 0.       0.       0.       1.       ]]
Mean Error Rotation: 0.00283
Mean Error Translation: 1.27788
== [Result] Frame: 96, Matches 311, Inliers: 88.75
Saved at vis_preFeature/frame096.jpg
[[ 0.9993 -0.0097  0.0354 -4.0373]
 [ 0.0097  1.       -0.0014 -0.7171]
 [-0.0354  0.0017  0.9994 57.55  ]
 [ 0.       0.       0.       1.       ]]
Mean Error Rotation: 0.00281
Mean Error Translation: 1.26582
== [Result] Frame: 97, Matches 314, Inliers: 85.99
Saved at vis_preFeature/frame097.jpg
[[ 0.9977 -0.0118  0.0671 -3.9901]
 [ 0.0118  0.9999  0.       -0.718 ]
 [-0.0671  0.0008  0.9977 57.8865]
 [ 0.       0.       0.       1.       ]]
Mean Error Rotation: 0.00281
Mean Error Translation: 1.25404

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```
== [Result] Frame: 98, Matches 304, Inliers: 87.83
Saved at vis_preFeature/frame098.jpg
[[ 0.9945 -0.0121  0.1044 -3.9352]
 [ 0.012   0.9999  0.0013 -0.7232]
 [-0.1044 -0.       0.9945 58.2218]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00280
Mean Error Translation: 1.24237
== [Result] Frame: 99, Matches 315, Inliers: 86.98
Saved at vis_preFeature/frame099.jpg
[[ 0.9894 -0.0138  0.1448 -3.8555]
 [ 0.0136  0.9999  0.0019 -0.7273]
 [-0.1448  0.0001  0.9895 58.5485]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00280
Mean Error Translation: 1.23098
== [Result] Frame: 100, Matches 311, Inliers: 85.21
Saved at vis_preFeature/frame100.jpg

<Figure size 432x288 with 0 Axes>
```



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[[ 0.9818 -0.0148  0.1893 -3.7669]
 [ 0.0145  0.9999  0.0027 -0.7293]
 [-0.1893  0.0001  0.9819  58.8696]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00278
Mean Error Translation: 1.21977
== [Result] Frame: 101, Matches 304, Inliers: 84.87
Saved at vis_preFeature/frame101.jpg
[[ 0.9712 -0.0135  0.2379 -3.664 ]
 [ 0.0135  0.9999  0.0017 -0.7348]
 [-0.2379  0.0016  0.9713  59.1756]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00277
Mean Error Translation: 1.20871
== [Result] Frame: 102, Matches 296, Inliers: 86.15
Saved at vis_preFeature/frame102.jpg
[[ 0.9566 -0.0132  0.2911 -3.5475]
 [ 0.0136  0.9999  0.0003 -0.7424]
 [-0.2911  0.0036  0.9567  59.4697]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00276
Mean Error Translation: 1.19795
== [Result] Frame: 103, Matches 303, Inliers: 86.47
Saved at vis_preFeature/frame103.jpg
[[ 0.9381 -0.0145  0.3461 -3.4069]
 [ 0.0157  0.9999 -0.0007 -0.7434]
 [-0.3461  0.0061  0.9382  59.7459]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00275
Mean Error Translation: 1.18728
== [Result] Frame: 104, Matches 297, Inliers: 84.18
Saved at vis_preFeature/frame104.jpg
[[ 0.9159 -0.0158  0.4011 -3.2424]
 [ 0.0181  0.9998 -0.002  -0.739 ]
 [-0.401   0.0091  0.916   59.9987]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00277
Mean Error Translation: 1.17696
== [Result] Frame: 105, Matches 291, Inliers: 88.66
Saved at vis_preFeature/frame105.jpg
[[ 0.8885 -0.017   0.4586 -3.071 ]
 [ 0.0204  0.9998 -0.0024 -0.7391]
 [-0.4585  0.0115  0.8886  60.2468]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00276
Mean Error Translation: 1.16676

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== [Result] Frame: 106, Matches 288, Inliers: 86.46
Saved at vis_preFeature/frame106.jpg
[[ 0.856 -0.0181 0.5167 -2.8959]
 [ 0.0225 0.9997 -0.0023 -0.7439]
 [-0.5165 0.0136 0.8562 60.481 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00277
Mean Error Translation: 1.15669
== [Result] Frame: 107, Matches 290, Inliers: 80.00
Saved at vis_preFeature/frame107.jpg
[[ 0.8225 -0.0212 0.5684 -2.6787]
 [ 0.0278 0.9996 -0.0029 -0.7427]
 [-0.5682 0.0182 0.8227 60.6811]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00281
Mean Error Translation: 1.14688
== [Result] Frame: 108, Matches 286, Inliers: 76.22
Saved at vis_preFeature/frame108.jpg
[[ 0.7841 -0.0231 0.6202 -2.4656]
 [ 0.0294 0.9996 0.0002 -0.7449]
 [-0.6199 0.0181 0.7845 60.8908]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00279
Mean Error Translation: 1.13706
== [Result] Frame: 109, Matches 302, Inliers: 74.50
Saved at vis_preFeature/frame109.jpg
[[ 0.7416 -0.0223 0.6705 -2.2478]
 [ 0.0257 0.9997 0.0048 -0.7482]
 [-0.6704 0.0137 0.7419 61.1064]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00281
Mean Error Translation: 1.12752
== [Result] Frame: 110, Matches 288, Inliers: 79.51
Saved at vis_preFeature/frame110.jpg
[[ 0.697 -0.0232 0.7167 -2.0126]
 [ 0.025 0.9997 0.008 -0.7545]
 [-0.7166 0.0123 0.6973 61.2972]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00282
Mean Error Translation: 1.11810
== [Result] Frame: 111, Matches 288, Inliers: 80.21
Saved at vis_preFeature/frame111.jpg
[[ 0.6539 -0.0261 0.7562 -1.7612]
 [ 0.0306 0.9995 0.0081 -0.7552]
 [-0.756 0.0178 0.6543 61.429 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00284
Mean Error Translation: 1.10895

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== [Result] Frame: 112, Matches 284, Inliers: 80.63
Saved at vis_preFeature/frame112.jpg
[[ 0.6082 -0.029  0.7933 -1.5059]
 [ 0.0358  0.9993  0.0092 -0.7553]
 [-0.793   0.0228  0.6088  61.5731]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00283
Mean Error Translation: 1.09992
== [Result] Frame: 113, Matches 294, Inliers: 86.39
Saved at vis_preFeature/frame113.jpg
[[ 0.5633 -0.0276  0.8258 -1.244 ]
 [ 0.0341  0.9994  0.0101 -0.7569]
 [-0.8256  0.0225  0.5639  61.7057]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00281
Mean Error Translation: 1.09096
== [Result] Frame: 114, Matches 299, Inliers: 81.27
Saved at vis_preFeature/frame114.jpg
[[ 0.5161 -0.0235  0.8562 -0.9735]
 [ 0.0277  0.9996  0.0107 -0.7552]
 [-0.8561  0.0182  0.5165  61.85  ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00281
Mean Error Translation: 1.08215
== [Result] Frame: 115, Matches 302, Inliers: 80.46
Saved at vis_preFeature/frame115.jpg
[[ 0.4724 -0.0218  0.8811 -0.6787]
 [ 0.0274  0.9996  0.0101 -0.7536]
 [-0.881   0.0194  0.4728  61.963 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00281
Mean Error Translation: 1.07339
== [Result] Frame: 116, Matches 303, Inliers: 81.52
Saved at vis_preFeature/frame116.jpg
[[ 0.4306 -0.0242  0.9022 -0.38  ]
 [ 0.0337  0.9994  0.0107 -0.7473]
 [-0.9019  0.0258  0.4311  62.0672]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00279
Mean Error Translation: 1.06476
== [Result] Frame: 117, Matches 293, Inliers: 85.32
Saved at vis_preFeature/frame117.jpg
[[ 0.3917 -0.0324  0.9195 -0.0777]
 [ 0.0475  0.9988  0.0149 -0.7453]
 [-0.9189  0.0379  0.3928  62.1452]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00278
Mean Error Translation: 1.05639

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== [Result] Frame: 118, Matches 290, Inliers: 87.59
Saved at vis_preFeature/frame118.jpg
[[ 0.3563 -0.0361  0.9337  0.2227]
 [ 0.0492  0.9986  0.0199 -0.7445]
 [-0.9331  0.0389  0.3576 62.234 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00280
Mean Error Translation: 1.04814
== [Result] Frame: 119, Matches 288, Inliers: 79.17
Saved at vis_preFeature/frame119.jpg
[[ 0.3235 -0.0316  0.9457  0.7705]
 [ 0.0455  0.9988  0.0178 -0.7349]
 [-0.9451  0.0373  0.3246 62.3954]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00280
Mean Error Translation: 1.04097
== [Result] Frame: 120, Matches 279, Inliers: 80.65
Saved at vis_preFeature/frame120.jpg
[[ 0.2927 -0.0232  0.9559  1.8435]
 [ 0.0328  0.9994  0.0142 -0.7431]
 [-0.9556  0.0272  0.2933 62.7349]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00279
Mean Error Translation: 1.03846
== [Result] Frame: 121, Matches 291, Inliers: 72.85
Saved at vis_preFeature/frame121.jpg
[[ 0.2646 -0.0188  0.9642  2.4975]
 [ 0.027   0.9996  0.012   -0.7555]
 [-0.964   0.0229  0.265   62.9033]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00277
Mean Error Translation: 1.03227
== [Result] Frame: 122, Matches 304, Inliers: 76.97
Saved at vis_preFeature/frame122.jpg
[[ 0.2395 -0.0174  0.9707  3.0794]
 [ 0.0284  0.9995  0.0109 -0.7614]
 [-0.9705  0.025   0.2399 63.0112]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00276
Mean Error Translation: 1.02541
== [Result] Frame: 123, Matches 306, Inliers: 72.55
Saved at vis_preFeature/frame123.jpg
[[ 0.216   -0.0161  0.9763  3.9081]
 [ 0.035   0.9994  0.0087 -0.7532]
 [-0.9758  0.0323  0.2164 63.148 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00275
Mean Error Translation: 1.02061

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== [Result] Frame: 124, Matches 298, Inliers: 71.14
Saved at vis_preFeature/frame124.jpg
[[ 0.196 -0.0095  0.9806  5.5828]
 [ 0.0415  0.9991  0.0014 -0.6913]
 [-0.9797  0.0404  0.1962 63.3645]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00275
Mean Error Translation: 1.02257
== [Result] Frame: 125, Matches 296, Inliers: 70.27
Saved at vis_preFeature/frame125.jpg
[[ 0.1769 -0.0034  0.9842  8.1707]
 [ 0.0433  0.9991 -0.0044 -0.6376]
 [-0.9833  0.0434  0.1769 63.7089]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00275
Mean Error Translation: 1.03177
== [Result] Frame: 126, Matches 279, Inliers: 73.12
Saved at vis_preFeature/frame126.jpg
[[ 0.1607 -0.0029  0.987   9.4932]
 [ 0.041   0.9992 -0.0038 -0.6496]
 [-0.9862  0.0411  0.1607 63.8717]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00274
Mean Error Translation: 1.03060
== [Result] Frame: 127, Matches 286, Inliers: 72.38
Saved at vis_preFeature/frame127.jpg
[[ 0.1442 -0.0069  0.9895 11.6954]
 [ 0.0376  0.9993  0.0015 -0.6854]
 [-0.9888  0.037   0.1444 64.2179]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00274
Mean Error Translation: 1.03631
== [Result] Frame: 128, Matches 294, Inliers: 62.93
Saved at vis_preFeature/frame128.jpg
[[ 0.1295 -0.0102  0.9915 12.0068]
 [ 0.0375  0.9993  0.0054 -0.6888]
 [-0.9909  0.0364  0.1298 64.2565]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00272
Mean Error Translation: 1.02955
== [Result] Frame: 129, Matches 290, Inliers: 60.34
Saved at vis_preFeature/frame129.jpg
[[ 0.1166 -0.0124  0.9931 12.3381]
 [ 0.0395  0.9992  0.0079 -0.6871]
 [-0.9924  0.0384  0.117   64.2844]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00270
Mean Error Translation: 1.02283

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== [Result] Frame: 130, Matches 285, Inliers: 62.81
Saved at vis_preFeature/frame130.jpg
[[ 0.1044 -0.0128  0.9945 12.6865]
 [ 0.042   0.9991  0.0084 -0.6833]
 [-0.9936  0.0409  0.1048 64.3173]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00270
Mean Error Translation: 1.01618
== [Result] Frame: 131, Matches 282, Inliers: 64.54
Saved at vis_preFeature/frame131.jpg
[[ 0.0946 -0.0117  0.9954 13.0593]
 [ 0.0436  0.999   0.0076 -0.6816]
 [-0.9946  0.0427  0.095  64.3466]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00270
Mean Error Translation: 1.00957
== [Result] Frame: 132, Matches 296, Inliers: 66.55
Saved at vis_preFeature/frame132.jpg
[[ 0.0868 -0.011   0.9962 13.4413]
 [ 0.0455  0.9989  0.007  -0.6787]
 [-0.9952  0.0448  0.0872 64.3733]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00268
Mean Error Translation: 1.00310
== [Result] Frame: 133, Matches 299, Inliers: 68.90
Saved at vis_preFeature/frame133.jpg
[[ 0.0817 -0.0108  0.9966 13.8383]
 [ 0.0484  0.9988  0.0068 -0.6768]
 [-0.9955  0.0477  0.0822 64.3977]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00268
Mean Error Translation: 0.99674
== [Result] Frame: 134, Matches 299, Inliers: 71.24
Saved at vis_preFeature/frame134.jpg
[[ 0.0761 -0.0099  0.997  14.2495]
 [ 0.0493  0.9988  0.0061 -0.6761]
 [-0.9959  0.0487  0.0765 64.4263]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00267
Mean Error Translation: 0.99049
== [Result] Frame: 135, Matches 301, Inliers: 66.78
Saved at vis_preFeature/frame135.jpg
[[ 0.0703 -0.0092  0.9975 14.6776]
 [ 0.0482  0.9988  0.0058 -0.6767]
 [-0.9964  0.0477  0.0706 64.4564]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00266
Mean Error Translation: 0.98436

```

```

== [Result] Frame: 136, Matches 304, Inliers: 67.76
Saved at vis_preFeature/frame136.jpg
[[ 0.066 -0.0094 0.9978 15.1198]
 [ 0.0502 0.9987 0.0061 -0.677 ]
 [-0.9966 0.0497 0.0664 64.4826]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00265
Mean Error Translation: 0.97836
== [Result] Frame: 137, Matches 306, Inliers: 69.28
Saved at vis_preFeature/frame137.jpg
[[ 0.0626 -0.0092 0.998 15.5704]
 [ 0.0504 0.9987 0.0061 -0.6752]
 [-0.9968 0.0499 0.063 64.5125]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00264
Mean Error Translation: 0.97251
== [Result] Frame: 138, Matches 299, Inliers: 63.55
Saved at vis_preFeature/frame138.jpg
[[ 0.0594 -0.0099 0.9982 16.0369]
 [ 0.0507 0.9987 0.0068 -0.6752]
 [-0.9969 0.0502 0.0598 64.5423]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00263
Mean Error Translation: 0.96678
== [Result] Frame: 139, Matches 296, Inliers: 66.89
Saved at vis_preFeature/frame139.jpg
[[ 0.057 -0.0104 0.9983 16.528 ]
 [ 0.0527 0.9986 0.0074 -0.6738]
 [-0.997 0.0522 0.0575 64.5686]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00262
Mean Error Translation: 0.96106
== [Result] Frame: 140, Matches 305, Inliers: 61.97
Saved at vis_preFeature/frame140.jpg
[[ 0.0561 -0.0108 0.9984 17.0747]
 [ 0.0572 0.9983 0.0076 -0.6717]
 [-0.9968 0.0567 0.0567 64.5961]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00261
Mean Error Translation: 0.95517
== [Result] Frame: 141, Matches 304, Inliers: 63.49
Saved at vis_preFeature/frame141.jpg
[[ 0.0566 -0.0112 0.9983 17.5996]
 [ 0.0599 0.9982 0.0078 -0.6706]
 [-0.9966 0.0594 0.0572 64.6267]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00261
Mean Error Translation: 0.94961

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```

== [Result] Frame: 142, Matches 272, Inliers: 72.43
Saved at vis_preFeature/frame142.jpg
[[ 0.0589 -0.0115  0.9982 18.1259]
 [ 0.0613  0.9981  0.0078 -0.6702]
 [-0.9964  0.0608  0.0595 64.6605]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00260
Mean Error Translation: 0.94426
== [Result] Frame: 143, Matches 277, Inliers: 74.37
Saved at vis_preFeature/frame143.jpg
[[ 0.0633 -0.0119  0.9979 18.6712]
 [ 0.0648  0.9979  0.0077 -0.6712]
 [-0.9959  0.0642  0.0639 64.6887]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00259
Mean Error Translation: 0.93895
== [Result] Frame: 144, Matches 264, Inliers: 76.52
Saved at vis_preFeature/frame144.jpg
[[ 0.0683 -0.0124  0.9976 19.2334]
 [ 0.0669  0.9977  0.0078 -0.6692]
 [-0.9954  0.0662  0.069   64.7224]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00259
Mean Error Translation: 0.93371
== [Result] Frame: 145, Matches 263, Inliers: 74.52
Saved at vis_preFeature/frame145.jpg
[[ 0.072  -0.0144  0.9973 19.7757]
 [ 0.0684  0.9976  0.0095 -0.6701]
 [-0.9951  0.0675  0.0728 64.765 ]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00258
Mean Error Translation: 0.92881
== [Result] Frame: 146, Matches 263, Inliers: 82.51
Saved at vis_preFeature/frame146.jpg
[[ 0.0758 -0.0153  0.997  20.3326]
 [ 0.0677  0.9977  0.0101 -0.6627]
 [-0.9948  0.0668  0.0767 64.8132]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00257
Mean Error Translation: 0.92397
== [Result] Frame: 147, Matches 254, Inliers: 82.68
Saved at vis_preFeature/frame147.jpg
[[ 0.0794 -0.0173  0.9967 20.8591]
 [ 0.0636  0.9979  0.0122 -0.6616]
 [-0.9948  0.0624  0.0803 64.8658]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00257
Mean Error Translation: 0.91950

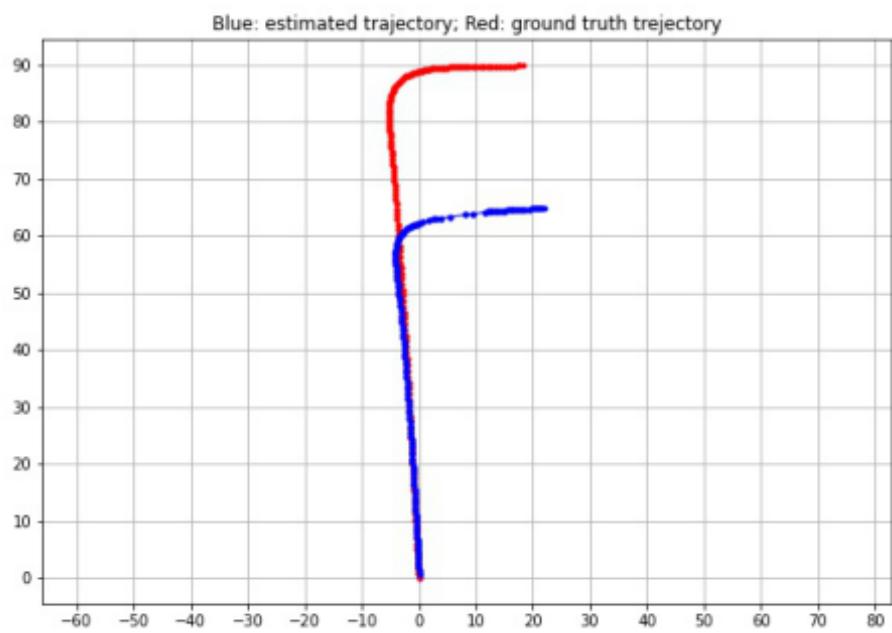
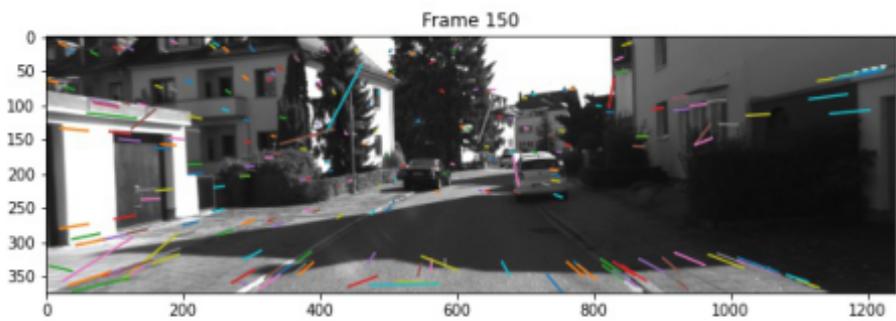
```

```
== [Result] Frame: 148, Matches 243, Inliers: 79.42
Saved at vis_preFeature/frame148.jpg
[[ 0.0845 -0.0185  0.9962 21.4507]
 [ 0.0646  0.9978  0.013  -0.6592]
 [-0.9943  0.0633  0.0856 64.9114]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00257
Mean Error Translation: 0.91470
== [Result] Frame: 149, Matches 227, Inliers: 88.99
Saved at vis_preFeature/frame149.jpg
[[ 0.0896 -0.0174  0.9958 22.0534]
 [ 0.0638  0.9979  0.0117 -0.6562]
 [-0.9939  0.0624  0.0906 64.9635]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00257
Mean Error Translation: 0.90994
== [Result] Frame: 150, Matches 230, Inliers: 85.22
Saved at vis_preFeature/frame150.jpg

<Figure size 432x288 with 0 Axes>
```



```

[[ 0.0943 -0.0136  0.9954 22.6531]
 [ 0.0634  0.998   0.0077 -0.6606]
 [-0.9935  0.0624  0.095  65.0141]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00258
Mean Error Translation: 0.90528
== [Result] Frame: 151, Matches 209, Inliers: 80.86
Saved at vis_preFeature/frame151.jpg
[[ 0.096 -0.0081  0.9953 23.2399]
 [ 0.0587  0.9983  0.0024 -0.6589]
 [-0.9936  0.0582  0.0963 65.0791]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00257
Mean Error Translation: 0.90080
== [Result] Frame: 152, Matches 216, Inliers: 83.80
Saved at vis_preFeature/frame152.jpg
[[ 0.0957 -0.0045  0.9954 23.7929]
 [ 0.0553  0.9985 -0.0008 -0.6593]
 [-0.9939  0.0552  0.0958 65.1435]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00256
Mean Error Translation: 0.89663
== [Result] Frame: 153, Matches 217, Inliers: 81.11
Saved at vis_preFeature/frame153.jpg
[[ 0.0971 -0.0052  0.9953 24.4688]
 [ 0.0559  0.9984 -0.0002 -0.6667]
 [-0.9937  0.0557  0.0973 65.1941]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00257
Mean Error Translation: 0.89175
== [Result] Frame: 154, Matches 240, Inliers: 79.58
Saved at vis_preFeature/frame154.jpg
[[ 0.0992 -0.0074  0.995 25.0337]
 [ 0.0558  0.9984  0.0019 -0.6771]
 [-0.9935  0.0553  0.0994 65.2312]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00259
Mean Error Translation: 0.88764
== [Result] Frame: 155, Matches 247, Inliers: 76.11
Saved at vis_preFeature/frame155.jpg
[[ 0.0986 -0.0081  0.9951 25.6615]
 [ 0.0561  0.9984  0.0026 -0.6787]
 [-0.9935  0.0555  0.0989 65.3012]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00258
Mean Error Translation: 0.88320

```

```

== [Result] Frame: 156, Matches 252, Inliers: 81.35
Saved at vis_preFeature/frame156.jpg
[[ 0.1011 -0.0097  0.9948 26.268 ]
 [ 0.0548  0.9985  0.0041 -0.6931]
 [-0.9934  0.0541  0.1014 65.3472]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00259
Mean Error Translation: 0.87892
== [Result] Frame: 157, Matches 255, Inliers: 78.82
Saved at vis_preFeature/frame157.jpg
[[ 0.1025 -0.0099  0.9947 26.8964]
 [ 0.0563  0.9984  0.0042 -0.6994]
 [-0.9931  0.0556  0.1029 65.4071]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00260
Mean Error Translation: 0.87457
== [Result] Frame: 158, Matches 240, Inliers: 82.08
Saved at vis_preFeature/frame158.jpg
[[ 0.1033 -0.0093  0.9946 27.5018]
 [ 0.0539  0.9985  0.0038 -0.7045]
 [-0.9932  0.0533  0.1037 65.4697]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00259
Mean Error Translation: 0.87039
== [Result] Frame: 159, Matches 261, Inliers: 83.52
Saved at vis_preFeature/frame159.jpg
[[ 0.1032 -0.0079  0.9946 28.1012]
 [ 0.0516  0.9987  0.0026 -0.7102]
 [-0.9933  0.0511  0.1034 65.5297]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00259
Mean Error Translation: 0.86629
== [Result] Frame: 160, Matches 267, Inliers: 85.39
Saved at vis_preFeature/frame160.jpg
[[ 0.101  -0.0084  0.9948 28.7052]
 [ 0.0491  0.9988  0.0035 -0.7173]
 [-0.9937  0.0485  0.1013 65.5913]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00258
Mean Error Translation: 0.86221
== [Result] Frame: 161, Matches 275, Inliers: 74.55
Saved at vis_preFeature/frame161.jpg
[[ 0.0976 -0.0094  0.9952 29.3285]
 [ 0.0465  0.9989  0.0049 -0.7217]
 [-0.9941  0.0458  0.0979 65.6538]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00257
Mean Error Translation: 0.85807

```

```

== [Result] Frame: 162, Matches 291, Inliers: 80.07
Saved at vis_preFeature/frame162.jpg
[[ 0.0933 -0.0118  0.9956 29.9611]
 [ 0.0452  0.9989  0.0076 -0.7264]
 [-0.9946  0.0443  0.0938 65.7128]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00256
Mean Error Translation: 0.85393
== [Result] Frame: 163, Matches 309, Inliers: 76.05
Saved at vis_preFeature/frame163.jpg
[[ 0.0879 -0.0136  0.996  30.6065]
 [ 0.0436  0.999  0.0098 -0.7291]
 [-0.9952  0.0426  0.0884 65.7684]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00256
Mean Error Translation: 0.84977
== [Result] Frame: 164, Matches 308, Inliers: 74.35
Saved at vis_preFeature/frame164.jpg
[[ 0.0805 -0.0137  0.9967 31.261 ]
 [ 0.0431  0.999  0.0102 -0.7343]
 [-0.9958  0.0421  0.081  65.8239]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00255
Mean Error Translation: 0.84559
== [Result] Frame: 165, Matches 316, Inliers: 72.47
Saved at vis_preFeature/frame165.jpg
[[ 0.0717 -0.0119  0.9974 31.904 ]
 [ 0.0424  0.9991  0.0089 -0.7312]
 [-0.9965  0.0417  0.0722 65.8723]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00254
Mean Error Translation: 0.84150
== [Result] Frame: 166, Matches 307, Inliers: 68.08
Saved at vis_preFeature/frame166.jpg
[[ 0.0621 -0.0115  0.998  32.6503]
 [ 0.0427  0.9991  0.0088 -0.7329]
 [-0.9972  0.042  0.0626 65.9148]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00253
Mean Error Translation: 0.83692
== [Result] Frame: 167, Matches 294, Inliers: 69.05
Saved at vis_preFeature/frame167.jpg
[[ 0.0526 -0.0127  0.9985 33.3726]
 [ 0.0438  0.999  0.0104 -0.7367]
 [-0.9977  0.0432  0.0531 65.9447]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00252
Mean Error Translation: 0.83246

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```

== [Result] Frame: 168, Matches 292, Inliers: 67.81
Saved at vis_preFeature/frame168.jpg
[[ 0.0423 -0.0135  0.999  34.3905]
 [ 0.0424  0.999   0.0118 -0.7401]
 [-0.9982  0.0419  0.0428 65.9854]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00251
Mean Error Translation: 0.82892
== [Result] Frame: 169, Matches 283, Inliers: 71.02
Saved at vis_preFeature/frame169.jpg
[[ 0.0325 -0.0141  0.9994 35.4406]
 [ 0.045   0.9989  0.0127 -0.7374]
 [-0.9985  0.0445  0.0331 65.9991]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00251
Mean Error Translation: 0.82559
== [Result] Frame: 170, Matches 273, Inliers: 71.06
Saved at vis_preFeature/frame170.jpg
[[ 0.0223 -0.0143  0.9996 36.5801]
 [ 0.046   0.9989  0.0133 -0.7455]
 [-0.9987  0.0457  0.0229 66.0134]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00251
Mean Error Translation: 0.82285
== [Result] Frame: 171, Matches 279, Inliers: 64.87
Saved at vis_preFeature/frame171.jpg
[[ 0.0112 -0.0137  0.9998 37.8937]
 [ 0.0462  0.9988  0.0132 -0.7489]
 [-0.9989  0.046   0.0118 66.0273]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00250
Mean Error Translation: 0.82120
== [Result] Frame: 172, Matches 270, Inliers: 64.44
Saved at vis_preFeature/frame172.jpg
[[ 0.0017 -0.0126  0.9999 38.9897]
 [ 0.045   0.9989  0.0125 -0.7522]
 [-0.999   0.045   0.0023 65.9955]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00249
Mean Error Translation: 0.81832
== [Result] Frame: 173, Matches 239, Inliers: 57.32
Saved at vis_preFeature/frame173.jpg
[[ -0.01  -0.0112  0.9999 40.2846]
 [ 0.0439  0.999   0.0116 -0.7456]
 [-0.999   0.044   -0.0095 66.0147]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00250
Mean Error Translation: 0.81668

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```

== [Result] Frame: 174, Matches 210, Inliers: 64.29
Saved at vis_preFeature/frame174.jpg
[[-0.0193 -0.0102  0.9998 41.4975]
 [ 0.0446  0.9989  0.011 -0.7422]
 [-0.9988  0.0448 -0.0188 65.993 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00249
Mean Error Translation: 0.81463
== [Result] Frame: 175, Matches 201, Inliers: 63.68
Saved at vis_preFeature/frame175.jpg
[[-0.0295 -0.0095  0.9995 42.4751]
 [ 0.045   0.9989  0.0108 -0.7413]
 [-0.9985  0.0453 -0.0291 65.9808]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00248
Mean Error Translation: 0.81134
== [Result] Frame: 176, Matches 205, Inliers: 69.76
Saved at vis_preFeature/frame176.jpg
[[-0.0403 -0.009   0.9991 43.0365]
 [ 0.0444  0.999   0.0108 -0.7409]
 [-0.9982  0.0448 -0.0399 65.9767]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00248
Mean Error Translation: 0.80788
== [Result] Frame: 177, Matches 210, Inliers: 69.52
Saved at vis_preFeature/frame177.jpg
[[-0.0483 -0.01    0.9988 43.6102]
 [ 0.0469  0.9988  0.0122 -0.7459]
 [-0.9977  0.0474 -0.0478 65.9423]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00248
Mean Error Translation: 0.80430
== [Result] Frame: 178, Matches 224, Inliers: 71.43
Saved at vis_preFeature/frame178.jpg
[[-0.0566 -0.0114  0.9983 44.1715]
 [ 0.0471  0.9988  0.014 -0.7477]
 [-0.9973  0.0478 -0.056  65.9186]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00247
Mean Error Translation: 0.80081
== [Result] Frame: 179, Matches 214, Inliers: 77.57
Saved at vis_preFeature/frame179.jpg
[[-0.0624 -0.0129  0.998  44.7321]
 [ 0.0488  0.9987  0.016 -0.7463]
 [-0.9969  0.0497 -0.0617 65.8867]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00247
Mean Error Translation: 0.79731

```

```

== [Result] Frame: 180, Matches 222, Inliers: 74.77
Saved at vis_preFeature/frame180.jpg
[[-0.0669 -0.0149  0.9976 45.266 ]
 [ 0.051   0.9985  0.0183 -0.747 ]
 [-0.9965  0.0521 -0.0661 65.8537]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00246
Mean Error Translation: 0.79395
== [Result] Frame: 181, Matches 211, Inliers: 76.30
Saved at vis_preFeature/frame181.jpg
[[-0.0702 -0.0159  0.9974 45.8047]
 [ 0.0516  0.9985  0.0195 -0.7439]
 [-0.9962  0.0529 -0.0693 65.823 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00246
Mean Error Translation: 0.79055
== [Result] Frame: 182, Matches 206, Inliers: 69.90
Saved at vis_preFeature/frame182.jpg
[[-0.0722 -0.0167  0.9973 46.3209]
 [ 0.0513  0.9985  0.0205 -0.7415]
 [-0.9961  0.0527 -0.0712 65.79  ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00245
Mean Error Translation: 0.78721
== [Result] Frame: 183, Matches 213, Inliers: 75.12
Saved at vis_preFeature/frame183.jpg
[[-0.0725 -0.0164  0.9972 46.816 ]
 [ 0.0533  0.9984  0.0203 -0.7401]
 [-0.9959  0.0546 -0.0715 65.7503]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00245
Mean Error Translation: 0.78393
== [Result] Frame: 184, Matches 211, Inliers: 72.51
Saved at vis_preFeature/frame184.jpg
[[-0.0708 -0.0153  0.9974 47.2873]
 [ 0.0552  0.9983  0.0192 -0.7394]
 [-0.996   0.0564 -0.0699 65.7117]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00245
Mean Error Translation: 0.78072
== [Result] Frame: 185, Matches 196, Inliers: 75.51
Saved at vis_preFeature/frame185.jpg
[[-0.0678 -0.0134  0.9976 47.7387]
 [ 0.0566  0.9983  0.0172 -0.7368]
 [-0.9961  0.0576 -0.0669 65.6805]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00244
Mean Error Translation: 0.77757

```

```

== [Result] Frame: 186, Matches 211, Inliers: 75.36
Saved at vis_preFeature/frame186.jpg
[[-0.0628 -0.0129  0.9979 48.1697]
 [ 0.0563  0.9983  0.0164 -0.7391]
 [-0.9964  0.0572 -0.0619 65.6573]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00243
Mean Error Translation: 0.77446
== [Result] Frame: 187, Matches 214, Inliers: 78.97
Saved at vis_preFeature/frame187.jpg
[[-0.0538 -0.0123  0.9985 48.6084]
 [ 0.056    0.9983  0.0153 -0.7434]
 [-0.997    0.0567 -0.053   65.6328]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00243
Mean Error Translation: 0.77124
== [Result] Frame: 188, Matches 228, Inliers: 75.44
Saved at vis_preFeature/frame188.jpg
[[-0.0421 -0.0122  0.999  49.0322]
 [ 0.0563  0.9983  0.0146 -0.7425]
 [-0.9975  0.0569 -0.0414 65.6175]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00243
Mean Error Translation: 0.76803
== [Result] Frame: 189, Matches 242, Inliers: 74.38
Saved at vis_preFeature/frame189.jpg
[[-0.0287 -0.0119  0.9995 49.4378]
 [ 0.0556  0.9984  0.0134 -0.7448]
 [-0.998    0.056   -0.028   65.6168]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00242
Mean Error Translation: 0.76484
== [Result] Frame: 190, Matches 260, Inliers: 80.00
Saved at vis_preFeature/frame190.jpg
[[-0.0118 -0.0104  0.9999 49.8232]
 [ 0.056    0.9984  0.0111 -0.7467]
 [-0.9984  0.0561 -0.0112 65.6226]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00241
Mean Error Translation: 0.76169
== [Result] Frame: 191, Matches 267, Inliers: 76.78
Saved at vis_preFeature/frame191.jpg
[[ 0.0089 -0.0071  0.9999 50.2006]
 [ 0.0549  0.9985  0.0066 -0.744 ]
 [-0.9985  0.0548  0.0093 65.6405]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00241
Mean Error Translation: 0.75856

```

```

== [Result] Frame: 192, Matches 274, Inliers: 76.28
Saved at vis_preFeature/frame192.jpg
[[ 0.0345 -0.0043  0.9994 50.5804]
 [ 0.0545  0.9985  0.0024 -0.7504]
 [-0.9979  0.0543  0.0347 65.6602]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00241
Mean Error Translation: 0.75541
== [Result] Frame: 193, Matches 278, Inliers: 78.06
Saved at vis_preFeature/frame193.jpg
[[ 0.0623 -0.0025  0.9981 50.9476]
 [ 0.0521  0.9986 -0.0008 -0.7577]
 [-0.9967  0.052   0.0624 65.7032]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00240
Mean Error Translation: 0.75233
== [Result] Frame: 194, Matches 263, Inliers: 76.81
Saved at vis_preFeature/frame194.jpg
[[ 0.0956 -0.0028  0.9954 51.3023]
 [ 0.0508  0.9987 -0.002  -0.7616]
 [-0.9941  0.0508  0.0956 65.7508]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00240
Mean Error Translation: 0.74935
== [Result] Frame: 195, Matches 270, Inliers: 73.33
Saved at vis_preFeature/frame195.jpg
[[ 0.1322 -0.0047  0.9912 51.648 ]
 [ 0.0498  0.9988 -0.0019 -0.7645]
 [-0.99    0.0496  0.1323 65.8221]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00239
Mean Error Translation: 0.74641
== [Result] Frame: 196, Matches 271, Inliers: 73.80
Saved at vis_preFeature/frame196.jpg
[[ 0.1737 -0.0078  0.9848 51.9982]
 [ 0.0488  0.9988 -0.0007 -0.7672]
 [-0.9836  0.0482  0.1738 65.9057]
 [ 0.       0.       0.       1.      ]]

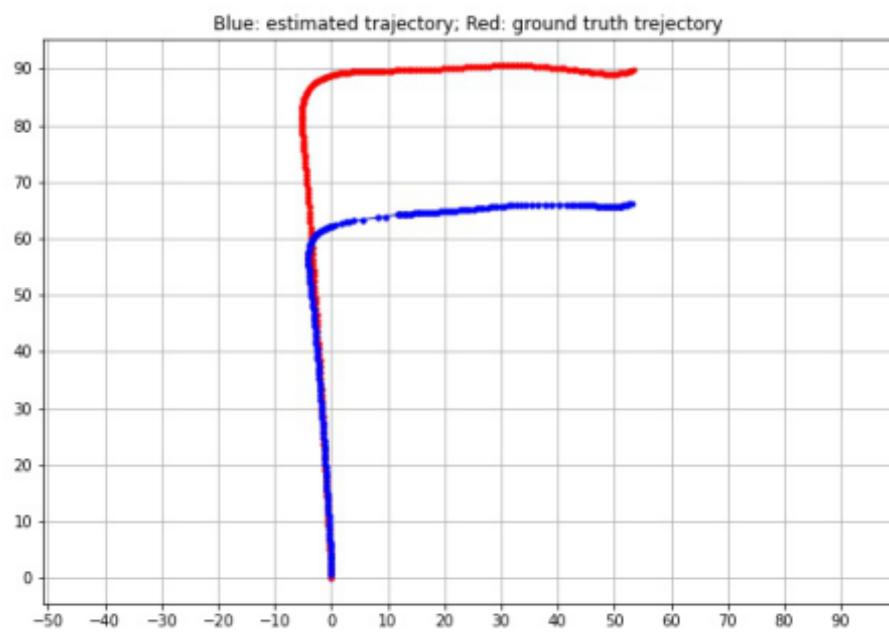
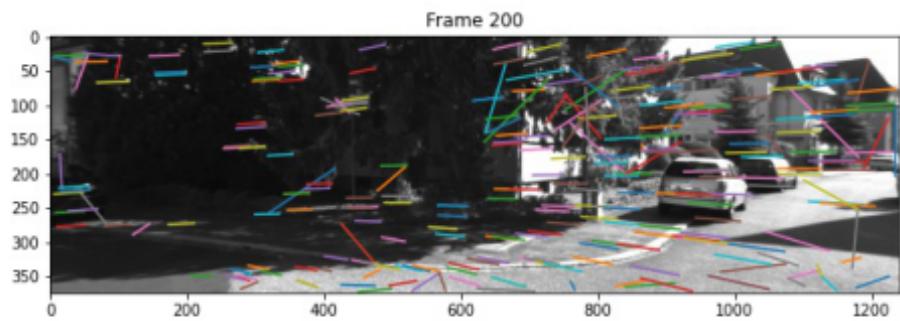
Mean Error Rotation: 0.00238
Mean Error Translation: 0.74343
== [Result] Frame: 197, Matches 268, Inliers: 72.39
Saved at vis_preFeature/frame197.jpg
[[ 0.2173 -0.0112  0.976  52.3521]
 [ 0.045   0.999   0.0014 -0.7728]
 [-0.9751  0.0436  0.2176 66.0164]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00238
Mean Error Translation: 0.74042

```

```
== [Result] Frame: 198, Matches 267, Inliers: 73.78
Saved at vis_preFeature/frame198.jpg
[[ 0.2633 -0.014  0.9646 52.7   ]
 [ 0.0394  0.9992  0.0037 -0.7841]
 [-0.9639  0.037   0.2636 66.1523]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00239
Mean Error Translation: 0.73745
== [Result] Frame: 199, Matches 262, Inliers: 72.14
Saved at vis_preFeature/frame199.jpg
[[ 0.3132 -0.0147  0.9496 53.0431]
 [ 0.0353  0.9994  0.0038 -0.7894]
 [-0.949   0.0323  0.3135 66.3007]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00239
Mean Error Translation: 0.73441
== [Result] Frame: 200, Matches 271, Inliers: 69.00
Saved at vis_preFeature/frame200.jpg

<Figure size 432x288 with 0 Axes>
```



```

[[ 0.3665 -0.0145  0.9303 53.3871]
 [ 0.0347  0.9994  0.0019 -0.7946]
 [-0.9298  0.0316  0.3668 66.4693]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00238
Mean Error Translation: 0.73135
== [Result] Frame: 201, Matches 271, Inliers: 74.91
Saved at vis_preFeature/frame201.jpg
[[ 0.4228 -0.0137  0.9061 53.7109]
 [ 0.0366  0.9993 -0.0019 -0.8048]
 [-0.9055  0.034   0.423  66.6548]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00237
Mean Error Translation: 0.72835
== [Result] Frame: 202, Matches 277, Inliers: 70.04
Saved at vis_preFeature/frame202.jpg
[[ 0.4815 -0.0108  0.8764 54.0295]
 [ 0.0387  0.9992 -0.0089 -0.8156]
 [-0.8756  0.0382  0.4815 66.858 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00237
Mean Error Translation: 0.72522
== [Result] Frame: 203, Matches 269, Inliers: 61.34
Saved at vis_preFeature/frame203.jpg
[[ 0.5396 -0.0076  0.8419 54.3268]
 [ 0.0411  0.999  -0.0173 -0.82  ]
 [-0.8409  0.0439  0.5393 67.0788]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00237
Mean Error Translation: 0.72221
== [Result] Frame: 204, Matches 266, Inliers: 58.65
Saved at vis_preFeature/frame204.jpg
[[ 0.5986 -0.0034  0.801  54.6   ]
 [ 0.0392  0.9989 -0.0251 -0.8186]
 [-0.8001  0.0464  0.5981 67.2957]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00239
Mean Error Translation: 0.71923
== [Result] Frame: 205, Matches 274, Inliers: 54.74
Saved at vis_preFeature/frame205.jpg
[[ 0.6519 -0.0001  0.7583 54.8283]
 [ 0.0352  0.9989 -0.0301 -0.8302]
 [-0.7575  0.0463  0.6512 67.5446]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00238
Mean Error Translation: 0.71642

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```

== [Result] Frame: 206, Matches 279, Inliers: 63.44
Saved at vis_preFeature/frame206.jpg
[[ 0.704 -0.0015 0.7102 55.0516]
 [ 0.0367 0.9987 -0.0343 -0.8431]
 [-0.7092 0.0503 0.7032 67.7834]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00240
Mean Error Translation: 0.71368
== [Result] Frame: 207, Matches 261, Inliers: 57.09
Saved at vis_preFeature/frame207.jpg
[[ 0.7523 -0.0047 0.6588 55.2609]
 [ 0.0385 0.9986 -0.0368 -0.8538]
 [-0.6577 0.053   0.7514 68.0389]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00241
Mean Error Translation: 0.71084
== [Result] Frame: 208, Matches 241, Inliers: 61.41
Saved at vis_preFeature/frame208.jpg
[[ 0.7948 -0.0064 0.6068 55.4276]
 [ 0.0346 0.9988 -0.0347 -0.8668]
 [-0.6059 0.0486 0.7941 68.3212]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00241
Mean Error Translation: 0.70817
== [Result] Frame: 209, Matches 246, Inliers: 63.82
Saved at vis_preFeature/frame209.jpg
[[ 0.8337 -0.0111 0.5522 55.5789]
 [ 0.0328 0.999 -0.0294 -0.8893]
 [-0.5513 0.0426 0.8332 68.6102]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00240
Mean Error Translation: 0.70553
== [Result] Frame: 210, Matches 231, Inliers: 71.86
Saved at vis_preFeature/frame210.jpg
[[ 0.8684 -0.0155 0.4956 55.7237]
 [ 0.0323 0.9992 -0.0254 -0.9025]
 [-0.4948 0.0381 0.8682 68.9077]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00241
Mean Error Translation: 0.70278
== [Result] Frame: 211, Matches 229, Inliers: 68.56
Saved at vis_preFeature/frame211.jpg
[[ 0.897 -0.0168 0.4418 55.8405]
 [ 0.0293 0.9993 -0.0216 -0.9093]
 [-0.4411 0.0323 0.8969 69.2297]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00241
Mean Error Translation: 0.70014

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```

== [Result] Frame: 212, Matches 218, Inliers: 67.89
Saved at vis_preFeature/frame212.jpg
[[ 0.9201 -0.016  0.3913 55.9352]
 [ 0.0253  0.9995 -0.0186 -0.9219]
 [-0.3908  0.0271  0.9201 69.5604]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00240
Mean Error Translation: 0.69752
== [Result] Frame: 213, Matches 205, Inliers: 76.59
Saved at vis_preFeature/frame213.jpg
[[ 0.9385 -0.0128  0.3452 56.025 ]
 [ 0.02     0.9996 -0.0175 -0.9336]
 [-0.3448  0.0234  0.9384 69.9013]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00241
Mean Error Translation: 0.69482
== [Result] Frame: 214, Matches 202, Inliers: 76.24
Saved at vis_preFeature/frame214.jpg
[[ 0.9521 -0.0064  0.3057 56.096 ]
 [ 0.0117  0.9998 -0.0157 -0.9532]
 [-0.3055  0.0186  0.952   70.2643]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00240
Mean Error Translation: 0.69217
== [Result] Frame: 215, Matches 209, Inliers: 77.51
Saved at vis_preFeature/frame215.jpg
[[ 0.9627 -0.0013  0.2707 56.1658]
 [ 0.0064  0.9998 -0.0182 -0.9609]
 [-0.2707  0.0193  0.9625 70.6307]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00240
Mean Error Translation: 0.68947
== [Result] Frame: 216, Matches 216, Inliers: 81.94
Saved at vis_preFeature/frame216.jpg
[[ 0.971   0.0007  0.2391 56.2404]
 [ 0.004   0.9998 -0.0192 -0.969 ]
 [-0.239   0.0196  0.9708 70.9888]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00239
Mean Error Translation: 0.68687
== [Result] Frame: 217, Matches 240, Inliers: 76.67
Saved at vis_preFeature/frame217.jpg
[[ 0.9761 -0.0047  0.2172 56.3236]
 [ 0.0093  0.9998 -0.02   -0.9797]
 [-0.2171  0.0215  0.9759 71.4166]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00238
Mean Error Translation: 0.68400

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```

== [Result] Frame: 218, Matches 213, Inliers: 76.06
Saved at vis_preFeature/frame218.jpg
[[ 0.9795 -0.0072  0.2014 56.4346]
 [ 0.0114  0.9997 -0.0196 -1.0047]
 [-0.2013  0.0215  0.9793 72.0017]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00238
Mean Error Translation: 0.68135
== [Result] Frame: 219, Matches 211, Inliers: 81.52
Saved at vis_preFeature/frame219.jpg
[[ 0.982 -0.0024  0.1887 56.5209]
 [ 0.0064  0.9998 -0.0204 -1.021 ]
 [-0.1887  0.0213  0.9818 72.5566]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00237
Mean Error Translation: 0.67854
== [Result] Frame: 220, Matches 208, Inliers: 84.13
Saved at vis_preFeature/frame220.jpg
[[ 0.9837  0.0041  0.1796 56.6095]
 [-0.0004  0.9998 -0.0207 -1.0327]
 [-0.1797  0.0203  0.9835 73.2012]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00237
Mean Error Translation: 0.67609
== [Result] Frame: 221, Matches 217, Inliers: 80.65
Saved at vis_preFeature/frame221.jpg
[[ 0.9848  0.0117  0.1736 56.7103]
 [-0.008   0.9997 -0.0219 -1.0532]
 [-0.1738  0.0202  0.9846 73.9108]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00236
Mean Error Translation: 0.67392
== [Result] Frame: 222, Matches 221, Inliers: 83.26
Saved at vis_preFeature/frame222.jpg
[[ 0.9852  0.0175  0.1708 56.8196]
 [-0.0133  0.9996 -0.0257 -1.0767]
 [-0.1712  0.023   0.985  74.6558]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00235
Mean Error Translation: 0.67189
== [Result] Frame: 223, Matches 221, Inliers: 85.07
Saved at vis_preFeature/frame223.jpg
[[ 0.9852  0.0192  0.1702 56.909 ]
 [-0.0146  0.9995 -0.0286 -1.0974]
 [-0.1707  0.0257  0.985  75.1979]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00235
Mean Error Translation: 0.66902

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```

== [Result] Frame: 224, Matches 234, Inliers: 79.06
Saved at vis_preFeature/frame224.jpg
[[ 0.9849  0.0174  0.1724 56.9886]
 [-0.012   0.9994 -0.0321 -1.1143]
 [-0.1729  0.0296  0.9845 75.6242]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00235
Mean Error Translation: 0.66660
== [Result] Frame: 225, Matches 234, Inliers: 88.03
Saved at vis_preFeature/frame225.jpg
[[ 0.9841  0.0159  0.1767 57.0917]
 [-0.0092  0.9992 -0.0386 -1.1322]
 [-0.1772  0.0363  0.9835 76.191 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00234
Mean Error Translation: 0.66381
== [Result] Frame: 226, Matches 243, Inliers: 77.78
Saved at vis_preFeature/frame226.jpg
[[ 0.9834  0.0166  0.1806 57.1986]
 [-0.009   0.999  -0.0433 -1.1518]
 [-0.1812  0.0409  0.9826 76.7418]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00234
Mean Error Translation: 0.66102
== [Result] Frame: 227, Matches 254, Inliers: 81.10
Saved at vis_preFeature/frame227.jpg
[[ 0.9824  0.0216  0.1856 57.2778]
 [-0.0139  0.999  -0.0428 -1.1718]
 [-0.1864  0.0395  0.9817 77.2229]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00233
Mean Error Translation: 0.65862
== [Result] Frame: 228, Matches 250, Inliers: 73.60
Saved at vis_preFeature/frame228.jpg
[[ 0.9811  0.0252  0.192  57.3591]
 [-0.018   0.9991 -0.0389 -1.1917]
 [-0.1928  0.0347  0.9806 77.7164]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00233
Mean Error Translation: 0.65624
== [Result] Frame: 229, Matches 232, Inliers: 69.83
Saved at vis_preFeature/frame229.jpg
[[ 0.9802  0.0223  0.1968 57.4541]
 [-0.0159  0.9993 -0.034  -1.2145]
 [-0.1975  0.0302  0.9798 78.1876]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00232
Mean Error Translation: 0.65402

```

```

== [Result] Frame: 230, Matches 225, Inliers: 76.89
Saved at vis_preFeature/frame230.jpg
[[ 0.9795  0.0179  0.2008 57.5866]
 [-0.0123  0.9995 -0.0287 -1.2387]
 [-0.2012  0.0256  0.9792 78.8165]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.65134
== [Result] Frame: 231, Matches 213, Inliers: 75.59
Saved at vis_preFeature/frame231.jpg
[[ 0.9787  0.0152  0.2046 57.7395]
 [-0.0104  0.9996 -0.0244 -1.2617]
 [-0.2049  0.0218  0.9785 79.5405]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.64897
== [Result] Frame: 232, Matches 219, Inliers: 78.08
Saved at vis_preFeature/frame232.jpg
[[ 0.978   0.012   0.2084 57.9246]
 [-0.0071  0.9997 -0.0239 -1.2887]
 [-0.2086  0.0219  0.9778 80.4525]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.64739
== [Result] Frame: 233, Matches 228, Inliers: 81.58
Saved at vis_preFeature/frame233.jpg
[[ 0.9779  0.0098  0.2088 58.0859]
 [-0.0043  0.9996 -0.0267 -1.3205]
 [-0.209   0.0252  0.9776 81.2069]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.64513
== [Result] Frame: 234, Matches 241, Inliers: 78.84
Saved at vis_preFeature/frame234.jpg
[[ 0.978   0.0091  0.2085 58.2525]
 [-0.0021  0.9994 -0.0336 -1.3524]
 [-0.2087  0.0325  0.9774 81.995 ]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.64300
== [Result] Frame: 235, Matches 239, Inliers: 81.17
Saved at vis_preFeature/frame235.jpg
[[ 0.9781  0.0108  0.2081 58.4273]
 [-0.0025  0.9992 -0.0402 -1.3883]
 [-0.2084  0.0388  0.9773 82.8462]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.64110

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```

== [Result] Frame: 236, Matches 239, Inliers: 77.82
Saved at vis_preFeature/frame236.jpg
[[ 0.9786  0.0133  0.2055  58.6282]
 [-0.0043  0.999   -0.0443 -1.427 ]
 [-0.2059  0.0425  0.9777  83.8625]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00230
Mean Error Translation: 0.63986
== [Result] Frame: 237, Matches 215, Inliers: 73.49
Saved at vis_preFeature/frame237.jpg
[[ 0.9789  0.0135  0.2041  58.7695]
 [-0.0055  0.9992 -0.0399 -1.4652]
 [-0.2045  0.0379  0.9781  84.6503]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00230
Mean Error Translation: 0.63761
== [Result] Frame: 238, Matches 202, Inliers: 75.74
Saved at vis_preFeature/frame238.jpg
[[ 0.979   0.011   0.2033  58.9581]
 [-0.0044  0.9995 -0.0325 -1.504 ]
 [-0.2036  0.0309  0.9786  85.6202]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00230
Mean Error Translation: 0.63604
== [Result] Frame: 239, Matches 207, Inliers: 75.36
Saved at vis_preFeature/frame239.jpg
[[ 0.9796  0.011   0.2008  59.1405]
 [-0.0058  0.9996 -0.0267 -1.546 ]
 [-0.201   0.025   0.9793  86.539 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00230
Mean Error Translation: 0.63423
== [Result] Frame: 240, Matches 203, Inliers: 77.34
Saved at vis_preFeature/frame240.jpg
[[ 0.9798  0.0154  0.1993  59.2922]
 [-0.0101  0.9996 -0.0273 -1.5812]
 [-0.1997  0.0248  0.9796  87.3787]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00230
Mean Error Translation: 0.63210
== [Result] Frame: 241, Matches 197, Inliers: 77.66
Saved at vis_preFeature/frame241.jpg
[[ 0.9801  0.0208  0.1974  59.4853]
 [-0.0148  0.9994 -0.032   -1.6217]
 [-0.198   0.0285  0.9798  88.4554]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00229
Mean Error Translation: 0.63093

```

```

== [Result] Frame: 242, Matches 205, Inliers: 77.56
Saved at vis_preFeature/frame242.jpg
[[ 0.9806  0.0225  0.1946  59.6659]
 [-0.0154  0.9992 -0.038   -1.6543]
 [-0.1952  0.0343  0.9802  89.5044]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00229
Mean Error Translation: 0.62960
== [Result] Frame: 243, Matches 209, Inliers: 77.03
Saved at vis_preFeature/frame243.jpg
[[ 0.9814  0.0213  0.191   59.8227]
 [-0.0136  0.9991 -0.0411 -1.6882]
 [-0.1917  0.0377  0.9807  90.3522]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00229
Mean Error Translation: 0.62743
== [Result] Frame: 244, Matches 201, Inliers: 78.11
Saved at vis_preFeature/frame244.jpg
[[ 0.982   0.0195  0.1877  60.0038]
 [-0.0122  0.9991 -0.0398 -1.7343]
 [-0.1883  0.0368  0.9814  91.3663]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00228
Mean Error Translation: 0.62587
== [Result] Frame: 245, Matches 209, Inliers: 69.38
Saved at vis_preFeature/frame245.jpg
[[ 0.9827  0.0158  0.1845  60.1758]
 [-0.009   0.9993 -0.0377 -1.7804]
 [-0.185   0.0354  0.9821  92.2968]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00228
Mean Error Translation: 0.62396
== [Result] Frame: 246, Matches 214, Inliers: 77.57
Saved at vis_preFeature/frame246.jpg
[[ 0.9833  0.0129  0.1816  60.3456]
 [-0.0067  0.9994 -0.0348 -1.8208]
 [-0.182   0.033   0.9828  93.1536]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00228
Mean Error Translation: 0.62171
== [Result] Frame: 247, Matches 222, Inliers: 80.63
Saved at vis_preFeature/frame247.jpg
[[ 0.9834  0.0105  0.181   60.4561]
 [-0.0047  0.9995 -0.0325 -1.8481]
 [-0.1813  0.0312  0.9829  93.7853]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00228
Mean Error Translation: 0.61998

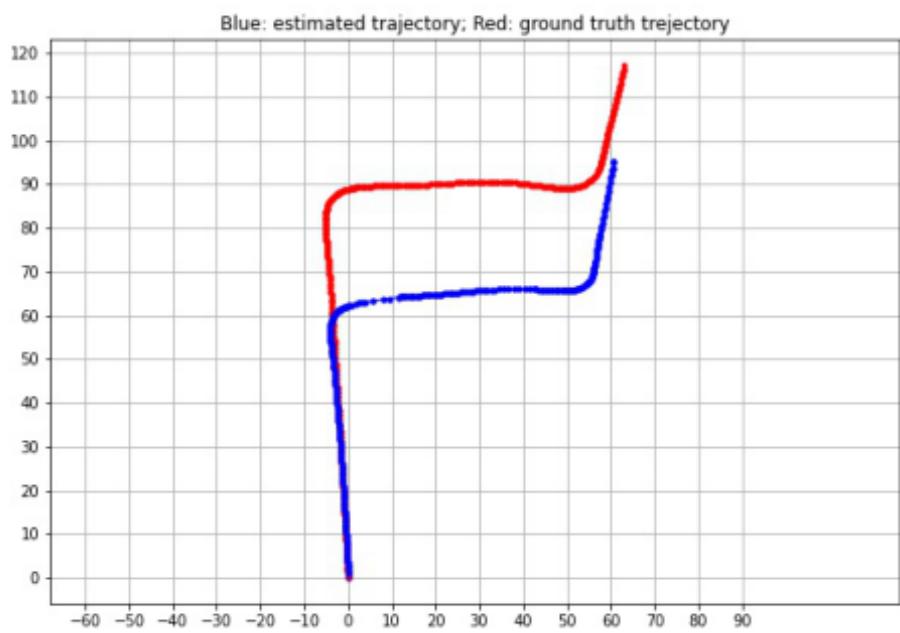
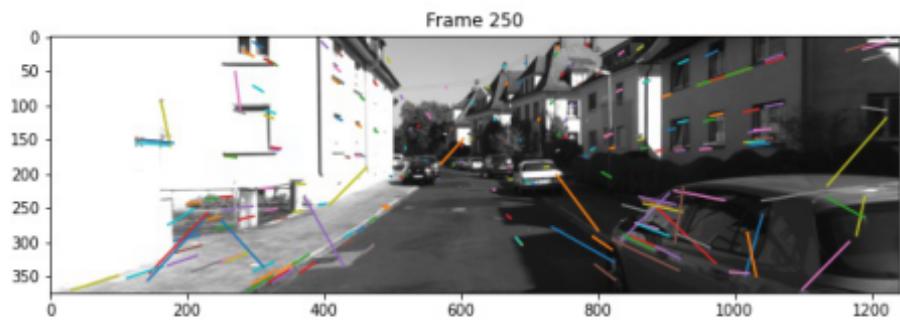
```

```
== [Result] Frame: 248, Matches 211, Inliers: 79.62
Saved at vis_preFeature/frame248.jpg
[[ 0.9835  0.0051  0.1806  60.6608]
 [ 0.0006  0.9995 -0.0313 -1.8943]
 [-0.1807  0.0309  0.983   94.8768]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00227
Mean Error Translation: 0.61863
== [Result] Frame: 249, Matches 211, Inliers: 79.15
Saved at vis_preFeature/frame249.jpg
[[ 0.9838  0.0052  0.1791  60.7735]
 [ 0.0001  0.9996 -0.0296 -1.9199]
 [-0.1792  0.0291  0.9834  95.4627]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00226
Mean Error Translation: 0.61713
== [Result] Frame: 250, Matches 207, Inliers: 76.81
Saved at vis_preFeature/frame250.jpg

<Figure size 432x288 with 0 Axes>
```



```

[[ 0.9839  0.0089  0.1787 60.8805]
 [-0.0033  0.9995 -0.0316 -1.9435]
 [-0.1789  0.0305  0.9834 96.0594]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00226
Mean Error Translation: 0.61560
== [Result] Frame: 251, Matches 211, Inliers: 76.78
Saved at vis_preFeature/frame251.jpg
[[ 0.9838  0.0138  0.1789 60.9836]
 [-0.0076  0.9994 -0.035  -1.9682]
 [-0.1792  0.033   0.9833 96.66  ]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00226
Mean Error Translation: 0.61409
== [Result] Frame: 252, Matches 221, Inliers: 84.16
Saved at vis_preFeature/frame252.jpg
[[ 0.9833  0.0224  0.1804 61.0711]
 [-0.0159  0.9992 -0.0371 -1.9855]
 [-0.1811  0.0337  0.9829 97.2695]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00226
Mean Error Translation: 0.61261
== [Result] Frame: 253, Matches 210, Inliers: 83.33
Saved at vis_preFeature/frame253.jpg
[[ 0.9829  0.027   0.1824 61.1819]
 [-0.0206  0.9991 -0.0368 -2.0103]
 [-0.1832  0.0324  0.9825 97.8874]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00227
Mean Error Translation: 0.61110
== [Result] Frame: 254, Matches 208, Inliers: 84.62
Saved at vis_preFeature/frame254.jpg
[[ 0.9823  0.0287  0.1849 61.3017]
 [-0.0227  0.9991 -0.0347 -2.0446]
 [-0.1858  0.0299  0.9821 98.5502]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00227
Mean Error Translation: 0.60945
== [Result] Frame: 255, Matches 197, Inliers: 78.17
Saved at vis_preFeature/frame255.jpg
[[ 0.9816  0.0304  0.1884 61.4155]
 [-0.0241  0.9991 -0.036  -2.0708]
 [-0.1893  0.0308  0.9814 99.2262]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00227
Mean Error Translation: 0.60778

```

```

== [Result] Frame: 256, Matches 193, Inliers: 80.31
Saved at vis_preFeature/frame256.jpg
[[ 0.9812  0.0297  0.1905  61.5358]
 [-0.0228  0.999   -0.0383 -2.106 ]
 [-0.1915  0.0332  0.9809  99.875 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00227
Mean Error Translation: 0.60622
== [Result] Frame: 257, Matches 194, Inliers: 76.80
Saved at vis_preFeature/frame257.jpg
[[ 0.9816  0.022   0.1898  61.6833]
 [-0.0153  0.9992 -0.0367 -2.1412]
 [-0.1905  0.0331  0.9811  100.485 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00227
Mean Error Translation: 0.60485
== [Result] Frame: 258, Matches 194, Inliers: 79.38
Saved at vis_preFeature/frame258.jpg
[[ 0.9816  0.0151  0.1902  61.8196]
 [-0.0078  0.9992 -0.0388 -2.1702]
 [-0.1907  0.0366  0.981   101.1659]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00227
Mean Error Translation: 0.60321
== [Result] Frame: 259, Matches 202, Inliers: 80.69
Saved at vis_preFeature/frame259.jpg
[[ 0.9813  0.0145  0.1919  61.9432]
 [-0.0071  0.9992 -0.0389 -2.2045]
 [-0.1924  0.0368  0.9806  101.8172]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00226
Mean Error Translation: 0.60170
== [Result] Frame: 260, Matches 192, Inliers: 81.25
Saved at vis_preFeature/frame260.jpg
[[ 0.9808  0.0177  0.1942  62.0599]
 [-0.0108  0.9993 -0.0364 -2.2319]
 [-0.1947  0.0336  0.9803  102.467 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00226
Mean Error Translation: 0.60023
== [Result] Frame: 261, Matches 192, Inliers: 83.85
Saved at vis_preFeature/frame261.jpg
[[ 0.9804  0.0209  0.1958  62.1783]
 [-0.0152  0.9994 -0.0309 -2.2602]
 [-0.1964  0.0273  0.9802  103.1348]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00226
Mean Error Translation: 0.59870

```

```

== [Result] Frame: 262, Matches 198, Inliers: 79.80
Saved at vis_preFeature/frame262.jpg
[[ 0.98      0.0247    0.1976   62.2968]
 [-0.0197    0.9994   -0.0273   -2.2868]
 [-0.1982    0.0229    0.9799  103.7932]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00227
Mean Error Translation: 0.59720
== [Result] Frame: 263, Matches 198, Inliers: 79.29
Saved at vis_preFeature/frame263.jpg
[[ 0.9797    0.0239    0.1991   62.4322]
 [-0.0175    0.9993   -0.0338   -2.3206]
 [-0.1998    0.0297    0.9794  104.4906]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00226
Mean Error Translation: 0.59548
== [Result] Frame: 264, Matches 192, Inliers: 83.85
Saved at vis_preFeature/frame264.jpg
[[ 0.9795    0.02      0.2003   62.5773]
 [-0.0106    0.9988   -0.0479   -2.3661]
 [-0.201     0.0448    0.9786  105.2534]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00226
Mean Error Translation: 0.59355
== [Result] Frame: 265, Matches 213, Inliers: 82.16
Saved at vis_preFeature/frame265.jpg
[[ 0.9797    0.0183    0.1998   62.7826]
 [-0.0071    0.9984   -0.0568   -2.4203]
 [-0.2005    0.0543    0.9782  106.2343]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00227
Mean Error Translation: 0.59196
== [Result] Frame: 266, Matches 207, Inliers: 79.71
Saved at vis_preFeature/frame266.jpg
[[ 0.9797    0.0172    0.1995   62.98  ]
 [-0.0078    0.9988   -0.0477   -2.473 ]
 [-0.2001    0.0452    0.9787  107.2477]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00228
Mean Error Translation: 0.59045
== [Result] Frame: 267, Matches 205, Inliers: 82.93
Saved at vis_preFeature/frame267.jpg
[[ 0.9801    0.0119    0.1983   63.1135]
 [-0.0067    0.9996   -0.0267   -2.5099]
 [-0.1985    0.0248    0.9798  107.9051]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00228
Mean Error Translation: 0.58900

```

```

== [Result] Frame: 268, Matches 197, Inliers: 76.65
Saved at vis_preFeature/frame268.jpg
[[ 0.9802  0.0092  0.1977  63.2425]
 [-0.0071  0.9999 -0.0116 -2.5452]
 [-0.1978  0.0099  0.9802 108.5718]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00229
Mean Error Translation: 0.58751
== [Result] Frame: 269, Matches 193, Inliers: 72.54
Saved at vis_preFeature/frame269.jpg
[[ 0.9799  0.0164  0.1986  63.3826]
 [-0.0134  0.9998 -0.0167 -2.5875]
 [-0.1989  0.0138  0.9799 109.4433]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00231
Mean Error Translation: 0.58567
== [Result] Frame: 270, Matches 187, Inliers: 80.21
Saved at vis_preFeature/frame270.jpg
[[ 0.9799  0.0258  0.1978  63.5137]
 [-0.0198  0.9993 -0.0323 -2.6198]
 [-0.1985  0.0278  0.9797 110.2313]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00232
Mean Error Translation: 0.58376
== [Result] Frame: 271, Matches 180, Inliers: 83.33
Saved at vis_preFeature/frame271.jpg
[[ 0.9802  0.0254  0.1963  63.6516]
 [-0.0178  0.999   -0.0402 -2.6441]
 [-0.1971  0.0359  0.9797 110.926 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00232
Mean Error Translation: 0.58207
== [Result] Frame: 272, Matches 169, Inliers: 88.76
Saved at vis_preFeature/frame272.jpg
[[ 0.9806  0.0226  0.1947  63.7896]
 [-0.0149  0.9991 -0.0408 -2.685 ]
 [-0.1955  0.0371  0.98   111.6636]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00232
Mean Error Translation: 0.58029
== [Result] Frame: 273, Matches 166, Inliers: 78.31
Saved at vis_preFeature/frame273.jpg
[[ 0.9809  0.0239  0.1929  63.9339]
 [-0.0167  0.9991 -0.0391 -2.7332]
 [-0.1937  0.0352  0.9804 112.4906]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00232
Mean Error Translation: 0.57836

```

```

== [Result] Frame: 274, Matches 166, Inliers: 81.33
Saved at vis_preFeature/frame274.jpg
[[ 0.9816  0.0238  0.1894  64.0761]
 [-0.0164  0.999   -0.0406  -2.7696]
 [-0.1902  0.0368  0.9811  113.2964]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.57643
== [Result] Frame: 275, Matches 184, Inliers: 77.72
Saved at vis_preFeature/frame275.jpg
[[ 0.9824  0.0251  0.1849  64.2117]
 [-0.0175  0.9989  -0.0425  -2.8093]
 [-0.1858  0.0385  0.9818  114.0851]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.57454
== [Result] Frame: 276, Matches 184, Inliers: 73.37
Saved at vis_preFeature/frame276.jpg
[[ 0.9827  0.031   0.1827  64.352 ]
 [-0.0236  0.9988  -0.0427  -2.8585]
 [-0.1838  0.0376  0.9822  114.9892]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.57283
== [Result] Frame: 277, Matches 195, Inliers: 71.28
Saved at vis_preFeature/frame277.jpg
[[ 0.9825  0.0381  0.1823  64.4644]
 [-0.0308  0.9986  -0.0429  -2.9023]
 [-0.1837  0.0365  0.9823  115.8288]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00232
Mean Error Translation: 0.57106
== [Result] Frame: 278, Matches 190, Inliers: 64.74
Saved at vis_preFeature/frame278.jpg
[[ 0.9827  0.0404  0.181   64.6231]
 [-0.0335  0.9986  -0.0411  -2.9541]
 [-0.1824  0.0343  0.9826  116.7906]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00232
Mean Error Translation: 0.56960
== [Result] Frame: 279, Matches 203, Inliers: 64.04
Saved at vis_preFeature/frame279.jpg
[[ 0.983   0.038   0.1797  64.7881]
 [-0.0319  0.9988  -0.0365  -3.0018]
 [-0.1809  0.0301  0.983   117.7253]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.56805

```

```

== [Result] Frame: 280, Matches 214, Inliers: 71.03
Saved at vis_preFeature/frame280.jpg
[[ 0.9831  0.0366  0.1793  64.9212]
 [-0.0305  0.9988 -0.037   -3.0401]
 [-0.1804  0.031   0.9831  118.5684]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.56627
== [Result] Frame: 281, Matches 215, Inliers: 69.30
Saved at vis_preFeature/frame281.jpg
[[ 0.9835  0.0355  0.1772  65.0964]
 [-0.0289  0.9988 -0.0399 -3.1003]
 [-0.1784  0.0341  0.9834  119.6277]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.56522
== [Result] Frame: 282, Matches 219, Inliers: 71.23
Saved at vis_preFeature/frame282.jpg
[[ 0.9845  0.0308  0.1724  65.2782]
 [-0.0237  0.9988 -0.0432 -3.1619]
 [-0.1735  0.0385  0.9841  120.6439]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.56405
== [Result] Frame: 283, Matches 230, Inliers: 66.52
Saved at vis_preFeature/frame283.jpg
[[ 0.9857  0.0287  0.1659  65.4739]
 [-0.0215  0.9988 -0.0445 -3.2185]
 [-0.167   0.0403  0.9851  121.8083]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.56338
== [Result] Frame: 284, Matches 237, Inliers: 68.78
Saved at vis_preFeature/frame284.jpg
[[ 0.9868  0.0272  0.1598  65.6407]
 [-0.0211  0.999   -0.0398 -3.2625]
 [-0.1607  0.0359  0.9864  122.9439]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.56258
== [Result] Frame: 285, Matches 228, Inliers: 59.65
Saved at vis_preFeature/frame285.jpg
[[ 0.9875  0.027   0.155   65.806 ]
 [-0.0223  0.9992 -0.0316 -3.3225]
 [-0.1557  0.0278  0.9874  124.1779]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.56212

```

```

== [Result] Frame: 286, Matches 225, Inliers: 67.56
Saved at vis_preFeature/frame286.jpg
[[ 0.9881  0.0249  0.1515  66.0552]
 [-0.0218  0.9995 -0.0222 -3.3943]
 [-0.152   0.0186  0.9882 125.8264]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.56313
== [Result] Frame: 287, Matches 220, Inliers: 74.55
Saved at vis_preFeature/frame287.jpg
[[ 0.9885  0.0317  0.1481  66.2727]
 [-0.0291  0.9994 -0.0199 -3.4531]
 [-0.1487  0.0154  0.9888 127.7065]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00231
Mean Error Translation: 0.56493
== [Result] Frame: 288, Matches 210, Inliers: 75.71
Saved at vis_preFeature/frame288.jpg
[[ 0.9891  0.0341  0.1434  66.3597]
 [-0.0308  0.9992 -0.0245 -3.48  ]
 [-0.1441  0.0198  0.9894 128.3713]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.56344
== [Result] Frame: 289, Matches 218, Inliers: 80.28
Saved at vis_preFeature/frame289.jpg
[[ 0.99    0.0353  0.1365  66.4344]
 [-0.0308  0.9989 -0.0347 -3.5036]
 [-0.1376  0.0302  0.99    128.9517]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.56223
== [Result] Frame: 290, Matches 228, Inliers: 82.89
Saved at vis_preFeature/frame290.jpg
[[ 0.991   0.032   0.1301  66.5106]
 [-0.027   0.9988 -0.0405 -3.5218]
 [-0.1313  0.0366  0.9907 129.522 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00230
Mean Error Translation: 0.56109
== [Result] Frame: 291, Matches 232, Inliers: 83.19
Saved at vis_preFeature/frame291.jpg
[[ 0.9919  0.0305  0.1233  66.5762]
 [-0.0258  0.9989 -0.0398 -3.5429]
 [-0.1244  0.0363  0.9916 130.0584]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00229
Mean Error Translation: 0.56011

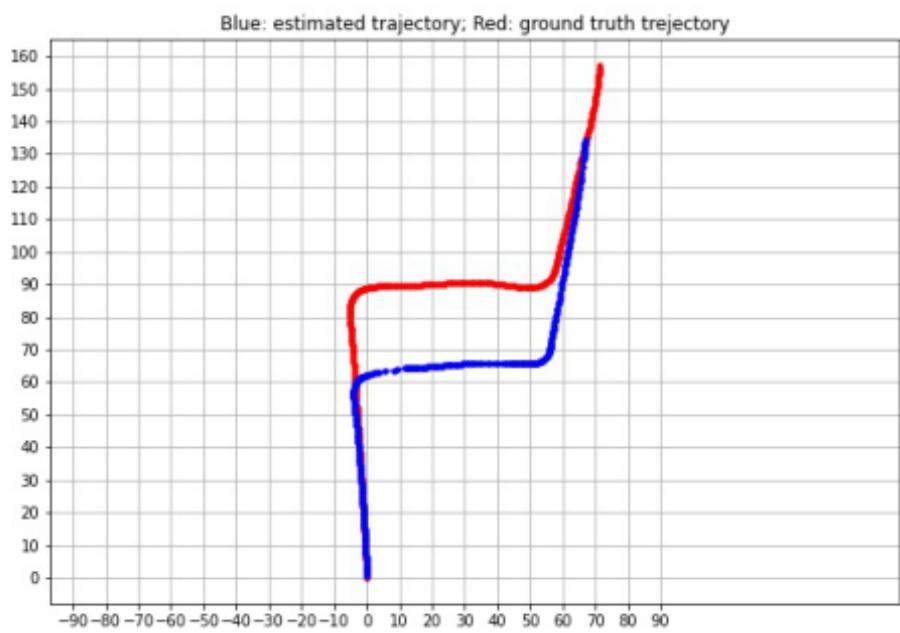
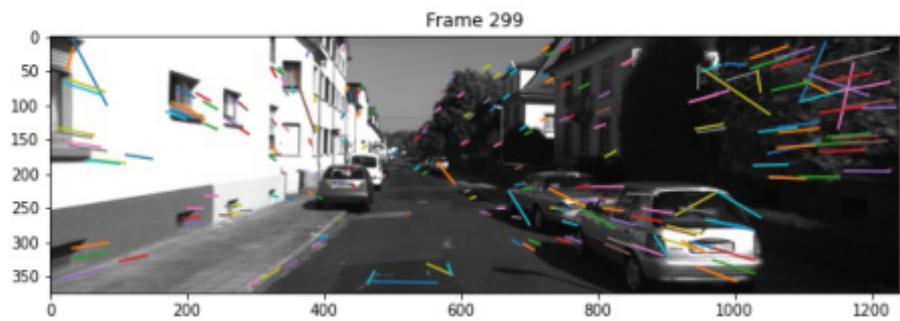
```

```

== [Result] Frame: 292, Matches 225, Inliers: 87.56
Saved at vis_preFeature/frame292.jpg
[[ 0.9926  0.037   0.1153  66.633 ]
 [-0.033   0.9988 -0.0362 -3.5726]
 [-0.1165  0.0322  0.9927 130.6138]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00229
Mean Error Translation: 0.55910
== [Result] Frame: 293, Matches 209, Inliers: 81.82
Saved at vis_preFeature/frame293.jpg
[[ 0.9933  0.0427   0.1072  66.679 ]
 [-0.0388  0.9985 -0.038   -3.5981]
 [-0.1087  0.0336  0.9935 131.1702]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00229
Mean Error Translation: 0.55808
== [Result] Frame: 294, Matches 203, Inliers: 86.21
Saved at vis_preFeature/frame294.jpg
[[ 0.9941  0.0463   0.0979  66.7201]
 [-0.0421  0.9981 -0.0441 -3.6244]
 [-0.0998  0.0398  0.9942 131.7642]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00229
Mean Error Translation: 0.55694
== [Result] Frame: 295, Matches 210, Inliers: 86.19
Saved at vis_preFeature/frame295.jpg
[[ 0.995   0.0449   0.0898  66.7628]
 [-0.0408  0.9981 -0.0467 -3.6503]
 [-0.0917  0.0428  0.9949 132.3211]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00228
Mean Error Translation: 0.55593
== [Result] Frame: 296, Matches 230, Inliers: 83.91
Saved at vis_preFeature/frame296.jpg
[[ 0.9956  0.0455   0.0816  66.8047]
 [-0.042   0.9982 -0.0439 -3.6793]
 [-0.0834  0.0403  0.9957 132.9162]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00228
Mean Error Translation: 0.55482
== [Result] Frame: 297, Matches 230, Inliers: 80.43
Saved at vis_preFeature/frame297.jpg
[[ 0.9961  0.0483   0.0743  66.8394]
 [-0.0456  0.9983 -0.0371 -3.7116]
 [-0.076   0.0335  0.9965 133.5574]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00228
Mean Error Translation: 0.55359

```

```
== [Result] Frame: 298, Matches 233, Inliers: 84.55
Saved at vis_preFeature/frame298.jpg
[[ 0.9966  0.0504  0.0656  66.8775]
 [ -0.0484  0.9983  -0.0315  -3.7394]
 [ -0.0671  0.0283  0.9973  134.1957]
 [ 0.         0.         0.         1.        ]]
Mean Error Rotation: 0.00228
Mean Error Translation: 0.55238
== [Result] Frame: 299, Matches 222, Inliers: 81.53
Saved at vis_preFeature/frame299.jpg
<Figure size 432x288 with 0 Axes>
```



1. Report the final rotation and translation error. (**2 points**)

SIFT result

Mean Error Rotation: 0.00228

Mean Error Translation: 0.55238

libviso2 result

Mean Error Rotation: 0.00299

Mean Error Translation: 0.53948

Next, answer the following questions:

2. Does SIFT yield higher accuracy than the original `libviso2`? Why or why not? If not, can you suggest one possible way to improve? (**5 points**)

SIFT yields higher accuracy when estimating rotation but lower accuracy when estimating translation. Since SIFT is used purely to extract the feature point, we can look at the number of matched points to determine why SIFT does not yield improved accuracy in both rotation and translation. The comparison against libviso2 is shown below.

SIFT

Matches 222, Inliers: 81.53

libviso2

Matches 295, Inliers: 85.42

SIFT detects fewer matches and also result in lower percentage of the matches becoming inlier when estimating the fundamental matrix. This explains why SIFT has worse performance when estimating translation. Looking visually at the images, we can also see that libviso2 obtains features more uniformly over the images and over the z-axis of the camera.

To improve accuracy, we can tune the hyper-parameters of SIFT to return more keypoints and then perform the post-processing steps of bucketing. This will have similar effects as to distribute the feature points more evenly over the images and over the z-axis of the camera.

3. Explain how SIFT achieves invariance to a. illumination b. rotation c. scale (**3 points**)

- (a) The feature descriptor vector is normalized to unit length to enhance invariance to affine changes in illumination. SIFT also detect keypoints in high contrast regions, such as object edges, which are more invariant to illumination changes.
- (b) The keypoint descriptor is computed using local image gradient directions. The gradient direction is rotated so that the dominant direction points in a canonical directions. Thus, two identical patches, with one being a rotated version of the other, would have the same feature descriptor.
- (c) By construction of the scale space through difference of Gaussians, SIFT detects feature points at multiple scale of the image. Therefore, the detected feature points are more invariant to scale.

1.4 Question 3: Using SuperPoint[1] for SfM

Now you are required to use keypoints and feature descriptors from SuperPoint for SfM. The code for the trained model of this method can be found from the [SuperPoint](#).

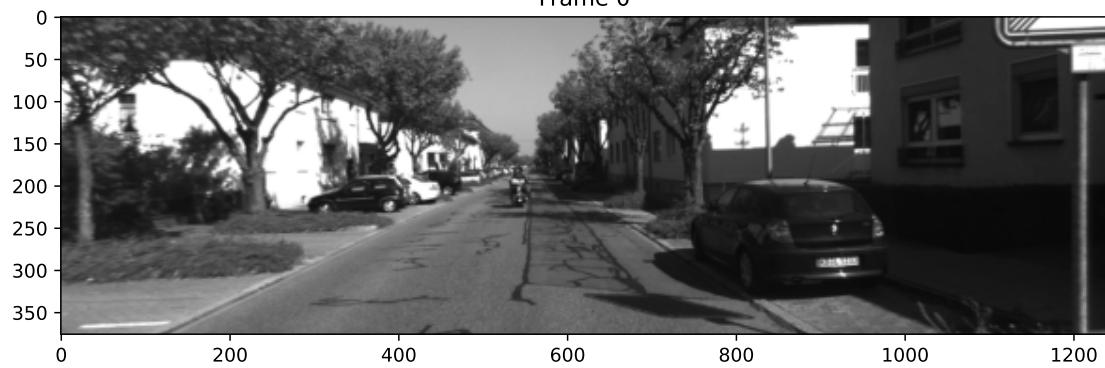
- (A) Go to SuperPoint directory and run `demo_superpoint.py`. The detected keypoints and feature descriptors are under the directory `SuperPoint`. The file format is similar to the SIFT case. For image `000abc.png`, the pre-computed features and keypoints should be saved in a `.npy` file named as `000abc_feature.npy`. The variable is a $258 \times N$ matrix with `single` precision, where N is the number of feature points being detected. For each 258-dimensional feature vector, the first two dimensions are the locations of the keypoint (column number first and then row number) on the image plane and the last 256 dimensions represent the feature descriptor.

- (B) Run the following script

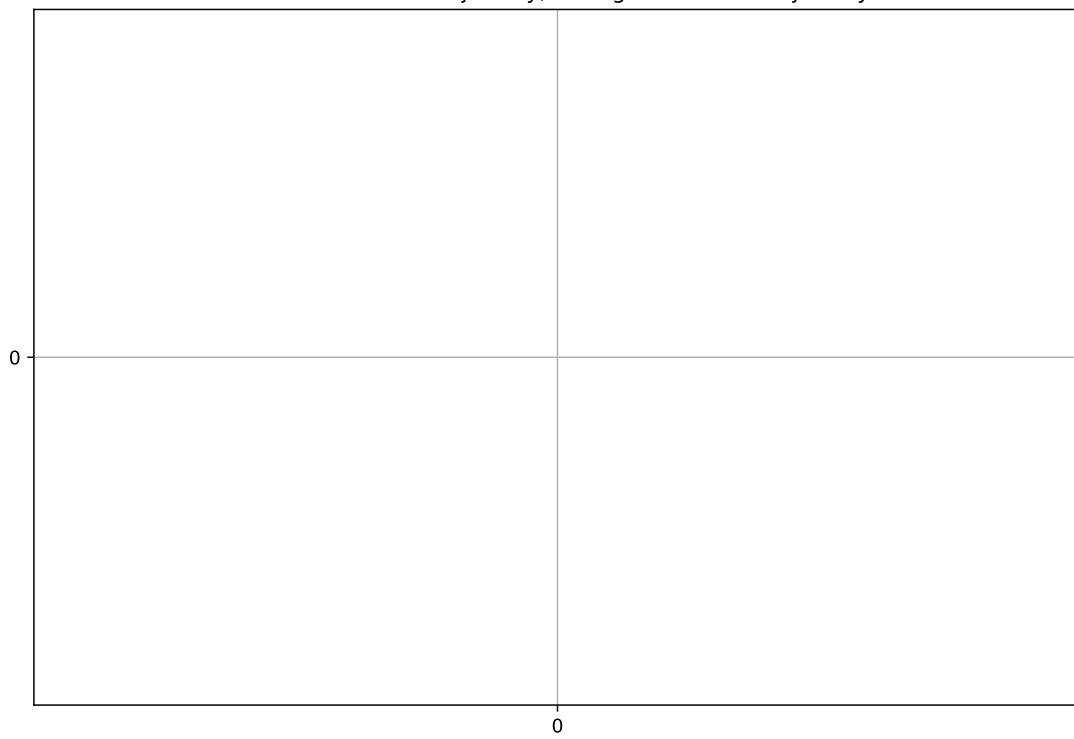
```
[11]: import runFeature  
dataset_path = '/Users/QV/code-project/datasets/dataset_SfM'  
feature_dir = 'SuperPoint'  
runFeature.runSFM(dataset_path, feature_dir )
```

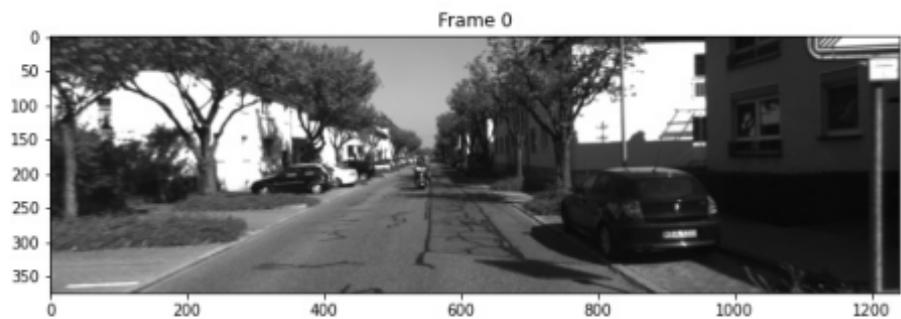
```
Mean Error Rotation: inf  
Mean Error Translation: inf  
== [Result] Frame: 0, Matches 0, Inliers: 0.00  
Saved at vis_preFeature/frame000.jpg
```

Frame 0

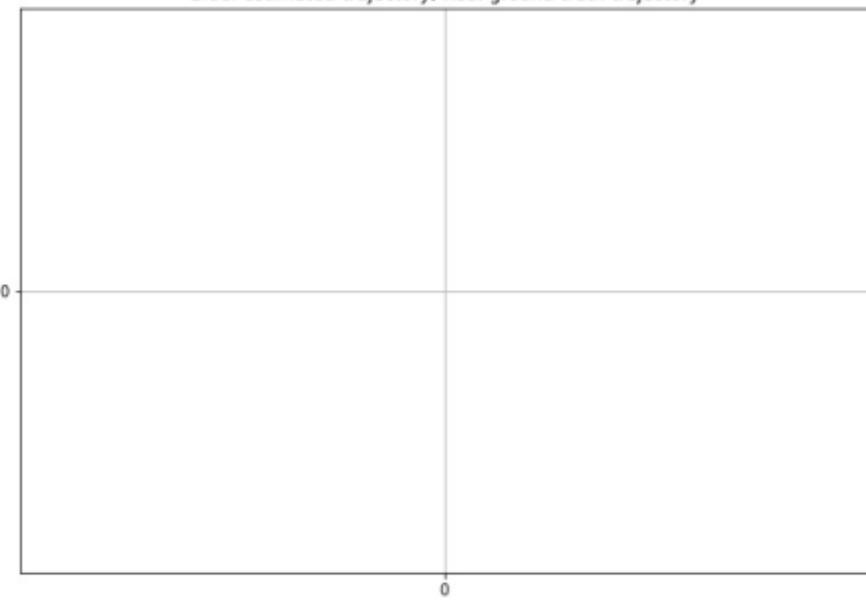


Blue: estimated trajectory; Red: ground truth trajectory





Blue: estimated trajectory; Red: ground truth trajectory



```

[[ 1.      -0.0065 -0.0059  0.021 ]
 [ 0.0065   1.      -0.0022 -0.0028]
 [ 0.0059   0.0022  1.      0.5221]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.08094
Mean Error Translation: 97.53184
== [Result] Frame: 1, Matches 293, Inliers: 66.89
Saved at vis_preFeature/frame001.jpg
[[ 0.9999 -0.0057 -0.012   0.0292]
 [ 0.0057   1.      -0.0043  0.0009]
 [ 0.012    0.0042  0.9999  1.0043]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.04340
Mean Error Translation: 48.95631
== [Result] Frame: 2, Matches 300, Inliers: 75.67
Saved at vis_preFeature/frame002.jpg
[[ 0.9999 -0.0059 -0.015   0.0104]
 [ 0.0058   1.      -0.0055 -0.0065]
 [ 0.015    0.0055  0.9999  1.5002]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.02948
Mean Error Translation: 32.75902
== [Result] Frame: 3, Matches 313, Inliers: 68.69
Saved at vis_preFeature/frame003.jpg
[[ 0.9998 -0.0039 -0.0192 -0.0082]
 [ 0.0038   1.      -0.0059 -0.0133]
 [ 0.0192   0.0058  0.9998  2.0125]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.02307
Mean Error Translation: 24.65605
== [Result] Frame: 4, Matches 319, Inliers: 72.10
Saved at vis_preFeature/frame004.jpg
[[ 0.9996 -0.0074 -0.0261 -0.0043]
 [ 0.0072   1.      -0.0058 -0.0217]
 [ 0.0261   0.0056  0.9996  2.5486]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.02027
Mean Error Translation: 19.79028
== [Result] Frame: 5, Matches 322, Inliers: 68.01
Saved at vis_preFeature/frame005.jpg
[[ 0.9995 -0.0082 -0.0296 -0.0275]
 [ 0.008    0.9999 -0.0069 -0.0306]
 [ 0.0297   0.0066  0.9995  3.0828]
 [ 0.      0.      0.      1.      ]]

Mean Error Rotation: 0.01737
Mean Error Translation: 16.54606

```

```

== [Result] Frame: 6, Matches 312, Inliers: 67.95
Saved at vis_preFeature/frame006.jpg
[[ 0.9994 -0.0057 -0.0352 -0.0471]
 [ 0.0054  1.     -0.0073 -0.0366]
 [ 0.0353  0.0071  0.9994  3.605 ]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.01573
Mean Error Translation: 14.23068
== [Result] Frame: 7, Matches 314, Inliers: 70.06
Saved at vis_preFeature/frame007.jpg
[[ 0.9992 -0.0076 -0.0397 -0.0684]
 [ 0.0074  1.     -0.0057 -0.0417]
 [ 0.0397  0.0054  0.9992  4.149 ]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.01456
Mean Error Translation: 12.49129
== [Result] Frame: 8, Matches 302, Inliers: 70.53
Saved at vis_preFeature/frame008.jpg
[[ 0.9991 -0.0049 -0.0418 -0.1168]
 [ 0.0047  1.     -0.0034 -0.0469]
 [ 0.0419  0.0032  0.9991  4.731 ]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.01359
Mean Error Translation: 11.13421
== [Result] Frame: 9, Matches 311, Inliers: 68.17
Saved at vis_preFeature/frame009.jpg
[[ 0.9989 -0.006  -0.0466 -0.14   ]
 [ 0.006  1.     -0.0007 -0.0552]
 [ 0.0466  0.0005  0.9989  5.3145]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.01294
Mean Error Translation: 10.04851
== [Result] Frame: 10, Matches 308, Inliers: 70.78
Saved at vis_preFeature/frame010.jpg
[[ 0.9988 -0.0056 -0.049  -0.1733]
 [ 0.0056  1.     -0.002  -0.0548]
 [ 0.049  0.0017  0.9988  5.8985]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.01181
Mean Error Translation: 9.16002
== [Result] Frame: 11, Matches 314, Inliers: 79.30
Saved at vis_preFeature/frame011.jpg
[[ 0.9986 -0.0088 -0.0522 -0.1958]
 [ 0.0087  1.     -0.0016 -0.0651]
 [ 0.0522  0.0012  0.9986  6.4929]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.01131
Mean Error Translation: 8.41885

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== [Result] Frame: 12, Matches 320, Inliers: 75.31
Saved at vis_preFeature/frame012.jpg
[[ 0.9985 -0.0123 -0.0528 -0.2343]
 [ 0.0123  0.9999 -0.0018 -0.0723]
 [ 0.0528  0.0011  0.9986  7.0741]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.01093
Mean Error Translation: 7.79266
== [Result] Frame: 13, Matches 317, Inliers: 77.60
Saved at vis_preFeature/frame013.jpg
[[ 0.9983 -0.0136 -0.0559 -0.2597]
 [ 0.0136  0.9999 -0.0008 -0.0793]
 [ 0.0559  0.       0.9984  7.6729]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.01047
Mean Error Translation: 7.25467
== [Result] Frame: 14, Matches 297, Inliers: 75.42
Saved at vis_preFeature/frame014.jpg
[[ 0.9981 -0.0185 -0.0588 -0.2783]
 [ 0.0185  0.9998 -0.0013 -0.0834]
 [ 0.0588  0.0002  0.9983  8.2827]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.01011
Mean Error Translation: 6.78749
== [Result] Frame: 15, Matches 288, Inliers: 75.35
Saved at vis_preFeature/frame015.jpg
[[ 0.9981 -0.015  -0.0604 -0.3247]
 [ 0.0148  0.9999 -0.004  -0.0862]
 [ 0.0604  0.0031  0.9982  8.915 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00961
Mean Error Translation: 6.37772
== [Result] Frame: 16, Matches 274, Inliers: 70.07
Saved at vis_preFeature/frame016.jpg
[[ 0.9978 -0.0174 -0.0632 -0.3517]
 [ 0.0169  0.9998 -0.007  -0.0919]
 [ 0.0633  0.006   0.998   9.5436]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00932
Mean Error Translation: 6.01682
== [Result] Frame: 17, Matches 285, Inliers: 67.37
Saved at vis_preFeature/frame017.jpg
[[ 0.9978 -0.015  -0.0652 -0.3981]
 [ 0.0145  0.9999 -0.0085 -0.1008]
 [ 0.0653  0.0075  0.9978  10.1867]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00891
Mean Error Translation: 5.69575

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```

== [Result] Frame: 18, Matches 287, Inliers: 73.87
Saved at vis_preFeature/frame018.jpg
[[ 0.9978 -0.0139 -0.0656 -0.4467]
 [ 0.0134  0.9999 -0.0083 -0.111 ]
 [ 0.0657  0.0074  0.9978 10.8244]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00852
Mean Error Translation: 5.40929
== [Result] Frame: 19, Matches 297, Inliers: 77.10
Saved at vis_preFeature/frame019.jpg
[[ 0.9977 -0.0134 -0.0664 -0.5026]
 [ 0.0129  0.9999 -0.0074 -0.1173]
 [ 0.0664  0.0065  0.9978 11.499 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00819
Mean Error Translation: 5.15014
== [Result] Frame: 20, Matches 299, Inliers: 72.91
Saved at vis_preFeature/frame020.jpg
[[ 0.9976 -0.0122 -0.0675 -0.5571]
 [ 0.0118  0.9999 -0.0059 -0.1278]
 [ 0.0676  0.005   0.9977 12.1673]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00787
Mean Error Translation: 4.91618
== [Result] Frame: 21, Matches 300, Inliers: 75.00
Saved at vis_preFeature/frame021.jpg
[[ 0.9975 -0.0137 -0.0691 -0.6015]
 [ 0.0134  0.9999 -0.0052 -0.1419]
 [ 0.0692  0.0042  0.9976 12.8268]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00759
Mean Error Translation: 4.70417
== [Result] Frame: 22, Matches 304, Inliers: 69.74
Saved at vis_preFeature/frame022.jpg
[[ 0.9974 -0.0134 -0.0708 -0.6518]
 [ 0.013   0.9999 -0.0064 -0.1492]
 [ 0.0709  0.0055  0.9975 13.4929]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00730
Mean Error Translation: 4.51043
== [Result] Frame: 23, Matches 305, Inliers: 72.79
Saved at vis_preFeature/frame023.jpg
[[ 0.9973 -0.0137 -0.0717 -0.7013]
 [ 0.0132  0.9999 -0.0074 -0.1592]
 [ 0.0718  0.0064  0.9974 14.1644]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00708
Mean Error Translation: 4.33274

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== [Result] Frame: 24, Matches 290, Inliers: 71.38
Saved at vis_preFeature/frame024.jpg
[[ 0.9974 -0.0135 -0.0714 -0.7605]
 [ 0.0131  0.9999 -0.0054 -0.1694]
 [ 0.0715  0.0045  0.9974 14.8307]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00686
Mean Error Translation: 4.16988
== [Result] Frame: 25, Matches 288, Inliers: 70.83
Saved at vis_preFeature/frame025.jpg
[[ 0.9973 -0.0122 -0.0718 -0.8102]
 [ 0.0121  0.9999 -0.002  -0.1806]
 [ 0.0718  0.0011  0.9974 15.5019]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00664
Mean Error Translation: 4.01964
== [Result] Frame: 26, Matches 288, Inliers: 72.22
Saved at vis_preFeature/frame026.jpg
[[ 0.9974 -0.0104 -0.0708 -0.8621]
 [ 0.0106  0.9999  0.0019 -0.1885]
 [ 0.0708 -0.0027  0.9975 16.1829]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00644
Mean Error Translation: 3.88022
== [Result] Frame: 27, Matches 280, Inliers: 71.43
Saved at vis_preFeature/frame027.jpg
[[ 0.9975 -0.0122 -0.0695 -0.9079]
 [ 0.0126  0.9999  0.0048 -0.194 ]
 [ 0.0695 -0.0057  0.9976 16.8954]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00626
Mean Error Translation: 3.74989
== [Result] Frame: 28, Matches 278, Inliers: 79.14
Saved at vis_preFeature/frame028.jpg
[[ 0.9975 -0.0132 -0.0693 -0.9492]
 [ 0.0137  0.9999  0.0063 -0.2037]
 [ 0.0692 -0.0072  0.9976 17.6218]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00612
Mean Error Translation: 3.62815
== [Result] Frame: 29, Matches 281, Inliers: 68.68
Saved at vis_preFeature/frame029.jpg
[[ 0.9975 -0.0147 -0.069  -0.9905]
 [ 0.0149  0.9999  0.0038 -0.2121]
 [ 0.0689 -0.0048  0.9976 18.3416]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00600
Mean Error Translation: 3.51484

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```

== [Result] Frame: 30, Matches 272, Inliers: 73.90
Saved at vis_preFeature/frame030.jpg
[[ 0.9976 -0.0142 -0.068 -1.0479]
 [ 0.0141  0.9999 -0.0008 -0.216 ]
 [ 0.068  -0.0002  0.9977 19.0775]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00585
Mean Error Translation: 3.40845
== [Result] Frame: 31, Matches 262, Inliers: 70.99
Saved at vis_preFeature/frame031.jpg
[[ 0.9976 -0.0131 -0.0675 -1.0935]
 [ 0.0129  0.9999 -0.0039 -0.2208]
 [ 0.0676  0.0031  0.9977 19.7808]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00575
Mean Error Translation: 3.30994
== [Result] Frame: 32, Matches 269, Inliers: 74.35
Saved at vis_preFeature/frame032.jpg
[[ 0.9977 -0.0133 -0.0657 -1.1514]
 [ 0.0132  0.9999 -0.0028 -0.2286]
 [ 0.0657  0.002   0.9978 20.4643]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00568
Mean Error Translation: 3.21831
== [Result] Frame: 33, Matches 265, Inliers: 69.81
Saved at vis_preFeature/frame033.jpg
[[ 0.9978 -0.0124 -0.0657 -1.1999]
 [ 0.0125  0.9999  0.0017 -0.2324]
 [ 0.0657 -0.0025  0.9978 21.1956]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00562
Mean Error Translation: 3.13087
== [Result] Frame: 34, Matches 266, Inliers: 67.29
Saved at vis_preFeature/frame034.jpg
[[ 0.9976 -0.0172 -0.0678 -1.2368]
 [ 0.0176  0.9998  0.0055 -0.2441]
 [ 0.0677 -0.0067  0.9977 21.9193]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00554
Mean Error Translation: 3.04874
== [Result] Frame: 35, Matches 284, Inliers: 69.72
Saved at vis_preFeature/frame035.jpg
[[ 0.9975 -0.023  -0.0674 -1.2907]
 [ 0.0234  0.9997  0.0053 -0.2533]
 [ 0.0673 -0.0069  0.9977 22.6515]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00548
Mean Error Translation: 2.97094

```

```

== [Result] Frame: 36, Matches 286, Inliers: 69.93
Saved at vis_preFeature/frame036.jpg
[[ 0.9972 -0.025 -0.07 -1.3253]
 [ 0.0251  0.9997  0.0005 -0.2514]
 [ 0.07 -0.0023  0.9975 23.3546]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00540
Mean Error Translation: 2.89815
== [Result] Frame: 37, Matches 273, Inliers: 58.61
Saved at vis_preFeature/frame037.jpg
[[ 0.9973 -0.024 -0.0698 -1.3944]
 [ 0.0238  0.9997 -0.0038 -0.2533]
 [ 0.0699  0.0021  0.9976 24.0508]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00532
Mean Error Translation: 2.82949
== [Result] Frame: 38, Matches 278, Inliers: 65.47
Saved at vis_preFeature/frame038.jpg
[[ 0.9971 -0.024 -0.0724 -1.4459]
 [ 0.0236  0.9997 -0.0056 -0.251 ]
 [ 0.0725  0.0039  0.9974 24.7561]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00522
Mean Error Translation: 2.76486
== [Result] Frame: 39, Matches 279, Inliers: 68.82
Saved at vis_preFeature/frame039.jpg
[[ 0.9971 -0.0225 -0.0732 -1.5046]
 [ 0.0223  0.9997 -0.0042 -0.262 ]
 [ 0.0733  0.0026  0.9973 25.4325]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00515
Mean Error Translation: 2.70533
== [Result] Frame: 40, Matches 285, Inliers: 67.37
Saved at vis_preFeature/frame040.jpg
[[ 0.997 -0.0205 -0.0743 -1.5569]
 [ 0.0205  0.9998 -0.0014 -0.2744]
 [ 0.0743 -0.0001  0.9972 26.1092]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00507
Mean Error Translation: 2.64830
== [Result] Frame: 41, Matches 280, Inliers: 67.50
Saved at vis_preFeature/frame041.jpg
[[ 0.9971 -0.0164 -0.0742 -1.6303]
 [ 0.0165  0.9999 -0.0001 -0.2882]
 [ 0.0742 -0.0011  0.9972 26.7941]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00509
Mean Error Translation: 2.59384

```

```

== [Result] Frame: 42, Matches 279, Inliers: 67.03
Saved at vis_preFeature/frame042.jpg
[[ 0.9971 -0.016 -0.0747 -1.6893]
 [ 0.0162  0.9999  0.0023 -0.2948]
 [ 0.0746 -0.0036  0.9972 27.5037]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00500
Mean Error Translation: 2.54107
== [Result] Frame: 43, Matches 279, Inliers: 68.82
Saved at vis_preFeature/frame043.jpg
[[ 0.9972 -0.0157 -0.0738 -1.7444]
 [ 0.0161  0.9999  0.0053 -0.3022]
 [ 0.0737 -0.0065  0.9973 28.1865]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00493
Mean Error Translation: 2.49136
== [Result] Frame: 44, Matches 273, Inliers: 68.86
Saved at vis_preFeature/frame044.jpg
[[ 0.9973 -0.0076 -0.0732 -1.8223]
 [ 0.0082  0.9999  0.008  -0.3118]
 [ 0.0731 -0.0085  0.9973 28.9069]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00490
Mean Error Translation: 2.44274
== [Result] Frame: 45, Matches 270, Inliers: 64.44
Saved at vis_preFeature/frame045.jpg
[[ 0.9972 -0.0093 -0.0745 -1.8646]
 [ 0.0099  0.9999  0.0072 -0.3126]
 [ 0.0744 -0.0079  0.9972 29.6152]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00487
Mean Error Translation: 2.39651
== [Result] Frame: 46, Matches 250, Inliers: 72.40
Saved at vis_preFeature/frame046.jpg
[[ 0.9972 -0.0103 -0.0743 -1.9196]
 [ 0.0108  0.9999  0.0062 -0.3225]
 [ 0.0742 -0.007  0.9972 30.3603]
 [ 0.       0.       0.       1.      ]]

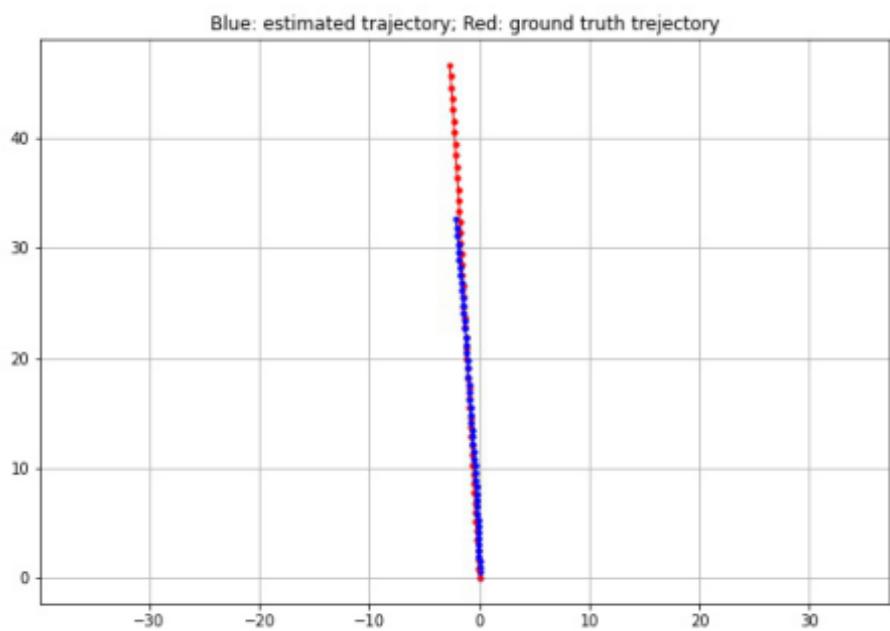
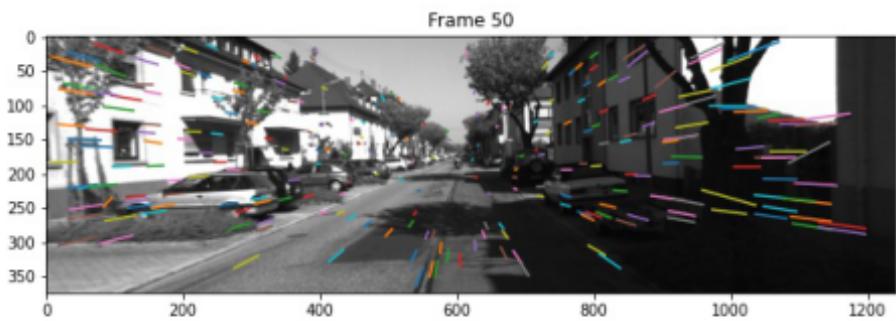
Mean Error Rotation: 0.00480
Mean Error Translation: 2.35118
== [Result] Frame: 47, Matches 249, Inliers: 73.49
Saved at vis_preFeature/frame047.jpg
[[ 0.9972 -0.0079 -0.074  -1.9897]
 [ 0.0083  1.       0.0046 -0.3318]
 [ 0.0739 -0.0052  0.9973 31.1133]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00474
Mean Error Translation: 2.30747

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== [Result] Frame: 48, Matches 255, Inliers: 75.29
Saved at vis_preFeature/frame048.jpg
[[ 0.9971 -0.0092 -0.0754 -2.05   ]
 [ 0.0096  0.9999  0.005  -0.3407]
 [ 0.0753 -0.0057  0.9971 31.836 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00468
Mean Error Translation: 2.26608
== [Result] Frame: 49, Matches 259, Inliers: 69.88
Saved at vis_preFeature/frame049.jpg
[[ 0.997  -0.0111 -0.0767 -2.1128]
 [ 0.0115  0.9999  0.006  -0.3436]
 [ 0.0766 -0.0068  0.997  32.639 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00460
Mean Error Translation: 2.22474
== [Result] Frame: 50, Matches 263, Inliers: 72.62
Saved at vis_preFeature/frame050.jpg

<Figure size 432x288 with 0 Axes>
```



```

[[ 0.9969 -0.0075 -0.0777 -2.1768]
 [ 0.0081  0.9999  0.0066 -0.35   ]
 [ 0.0777 -0.0073  0.997  33.4035]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00461
Mean Error Translation: 2.18567
== [Result] Frame: 51, Matches 283, Inliers: 65.72
Saved at vis_preFeature/frame051.jpg
[[ 0.9969 -0.0065 -0.0786 -2.2388]
 [ 0.0067  1.       0.0028 -0.3551]
 [ 0.0786 -0.0033  0.9969 34.2244]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00458
Mean Error Translation: 2.14686
== [Result] Frame: 52, Matches 283, Inliers: 69.96
Saved at vis_preFeature/frame052.jpg
[[ 0.9969 -0.0029 -0.0781 -2.3227]
 [ 0.0029  1.       -0.0006 -0.3686]
 [ 0.0781  0.0004  0.9969 35.0314]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00460
Mean Error Translation: 2.10960
== [Result] Frame: 53, Matches 292, Inliers: 72.95
Saved at vis_preFeature/frame053.jpg
[[ 0.9969 -0.0021 -0.0792 -2.3807]
 [ 0.002   1.       -0.0014 -0.381  ]
 [ 0.0792  0.0012  0.9969 35.8016]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00454
Mean Error Translation: 2.07447
== [Result] Frame: 54, Matches 311, Inliers: 78.14
Saved at vis_preFeature/frame054.jpg
[[ 0.9968 -0.0031 -0.08   -2.4354]
 [ 0.0033  1.       0.002  -0.3877]
 [ 0.08   -0.0022  0.9968 36.5845]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00448
Mean Error Translation: 2.04040
== [Result] Frame: 55, Matches 315, Inliers: 72.06
Saved at vis_preFeature/frame055.jpg
[[ 0.9967 -0.0059 -0.0811 -2.5054]
 [ 0.0063  1.       0.0052 -0.4012]
 [ 0.081  -0.0057  0.9967 37.4662]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00442
Mean Error Translation: 2.00569

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```

== [Result] Frame: 56, Matches 307, Inliers: 72.31
Saved at vis_preFeature/frame056.jpg
[[ 0.9967 -0.0066 -0.0808 -2.586 ]
 [ 0.0071  1.       0.0054 -0.4076]
 [ 0.0807 -0.0059  0.9967 38.3196]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00437
Mean Error Translation: 1.97261
== [Result] Frame: 57, Matches 306, Inliers: 74.84
Saved at vis_preFeature/frame057.jpg
[[ 0.9966 -0.0109 -0.0811 -2.6358]
 [ 0.0113  0.9999  0.0044 -0.4179]
 [ 0.0811 -0.0053  0.9967 39.029 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00432
Mean Error Translation: 1.94299
== [Result] Frame: 58, Matches 309, Inliers: 71.52
Saved at vis_preFeature/frame058.jpg
[[ 0.9964 -0.0137 -0.0832 -2.6749]
 [ 0.014   0.9999  0.0025 -0.4189]
 [ 0.0832 -0.0036  0.9965 39.7362]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00429
Mean Error Translation: 1.91444
== [Result] Frame: 59, Matches 301, Inliers: 71.43
Saved at vis_preFeature/frame059.jpg
[[ 0.9964 -0.0143 -0.0837 -2.7427]
 [ 0.0147  0.9999  0.0037 -0.4264]
 [ 0.0837 -0.0049  0.9965 40.4503]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00425
Mean Error Translation: 1.88663
== [Result] Frame: 60, Matches 293, Inliers: 74.06
Saved at vis_preFeature/frame060.jpg
[[ 0.9963 -0.017  -0.0848 -2.8011]
 [ 0.0177  0.9998  0.0078 -0.4318]
 [ 0.0846 -0.0093  0.9964 41.1429]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00418
Mean Error Translation: 1.86013
== [Result] Frame: 61, Matches 277, Inliers: 76.17
Saved at vis_preFeature/frame061.jpg
[[ 0.9964 -0.0161 -0.0835 -2.8799]
 [ 0.0173  0.9998  0.0129 -0.4369]
 [ 0.0833 -0.0143  0.9964 41.8497]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00418
Mean Error Translation: 1.83424

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== [Result] Frame: 62, Matches 290, Inliers: 74.48
Saved at vis_preFeature/frame062.jpg
[[ 0.9964 -0.013 -0.084 -2.947 ]
 [ 0.0143 0.9998 0.0149 -0.4393]
 [ 0.0838 -0.016 0.9964 42.5831]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00415
Mean Error Translation: 1.80860
== [Result] Frame: 63, Matches 276, Inliers: 76.45
Saved at vis_preFeature/frame063.jpg
[[ 0.9962 -0.0139 -0.0861 -3.0087]
 [ 0.0149 0.9998 0.0109 -0.4442]
 [ 0.0859 -0.0121 0.9962 43.3382]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00415
Mean Error Translation: 1.78326
== [Result] Frame: 64, Matches 277, Inliers: 74.01
Saved at vis_preFeature/frame064.jpg
[[ 0.9961 -0.0141 -0.0876 -3.0722]
 [ 0.0145 0.9999 0.0035 -0.4524]
 [ 0.0876 -0.0048 0.9961 44.0886]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00412
Mean Error Translation: 1.75852
== [Result] Frame: 65, Matches 287, Inliers: 76.31
Saved at vis_preFeature/frame065.jpg
[[ 0.996 -0.011 -0.0884 -3.1419]
 [ 0.0109 0.9999 -0.0018 -0.4571]
 [ 0.0885 0.0009 0.9961 44.8253]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00411
Mean Error Translation: 1.73460
== [Result] Frame: 66, Matches 284, Inliers: 72.18
Saved at vis_preFeature/frame066.jpg
[[ 0.996 -0.004 -0.089 -3.2205]
 [ 0.004 1. -0.0008 -0.4691]
 [ 0.089 0.0004 0.996 45.5356]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00409
Mean Error Translation: 1.71171
== [Result] Frame: 67, Matches 296, Inliers: 70.95
Saved at vis_preFeature/frame067.jpg
[[ 0.9958 -0.0056 -0.0916 -3.2726]
 [ 0.0057 1. 0.0015 -0.4827]
 [ 0.0916 -0.0021 0.9958 46.2559]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00414
Mean Error Translation: 1.68919

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== [Result] Frame: 68, Matches 300, Inliers: 69.67
Saved at vis_preFeature/frame068.jpg
[[ 0.9957 -0.0037 -0.0929 -3.3404]
 [ 0.004   1.      0.003  -0.4937]
 [ 0.0929 -0.0034  0.9957 46.9578]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00410
Mean Error Translation: 1.66735
== [Result] Frame: 69, Matches 313, Inliers: 76.68
Saved at vis_preFeature/frame069.jpg
[[ 0.9955 -0.0037 -0.0942 -3.4072]
 [ 0.004   1.      0.0026 -0.5016]
 [ 0.0942 -0.0029  0.9955 47.6394]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00405
Mean Error Translation: 1.64622
== [Result] Frame: 70, Matches 296, Inliers: 76.69
Saved at vis_preFeature/frame070.jpg
[[ 0.9954 -0.0018 -0.0958 -3.4739]
 [ 0.0021  1.      0.0031 -0.509 ]
 [ 0.0958 -0.0033  0.9954 48.2838]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00400
Mean Error Translation: 1.62601
== [Result] Frame: 71, Matches 289, Inliers: 70.59
Saved at vis_preFeature/frame071.jpg
[[ 0.9952 -0.0007 -0.0975 -3.5451]
 [ 0.0011  1.      0.0038 -0.5228]
 [ 0.0975 -0.0039  0.9952 48.9634]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00396
Mean Error Translation: 1.60571
== [Result] Frame: 72, Matches 294, Inliers: 71.43
Saved at vis_preFeature/frame072.jpg
[[ 0.9951 -0.0005 -0.0992 -3.609 ]
 [ 0.0009  1.      0.004  -0.5316]
 [ 0.0992 -0.0041  0.9951 49.6335]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00392
Mean Error Translation: 1.58590
== [Result] Frame: 73, Matches 288, Inliers: 72.92
Saved at vis_preFeature/frame073.jpg
[[ 0.995   0.0001 -0.0999 -3.6928]
 [ 0.0004  1.      0.0046 -0.5339]
 [ 0.0999 -0.0047  0.995  50.3359]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00389
Mean Error Translation: 1.56606

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== [Result] Frame: 74, Matches 278, Inliers: 73.74
Saved at vis_preFeature/frame074.jpg
[[ 0.9947 -0.0015 -0.103 -3.7469]
 [ 0.0022  1.       0.0068 -0.5367]
 [ 0.103   -0.007   0.9947 51.0372]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00392
Mean Error Translation: 1.54660
== [Result] Frame: 75, Matches 277, Inliers: 65.34
Saved at vis_preFeature/frame075.jpg
[[ 0.9946  0.0005 -0.1041 -3.8236]
 [ 0.0007  0.9999  0.0113 -0.5465]
 [ 0.1041 -0.0113  0.9945 51.6904]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00387
Mean Error Translation: 1.52811
== [Result] Frame: 76, Matches 293, Inliers: 70.99
Saved at vis_preFeature/frame076.jpg
[[ 0.9942  0.0013 -0.1072 -3.8838]
 [ 0.0001  0.9999  0.0129 -0.5551]
 [ 0.1072 -0.0128  0.9942 52.3667]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00386
Mean Error Translation: 1.50958
== [Result] Frame: 77, Matches 295, Inliers: 71.19
Saved at vis_preFeature/frame077.jpg
[[ 0.9941  0.006  -0.1081 -3.9634]
 [-0.005   0.9999  0.0089 -0.5668]
 [ 0.1082 -0.0083  0.9941 53.0366]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00385
Mean Error Translation: 1.49132
== [Result] Frame: 78, Matches 303, Inliers: 72.28
Saved at vis_preFeature/frame078.jpg
[[ 0.9941  0.0084 -0.108  -4.0499]
 [-0.0082  1.       0.0016 -0.5749]
 [ 0.108  -0.0007  0.9942 53.6597]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00385
Mean Error Translation: 1.47385
== [Result] Frame: 79, Matches 314, Inliers: 74.20
Saved at vis_preFeature/frame079.jpg
[[ 0.9939  0.006  -0.1104 -4.1007]
 [-0.0065  1.       -0.004  -0.5852]
 [ 0.1104  0.0047  0.9939 54.2312]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00382
Mean Error Translation: 1.45720

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== [Result] Frame: 80, Matches 321, Inliers: 76.64
Saved at vis_preFeature/frame080.jpg
[[ 0.9937  0.005 -0.112 -4.1553]
 [-0.0057  1.     -0.0057 -0.5857]
 [ 0.112   0.0063  0.9937 54.795 ]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00381
Mean Error Translation: 1.44087
== [Result] Frame: 81, Matches 323, Inliers: 82.35
Saved at vis_preFeature/frame081.jpg
[[ 0.9937  0.0107 -0.112 -4.2265]
 [-0.0109  0.9999 -0.0019 -0.5988]
 [ 0.1119  0.0032  0.9937 55.3129]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00382
Mean Error Translation: 1.42524
== [Result] Frame: 82, Matches 314, Inliers: 72.29
Saved at vis_preFeature/frame082.jpg
[[ 0.9934  0.0094 -0.1142 -4.2777]
 [-0.0093  1.     0.0007 -0.6149]
 [ 0.1142  0.0003  0.9935 55.8224]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00382
Mean Error Translation: 1.40985
== [Result] Frame: 83, Matches 302, Inliers: 78.48
Saved at vis_preFeature/frame083.jpg
[[ 0.9934  0.0068 -0.1149 -4.3364]
 [-0.0072  1.     -0.0029 -0.6224]
 [ 0.1149  0.0037  0.9934 56.2958]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00380
Mean Error Translation: 1.39496
== [Result] Frame: 84, Matches 316, Inliers: 80.06
Saved at vis_preFeature/frame084.jpg
[[ 0.9933 -0.002 -0.1156 -4.378 ]
 [ 0.0011  1.     -0.008 -0.6314]
 [ 0.1156  0.0078  0.9933 56.7414]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00377
Mean Error Translation: 1.38052
== [Result] Frame: 85, Matches 301, Inliers: 77.74
Saved at vis_preFeature/frame085.jpg
[[ 0.9932 -0.0085 -0.1161 -4.4092]
 [ 0.0071  0.9999 -0.0128 -0.6392]
 [ 0.1162  0.0119  0.9932 57.1263]
 [ 0.     0.     0.     1.     ]]
Mean Error Rotation: 0.00377
Mean Error Translation: 1.36692

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== [Result] Frame: 86, Matches 291, Inliers: 81.10
Saved at vis_preFeature/frame086.jpg
[[ 0.9934 -0.0079 -0.1144 -4.442 ]
 [ 0.0064  0.9999 -0.0139 -0.6401]
 [ 0.1145  0.0131  0.9933 57.5135]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00375
Mean Error Translation: 1.35348
== [Result] Frame: 87, Matches 294, Inliers: 86.05
Saved at vis_preFeature/frame087.jpg
[[ 0.994 -0.0026 -0.1091 -4.5055]
 [ 0.0014  0.9999 -0.0115 -0.6446]
 [ 0.1091  0.0112  0.994 57.9029]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00373
Mean Error Translation: 1.34016
== [Result] Frame: 88, Matches 296, Inliers: 84.46
Saved at vis_preFeature/frame088.jpg
[[ 0.9947 -0.0022 -0.1032 -4.557 ]
 [ 0.0014  1.       -0.0082 -0.6547]
 [ 0.1032  0.008   0.9946 58.269 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00372
Mean Error Translation: 1.32724
== [Result] Frame: 89, Matches 289, Inliers: 85.12
Saved at vis_preFeature/frame089.jpg
[[ 0.9953 -0.0035 -0.0965 -4.5967]
 [ 0.0031  1.       -0.0042 -0.6618]
 [ 0.0966  0.0039  0.9953 58.6452]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00374
Mean Error Translation: 1.31436
== [Result] Frame: 90, Matches 283, Inliers: 87.63
Saved at vis_preFeature/frame090.jpg
[[ 0.996 -0.0099 -0.0887 -4.6184]
 [ 0.0099  1.       -0.0005 -0.6731]
 [ 0.0887 -0.0004  0.9961 59.0189]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00373
Mean Error Translation: 1.30165
== [Result] Frame: 91, Matches 292, Inliers: 83.56
Saved at vis_preFeature/frame091.jpg
[[ 0.9971 -0.0033 -0.0757 -4.6679]
 [ 0.0033  1.       -0.0005 -0.6826]
 [ 0.0757  0.0002  0.9971 59.3808]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00376
Mean Error Translation: 1.28916

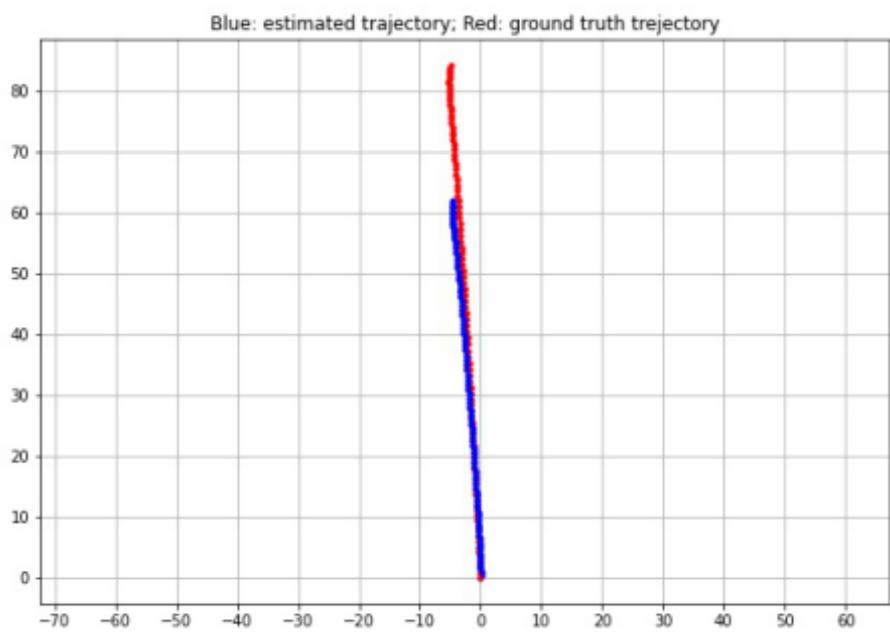
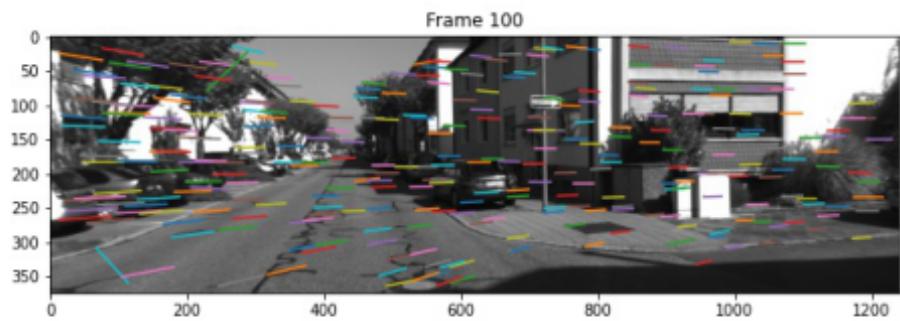
```

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== [Result] Frame: 92, Matches 290, Inliers: 85.52
Saved at vis_preFeature/frame092.jpg
[[ 0.9981  0.0018 -0.0611 -4.6882]
 [-0.0018  1.      -0.0007 -0.6911]
 [ 0.0611  0.0008  0.9981 59.7318]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00373
Mean Error Translation: 1.27692
== [Result] Frame: 93, Matches 291, Inliers: 86.25
Saved at vis_preFeature/frame093.jpg
[[ 0.9991  0.0097 -0.041   -4.7188]
 [-0.0097  1.      0.0002 -0.7013]
 [ 0.041   0.0002  0.9992 60.0867]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00374
Mean Error Translation: 1.26476
== [Result] Frame: 94, Matches 294, Inliers: 81.63
Saved at vis_preFeature/frame094.jpg
[[ 0.9998  0.0069 -0.0198 -4.7084]
 [-0.0069  1.      0.0002 -0.702 ]
 [ 0.0198 -0.0001  0.9998 60.4266]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00372
Mean Error Translation: 1.25287
== [Result] Frame: 95, Matches 303, Inliers: 80.53
Saved at vis_preFeature/frame095.jpg
[[ 1.      0.0027  0.0062 -4.6906]
 [-0.0027  1.      0.0015 -0.7098]
 [-0.0062 -0.0015  1.      60.771 ]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00370
Mean Error Translation: 1.24103
== [Result] Frame: 96, Matches 311, Inliers: 85.53
Saved at vis_preFeature/frame096.jpg
[[ 0.9994  0.0023  0.0357 -4.666 ]
 [-0.0025  1.      0.0033 -0.7141]
 [-0.0357 -0.0034  0.9994 61.1167]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00368
Mean Error Translation: 1.22936
== [Result] Frame: 97, Matches 312, Inliers: 85.58
Saved at vis_preFeature/frame097.jpg
[[ 0.9975  0.0059  0.07   -4.6402]
 [-0.0063  1.      0.0052 -0.7225]
 [-0.0699 -0.0056  0.9975 61.4621]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00370
Mean Error Translation: 1.21790

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== [Result] Frame: 98, Matches 301, Inliers: 81.40
Saved at vis_preFeature/frame098.jpg
[[ 0.9945  0.0027  0.105  -4.5648]
 [-0.0033  1.       0.0054 -0.7273]
 [-0.105   -0.0057  0.9945  61.7964]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00371
Mean Error Translation: 1.20658
== [Result] Frame: 99, Matches 304, Inliers: 82.57
Saved at vis_preFeature/frame099.jpg
[[ 0.9892  0.0019  0.1462 -4.4955]
 [-0.0026  1.       0.0052 -0.727 ]
 [-0.1462 -0.0056  0.9892  62.1221]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00369
Mean Error Translation: 1.19558
== [Result] Frame: 100, Matches 294, Inliers: 77.89
Saved at vis_preFeature/frame100.jpg
<Figure size 432x288 with 0 Axes>
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[[ 0.9822 -0.0032  0.1878 -4.3786]
 [ 0.0024  1.       0.0045 -0.7312]
 [-0.1878 -0.004   0.9822 62.4296]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00373
Mean Error Translation: 1.18481
== [Result] Frame: 101, Matches 296, Inliers: 81.76
Saved at vis_preFeature/frame101.jpg
[[ 0.972  -0.0015  0.2348 -4.2657]
 [ 0.0009  1.       0.0026 -0.7362]
 [-0.2348 -0.0023  0.972   62.7342]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00371
Mean Error Translation: 1.17407
== [Result] Frame: 102, Matches 305, Inliers: 79.67
Saved at vis_preFeature/frame102.jpg
[[ 0.9596 -0.0067  0.2814 -4.0896]
 [ 0.0074  1.       -0.0015 -0.7412]
 [-0.2814  0.0035  0.9596 63.0165]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00380
Mean Error Translation: 1.16368
== [Result] Frame: 103, Matches 302, Inliers: 78.15
Saved at vis_preFeature/frame103.jpg
[[ 0.9427 -0.0115  0.3334 -3.919 ]
 [ 0.0134  0.9999 -0.0034 -0.7476]
 [-0.3333  0.0076  0.9428 63.2865]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00385
Mean Error Translation: 1.15329
== [Result] Frame: 104, Matches 296, Inliers: 82.77
Saved at vis_preFeature/frame104.jpg
[[ 0.9211 -0.0151  0.389  -3.7547]
 [ 0.0182  0.9998 -0.0041 -0.7518]
 [-0.3889  0.0109  0.9212 63.547 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00387
Mean Error Translation: 1.14322
== [Result] Frame: 105, Matches 304, Inliers: 78.62
Saved at vis_preFeature/frame105.jpg
[[ 0.8943 -0.0161  0.4472 -3.5877]
 [ 0.0203  0.9998 -0.0046 -0.7531]
 [-0.447   0.0132  0.8944 63.7997]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00386
Mean Error Translation: 1.13332

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== [Result] Frame: 106, Matches 305, Inliers: 81.31
Saved at vis_preFeature/frame106.jpg
[[ 0.865 -0.0201  0.5014 -3.3811]
 [ 0.0263  0.9996 -0.0054 -0.7572]
 [-0.5011  0.0179  0.8652 64.0159]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00387
Mean Error Translation: 1.12349
== [Result] Frame: 107, Matches 310, Inliers: 74.84
Saved at vis_preFeature/frame107.jpg
[[ 0.8323 -0.0225  0.5539 -3.1707]
 [ 0.0309  0.9995 -0.0059 -0.7555]
 [-0.5535  0.022   0.8325 64.2193]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00389
Mean Error Translation: 1.11400
== [Result] Frame: 108, Matches 320, Inliers: 80.31
Saved at vis_preFeature/frame108.jpg
[[ 0.7974 -0.0273  0.6028 -2.9367]
 [ 0.0375  0.9993 -0.0044 -0.7517]
 [-0.6022  0.0262  0.7979 64.4039]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00395
Mean Error Translation: 1.10452
== [Result] Frame: 109, Matches 313, Inliers: 75.40
Saved at vis_preFeature/frame109.jpg
[[ 0.758 -0.0288  0.6516 -2.7077]
 [ 0.0381  0.9993 -0.0001 -0.7518]
 [-0.6511  0.0249  0.7586 64.6032]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00393
Mean Error Translation: 1.09525
== [Result] Frame: 110, Matches 308, Inliers: 77.60
Saved at vis_preFeature/frame110.jpg
[[ 0.7169 -0.0315  0.6965 -2.4624]
 [ 0.0417  0.9991  0.0023 -0.7495]
 [-0.696   0.0274  0.7175 64.771 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00394
Mean Error Translation: 1.08617
== [Result] Frame: 111, Matches 298, Inliers: 81.21
Saved at vis_preFeature/frame111.jpg
[[ 0.6712 -0.0317  0.7406 -2.2095]
 [ 0.0424  0.9991  0.0043 -0.7534]
 [-0.7401  0.0285  0.6719 64.9714]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00395
Mean Error Translation: 1.07714

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== [Result] Frame: 112, Matches 314, Inliers: 82.17
Saved at vis_preFeature/frame112.jpg
[[ 0.6292 -0.0362  0.7764 -1.9357]
 [ 0.0512  0.9987  0.0051 -0.7507]
 [-0.7755  0.0365  0.6303 65.0941]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00397
Mean Error Translation: 1.06835
== [Result] Frame: 113, Matches 314, Inliers: 82.80
Saved at vis_preFeature/frame113.jpg
[[ 0.5856 -0.0343  0.8099 -1.6719]
 [ 0.0502  0.9987  0.006 -0.7481]
 [-0.809   0.0371  0.5866 65.231 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00395
Mean Error Translation: 1.05965
== [Result] Frame: 114, Matches 329, Inliers: 77.81
Saved at vis_preFeature/frame114.jpg
[[ 0.5418 -0.0327  0.8399 -1.4019]
 [ 0.0483  0.9988  0.0077 -0.751 ]
 [-0.8391  0.0364  0.5428 65.3562]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00395
Mean Error Translation: 1.05116
== [Result] Frame: 115, Matches 314, Inliers: 82.17
Saved at vis_preFeature/frame115.jpg
[[ 0.4988 -0.0307  0.8662 -1.1172]
 [ 0.0469  0.9989  0.0084 -0.7523]
 [-0.8655  0.0364  0.4996 65.4807]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00392
Mean Error Translation: 1.04272
== [Result] Frame: 116, Matches 326, Inliers: 80.98
Saved at vis_preFeature/frame116.jpg
[[ 0.4577 -0.0336  0.8885 -0.6206]
 [ 0.0535  0.9985  0.0102 -0.7499]
 [-0.8875  0.0428  0.4588 65.6657]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00390
Mean Error Translation: 1.03515
== [Result] Frame: 117, Matches 318, Inliers: 78.62
Saved at vis_preFeature/frame117.jpg
[[ 0.4191 -0.0421  0.907 -0.1467]
 [ 0.0688  0.9975  0.0146 -0.7377]
 [-0.9053  0.0563  0.4209 65.8064]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00388
Mean Error Translation: 1.02731

```

```

== [Result] Frame: 118, Matches 318, Inliers: 82.39
Saved at vis_preFeature/frame118.jpg
[[ 0.3848 -0.0467  0.9218  0.4002]
 [ 0.0727  0.9971  0.0202 -0.7323]
 [-0.9201  0.0593  0.3871  65.9698]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00386
Mean Error Translation: 1.02025
== [Result] Frame: 119, Matches 307, Inliers: 78.50
Saved at vis_preFeature/frame119.jpg
[[ 0.3522 -0.0424  0.935   0.9115]
 [ 0.069   0.9974  0.0192 -0.7275]
 [-0.9334  0.0578  0.3542  66.1433]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00385
Mean Error Translation: 1.01308
== [Result] Frame: 120, Matches 316, Inliers: 73.10
Saved at vis_preFeature/frame120.jpg
[[ 0.3217 -0.0349  0.9462  1.4663]
 [ 0.0571  0.9982  0.0174 -0.7433]
 [-0.9451  0.0484  0.3231  66.3361]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00383
Mean Error Translation: 1.00637
== [Result] Frame: 121, Matches 315, Inliers: 72.38
Saved at vis_preFeature/frame121.jpg
[[ 0.295  -0.0299  0.955   2.0394]
 [ 0.0525  0.9985  0.0151 -0.7399]
 [-0.9541  0.0457  0.2961  66.4848]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00383
Mean Error Translation: 0.99977
== [Result] Frame: 122, Matches 325, Inliers: 71.69
Saved at vis_preFeature/frame122.jpg
[[ 0.2686 -0.0279  0.9628  2.6818]
 [ 0.0525  0.9985  0.0143 -0.7401]
 [-0.9618  0.0467  0.2697  66.6452]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00381
Mean Error Translation: 0.99377
== [Result] Frame: 123, Matches 333, Inliers: 70.27
Saved at vis_preFeature/frame123.jpg
[[ 0.2471 -0.0272  0.9686  3.3808]
 [ 0.0609  0.9981  0.0125 -0.7328]
 [-0.9671  0.0559  0.2482  66.7375]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00382
Mean Error Translation: 0.98813

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```

== [Result] Frame: 124, Matches 341, Inliers: 70.09
Saved at vis_preFeature/frame124.jpg
[[ 0.2271 -0.0209  0.9736  4.1331]
 [ 0.0675  0.9977  0.0057 -0.6985]
 [-0.9715  0.0644  0.228   66.8656]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00381
Mean Error Translation: 0.98297
== [Result] Frame: 125, Matches 326, Inliers: 68.71
Saved at vis_preFeature/frame125.jpg
[[ 0.2073 -0.0148  0.9782  5.0156]
 [ 0.0695  0.9976  0.0003 -0.6747]
 [-0.9758  0.0679  0.2078  67.0393]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00380
Mean Error Translation: 0.97893
== [Result] Frame: 126, Matches 316, Inliers: 64.87
Saved at vis_preFeature/frame126.jpg
[[ 0.1881 -0.0127  0.9821  6.377 ]
 [ 0.0643  0.9979  0.0006 -0.6536]
 [-0.98     0.063   0.1885  67.3656]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00380
Mean Error Translation: 0.97874
== [Result] Frame: 127, Matches 313, Inliers: 64.86
Saved at vis_preFeature/frame127.jpg
[[ 0.172  -0.0171  0.985   7.2568]
 [ 0.0616  0.9981  0.0065 -0.6701]
 [-0.9832  0.0595  0.1727  67.5278]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00378
Mean Error Translation: 0.97445
== [Result] Frame: 128, Matches 313, Inliers: 65.50
Saved at vis_preFeature/frame128.jpg
[[ 0.1572 -0.0199  0.9874  7.5931]
 [ 0.061   0.9981  0.0104 -0.6703]
 [-0.9857  0.0586  0.1581  67.5797]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00376
Mean Error Translation: 0.96798
== [Result] Frame: 129, Matches 301, Inliers: 64.12
Saved at vis_preFeature/frame129.jpg
[[ 0.1425 -0.0221  0.9895  7.9341]
 [ 0.0617  0.998   0.0134 -0.6693]
 [-0.9879  0.0591  0.1436  67.6336]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00376
Mean Error Translation: 0.96169

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```

== [Result] Frame: 130, Matches 312, Inliers: 63.46
Saved at vis_preFeature/frame130.jpg
[[ 0.1311 -0.0233  0.9911  8.3023]
 [ 0.0646  0.9978  0.015  -0.6664]
 [-0.9893  0.062   0.1323  67.673 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00374
Mean Error Translation: 0.95535
== [Result] Frame: 131, Matches 295, Inliers: 72.54
Saved at vis_preFeature/frame131.jpg
[[ 0.1216 -0.0224  0.9923  8.6829]
 [ 0.0679  0.9976  0.0142 -0.6587]
 [-0.9902  0.0657  0.1229  67.7048]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00372
Mean Error Translation: 0.94915
== [Result] Frame: 132, Matches 306, Inliers: 71.24
Saved at vis_preFeature/frame132.jpg
[[ 0.114  -0.0221  0.9932  9.0812]
 [ 0.0701  0.9974  0.0141 -0.6555]
 [-0.991   0.0681  0.1153  67.7478]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00370
Mean Error Translation: 0.94304
== [Result] Frame: 133, Matches 307, Inliers: 72.96
Saved at vis_preFeature/frame133.jpg
[[ 0.1076 -0.0214  0.994   9.4783]
 [ 0.0696  0.9975  0.014  -0.6534]
 [-0.9918  0.0676  0.1088  67.799 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00370
Mean Error Translation: 0.93715
== [Result] Frame: 134, Matches 297, Inliers: 64.65
Saved at vis_preFeature/frame134.jpg
[[ 0.1024 -0.0201  0.9945  9.8972]
 [ 0.0717  0.9973  0.0128 -0.6471]
 [-0.9922  0.07    0.1036  67.8383]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00368
Mean Error Translation: 0.93131
== [Result] Frame: 135, Matches 296, Inliers: 70.27
Saved at vis_preFeature/frame135.jpg
[[ 0.0975 -0.02    0.995   10.3399]
 [ 0.0739  0.9972  0.0128 -0.6441]
 [-0.9925  0.0723  0.0987  67.8676]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00368
Mean Error Translation: 0.92551

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```

== [Result] Frame: 136, Matches 295, Inliers: 65.76
Saved at vis_preFeature/frame136.jpg
[[ 0.0926 -0.0205  0.9955 10.7969]
 [ 0.0769  0.997   0.0134 -0.6407]
 [-0.9927  0.0753  0.0939 67.9136]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00366
Mean Error Translation: 0.91985
== [Result] Frame: 137, Matches 285, Inliers: 65.26
Saved at vis_preFeature/frame137.jpg
[[ 0.0896 -0.0212  0.9957 11.2772]
 [ 0.0813  0.9966  0.0139 -0.6355]
 [-0.9927  0.0797  0.0911 67.9502]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00367
Mean Error Translation: 0.91423
== [Result] Frame: 138, Matches 299, Inliers: 60.54
Saved at vis_preFeature/frame138.jpg
[[ 0.0862 -0.0216  0.996   12.0741]
 [ 0.0804  0.9967  0.0147 -0.6304]
 [-0.993   0.0789  0.0877 68.0283]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00366
Mean Error Translation: 0.90890
== [Result] Frame: 139, Matches 297, Inliers: 67.00
Saved at vis_preFeature/frame139.jpg
[[ 0.0848 -0.0234  0.9961 12.8527]
 [ 0.0852  0.9962  0.0161 -0.6362]
 [-0.9927  0.0835  0.0865 68.063 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00367
Mean Error Translation: 0.90333
== [Result] Frame: 140, Matches 308, Inliers: 65.26
Saved at vis_preFeature/frame140.jpg
[[ 0.0848 -0.0243  0.9961 13.5485]
 [ 0.091   0.9957  0.0166 -0.6292]
 [-0.9922  0.0892  0.0866 68.105 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00366
Mean Error Translation: 0.89729
== [Result] Frame: 141, Matches 295, Inliers: 67.80
Saved at vis_preFeature/frame141.jpg
[[ 0.0857 -0.0247  0.996   14.1252]
 [ 0.0954  0.9953  0.0165 -0.6216]
 [-0.9917  0.0936  0.0877 68.1496]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00365
Mean Error Translation: 0.89182

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```

== [Result] Frame: 142, Matches 288, Inliers: 72.92
Saved at vis_preFeature/frame142.jpg
[[ 0.0876 -0.0247  0.9958 14.7377]
 [ 0.0969  0.9952  0.0162 -0.6132]
 [-0.9914  0.0951  0.0896 68.2107]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00363
Mean Error Translation: 0.88637
== [Result] Frame: 143, Matches 285, Inliers: 75.44
Saved at vis_preFeature/frame143.jpg
[[ 0.0915 -0.0242  0.9955 15.3354]
 [ 0.1003  0.9948  0.015  -0.5976]
 [-0.9907  0.0985  0.0934 68.2651]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00362
Mean Error Translation: 0.88117
== [Result] Frame: 144, Matches 280, Inliers: 75.71
Saved at vis_preFeature/frame144.jpg
[[ 0.0952 -0.0247  0.9951 15.9401]
 [ 0.0989  0.995  0.0152 -0.5929]
 [-0.9905  0.097  0.0972 68.3276]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00361
Mean Error Translation: 0.87609
== [Result] Frame: 145, Matches 273, Inliers: 77.29
Saved at vis_preFeature/frame145.jpg
[[ 0.0962 -0.0245  0.9951 16.5141]
 [ 0.095  0.9954  0.0153 -0.5804]
 [-0.9908  0.0931  0.098  68.4179]
 [ 0.       0.       0.       1.      ]]

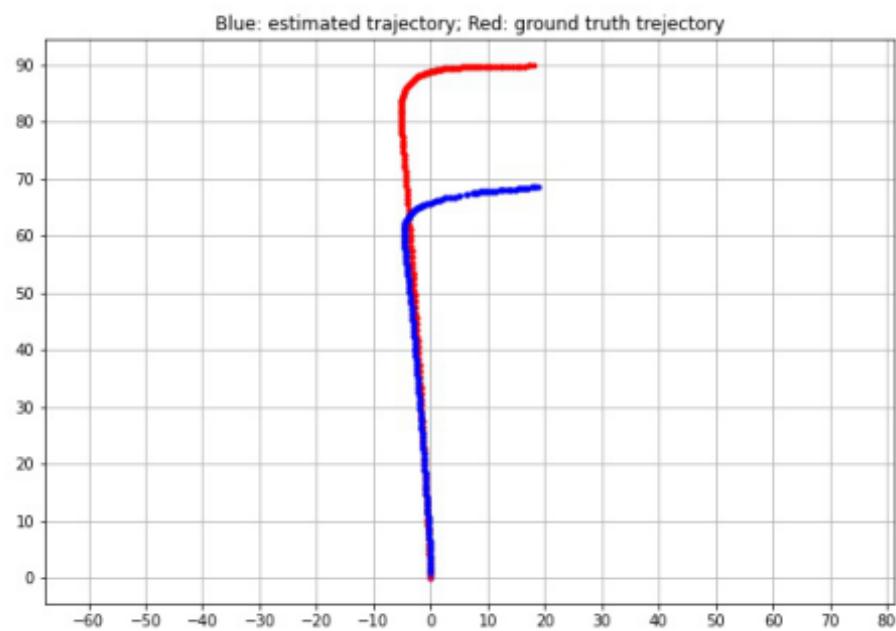
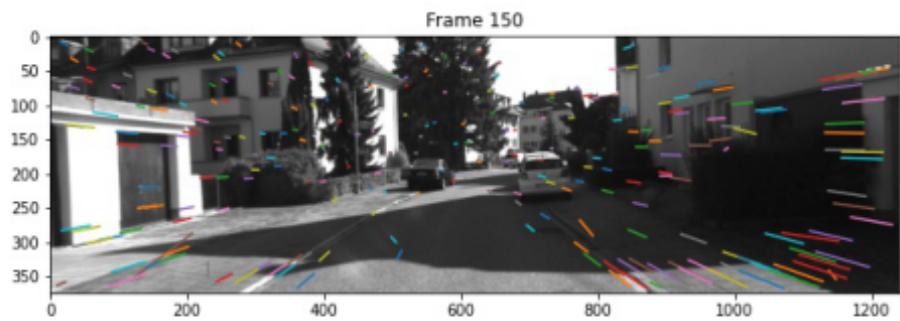
Mean Error Rotation: 0.00365
Mean Error Translation: 0.87146
== [Result] Frame: 146, Matches 266, Inliers: 80.45
Saved at vis_preFeature/frame146.jpg
[[ 0.1002 -0.0264  0.9946 17.0997]
 [ 0.0944  0.9954  0.0169 -0.5782]
 [-0.9905  0.0922  0.1022 68.4834]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00363
Mean Error Translation: 0.86683
== [Result] Frame: 147, Matches 265, Inliers: 87.55
Saved at vis_preFeature/frame147.jpg
[[ 0.1032 -0.0286  0.9943 17.6949]
 [ 0.091  0.9957  0.0192 -0.577 ]
 [-0.9905  0.0885  0.1053 68.5615]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00362
Mean Error Translation: 0.86231

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```
== [Result] Frame: 148, Matches 261, Inliers: 85.82
Saved at vis_preFeature/frame148.jpg
[[ 0.1071 -0.0297  0.9938 18.311 ]
 [ 0.0907  0.9957  0.02   -0.5707]
 [-0.9901  0.088   0.1093 68.636 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00360
Mean Error Translation: 0.85775
== [Result] Frame: 149, Matches 258, Inliers: 79.84
Saved at vis_preFeature/frame149.jpg
[[ 0.112  -0.0292  0.9933 18.9525]
 [ 0.0902  0.9957  0.0191 -0.5669]
 [-0.9896  0.0874  0.1142 68.7041]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00360
Mean Error Translation: 0.85313
== [Result] Frame: 150, Matches 254, Inliers: 82.68
Saved at vis_preFeature/frame150.jpg
<Figure size 432x288 with 0 Axes>
```



```

[[ 0.1178 -0.0265  0.9927 19.6087]
 [ 0.0923  0.9956  0.0156 -0.5708]
 [-0.9887  0.0898  0.1198 68.7593]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00362
Mean Error Translation: 0.84848
== [Result] Frame: 151, Matches 239, Inliers: 76.57
Saved at vis_preFeature/frame151.jpg
[[ 0.1205 -0.0215  0.9925 20.2501]
 [ 0.0887  0.996   0.0108 -0.5732]
 [-0.9887  0.0867  0.1219 68.8348]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00362
Mean Error Translation: 0.84402
== [Result] Frame: 152, Matches 238, Inliers: 75.63
Saved at vis_preFeature/frame152.jpg
[[ 0.1203 -0.0179  0.9926 20.9406]
 [ 0.0869  0.9962  0.0075 -0.5659]
 [-0.9889  0.0854  0.1214 68.9274]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00360
Mean Error Translation: 0.83939
== [Result] Frame: 153, Matches 244, Inliers: 75.82
Saved at vis_preFeature/frame153.jpg
[[ 0.1192 -0.0174  0.9927 21.6256]
 [ 0.0833  0.9965  0.0075 -0.5596]
 [-0.9894  0.0818  0.1202 69.0412]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00360
Mean Error Translation: 0.83494
== [Result] Frame: 154, Matches 262, Inliers: 76.72
Saved at vis_preFeature/frame154.jpg
[[ 0.1187 -0.019   0.9928 22.3641]
 [ 0.0797  0.9968  0.0095 -0.5634]
 [-0.9897  0.078   0.1198 69.1483]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00358
Mean Error Translation: 0.83023
== [Result] Frame: 155, Matches 265, Inliers: 75.47
Saved at vis_preFeature/frame155.jpg
[[ 0.1197 -0.0204  0.9926 23.2245]
 [ 0.0819  0.9966  0.0106 -0.5649]
 [-0.9894  0.08     0.1209 69.2257]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00358
Mean Error Translation: 0.82533

```

```

== [Result] Frame: 156, Matches 271, Inliers: 77.12
Saved at vis_preFeature/frame156.jpg
[[ 0.1202 -0.0209  0.9925 24.0559]
 [ 0.0796  0.9968  0.0114 -0.5691]
 [-0.9896  0.0776  0.1214 69.3322]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00356
Mean Error Translation: 0.82053
== [Result] Frame: 157, Matches 274, Inliers: 76.64
Saved at vis_preFeature/frame157.jpg
[[ 0.1208 -0.021   0.9925 24.7952]
 [ 0.0793  0.9968  0.0114 -0.5755]
 [-0.9895  0.0773  0.1221 69.4129]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00355
Mean Error Translation: 0.81592
== [Result] Frame: 158, Matches 273, Inliers: 77.29
Saved at vis_preFeature/frame158.jpg
[[ 0.1221 -0.0203  0.9923 25.6069]
 [ 0.0771  0.997   0.0109 -0.5783]
 [-0.9895  0.0751  0.1233 69.5075]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00354
Mean Error Translation: 0.81116
== [Result] Frame: 159, Matches 272, Inliers: 72.43
Saved at vis_preFeature/frame159.jpg
[[ 0.1194 -0.0183  0.9927 26.2944]
 [ 0.0712  0.9974  0.0098 -0.5835]
 [-0.9903  0.0695  0.1204 69.6229]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00355
Mean Error Translation: 0.80700
== [Result] Frame: 160, Matches 274, Inliers: 70.07
Saved at vis_preFeature/frame160.jpg
[[ 0.1164 -0.019   0.993   27.0746]
 [ 0.0669  0.9977  0.0112 -0.5911]
 [-0.9909  0.0652  0.1174 69.7267]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00354
Mean Error Translation: 0.80244
== [Result] Frame: 161, Matches 284, Inliers: 71.13
Saved at vis_preFeature/frame161.jpg
[[ 0.1113 -0.0193  0.9936 27.7574]
 [ 0.0638  0.9979  0.0122 -0.5847]
 [-0.9917  0.062   0.1123 69.8201]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00353
Mean Error Translation: 0.79838

```

```

== [Result] Frame: 162, Matches 293, Inliers: 70.65
Saved at vis_preFeature/frame162.jpg
[[ 0.1052 -0.0215  0.9942 28.4772]
 [ 0.0605  0.9981  0.0152 -0.5866]
 [-0.9926  0.0586  0.1063 69.9168]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00353
Mean Error Translation: 0.79419
== [Result] Frame: 163, Matches 299, Inliers: 65.22
Saved at vis_preFeature/frame163.jpg
[[ 0.0991 -0.0239  0.9948 29.5402]
 [ 0.0584  0.9981  0.0182 -0.5914]
 [-0.9934  0.0563  0.1003 70.0333]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00351
Mean Error Translation: 0.79098
== [Result] Frame: 164, Matches 299, Inliers: 61.87
Saved at vis_preFeature/frame164.jpg
[[ 0.0908 -0.0236  0.9956 30.6089]
 [ 0.0559  0.9983  0.0186 -0.5971]
 [-0.9943  0.0539  0.092  70.1542]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00350
Mean Error Translation: 0.78789
== [Result] Frame: 165, Matches 309, Inliers: 68.93
Saved at vis_preFeature/frame165.jpg
[[ 0.0816 -0.0227  0.9964 31.662 ]
 [ 0.0538  0.9984  0.0183 -0.5963]
 [-0.9952  0.0521  0.0826 70.2595]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00349
Mean Error Translation: 0.78477
== [Result] Frame: 166, Matches 313, Inliers: 65.81
Saved at vis_preFeature/frame166.jpg
[[ 0.0716 -0.0214  0.9972 32.7351]
 [ 0.0536  0.9984  0.0175 -0.5743]
 [-0.996   0.0522  0.0727 70.3452]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00348
Mean Error Translation: 0.78181
== [Result] Frame: 167, Matches 314, Inliers: 62.42
Saved at vis_preFeature/frame167.jpg
[[ 0.0602 -0.0226  0.9979 33.8241]
 [ 0.0542  0.9983  0.0193 -0.5765]
 [-0.9967  0.0529  0.0613 70.4283]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00347
Mean Error Translation: 0.77898

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```

== [Result] Frame: 168, Matches 312, Inliers: 63.14
Saved at vis_preFeature/frame168.jpg
[[ 0.0492 -0.0235  0.9985 34.871 ]
 [ 0.0515  0.9985  0.0209 -0.5777]
 [-0.9975  0.0504  0.0504 70.4995]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00346
Mean Error Translation: 0.77597
== [Result] Frame: 169, Matches 292, Inliers: 66.10
Saved at vis_preFeature/frame169.jpg
[[ 0.0377 -0.0246  0.999  35.954 ]
 [ 0.0515  0.9984  0.0226 -0.5741]
 [-0.998   0.0506  0.0389 70.5413]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00345
Mean Error Translation: 0.77317
== [Result] Frame: 170, Matches 301, Inliers: 70.76
Saved at vis_preFeature/frame170.jpg
[[ 0.0277 -0.0238  0.9993 37.1283]
 [ 0.0523  0.9984  0.0223 -0.5604]
 [-0.9982  0.0516  0.0289 70.5596]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00344
Mean Error Translation: 0.77095
== [Result] Frame: 171, Matches 309, Inliers: 71.84
Saved at vis_preFeature/frame171.jpg
[[ 0.0166 -0.0233  0.9996 38.3018]
 [ 0.0555  0.9982  0.0224 -0.5536]
 [-0.9983  0.0551  0.0179 70.5702]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00345
Mean Error Translation: 0.76880
== [Result] Frame: 172, Matches 306, Inliers: 61.44
Saved at vis_preFeature/frame172.jpg
[[ 0.0055 -0.0223  0.9997 39.5713]
 [ 0.0555  0.9982  0.0219 -0.5423]
 [-0.9984  0.0554  0.0067 70.5863]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00344
Mean Error Translation: 0.76725
== [Result] Frame: 173, Matches 293, Inliers: 58.70
Saved at vis_preFeature/frame173.jpg
[[ -0.005 -0.0213  0.9998 40.7491]
 [ 0.0553  0.9982  0.0215 -0.5352]
 [-0.9985  0.0554 -0.0039 70.586 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00342
Mean Error Translation: 0.76523

```

```

== [Result] Frame: 174, Matches 280, Inliers: 60.36
Saved at vis_preFeature/frame174.jpg
[[-0.0141 -0.0205  0.9997 41.8056]
 [ 0.0561  0.9982  0.0213 -0.5246]
 [-0.9983  0.0564 -0.0129 70.5643]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00341
Mean Error Translation: 0.76259
== [Result] Frame: 175, Matches 269, Inliers: 60.97
Saved at vis_preFeature/frame175.jpg
[[-0.0231 -0.0199  0.9995 42.8418]
 [ 0.0576  0.9981  0.0212 -0.5107]
 [-0.9981  0.058   -0.0219 70.5255]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00340
Mean Error Translation: 0.75990
== [Result] Frame: 176, Matches 253, Inliers: 63.64
Saved at vis_preFeature/frame176.jpg
[[-0.0332 -0.0198  0.9993 43.8299]
 [ 0.0584  0.9981  0.0217 -0.5048]
 [-0.9977  0.0591 -0.032  70.5094]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00339
Mean Error Translation: 0.75705
== [Result] Frame: 177, Matches 257, Inliers: 66.93
Saved at vis_preFeature/frame177.jpg
[[-0.0396 -0.0206  0.999  44.386 ]
 [ 0.0631  0.9977  0.0231 -0.5065]
 [-0.9972  0.0639 -0.0382 70.4632]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00340
Mean Error Translation: 0.75383
== [Result] Frame: 178, Matches 254, Inliers: 66.54
Saved at vis_preFeature/frame178.jpg
[[-0.0465 -0.0215  0.9987 44.9127]
 [ 0.0643  0.9976  0.0245 -0.4998]
 [-0.9968  0.0654 -0.045  70.4337]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00339
Mean Error Translation: 0.75081
== [Result] Frame: 179, Matches 253, Inliers: 74.70
Saved at vis_preFeature/frame179.jpg
[[-0.052  -0.0228  0.9984 45.4694]
 [ 0.0665  0.9974  0.0262 -0.4877]
 [-0.9964  0.0677 -0.0504 70.4048]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00337
Mean Error Translation: 0.74762

```

```

== [Result] Frame: 180, Matches 269, Inliers: 76.95
Saved at vis_preFeature/frame180.jpg
[[-0.0559 -0.0245  0.9981 46.0267]
 [ 0.0692  0.9972  0.0284 -0.4793]
 [-0.996   0.0707 -0.054   70.3769]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00336
Mean Error Translation: 0.74444
== [Result] Frame: 181, Matches 266, Inliers: 65.04
Saved at vis_preFeature/frame181.jpg
[[-0.0579 -0.0266  0.998  46.5612]
 [ 0.0718  0.9969  0.0307 -0.4796]
 [-0.9957  0.0734 -0.0558 70.3407]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00335
Mean Error Translation: 0.74132
== [Result] Frame: 182, Matches 263, Inliers: 74.14
Saved at vis_preFeature/frame182.jpg
[[-0.0596 -0.0275  0.9978 47.0985]
 [ 0.0718  0.9969  0.0318 -0.4723]
 [-0.9956  0.0736 -0.0575 70.3117]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00334
Mean Error Translation: 0.73815
== [Result] Frame: 183, Matches 260, Inliers: 75.77
Saved at vis_preFeature/frame183.jpg
[[-0.0605 -0.0265  0.9978 47.6124]
 [ 0.0745  0.9967  0.031  -0.4602]
 [-0.9954  0.0762 -0.0583 70.282 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00334
Mean Error Translation: 0.73507
== [Result] Frame: 184, Matches 258, Inliers: 70.93
Saved at vis_preFeature/frame184.jpg
[[-0.0594 -0.0263  0.9979 48.0961]
 [ 0.075   0.9967  0.0307 -0.4602]
 [-0.9954  0.0766 -0.0572 70.247 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00333
Mean Error Translation: 0.73207
== [Result] Frame: 185, Matches 248, Inliers: 67.34
Saved at vis_preFeature/frame185.jpg
[[-0.0557 -0.0254  0.9981 48.5727]
 [ 0.0781  0.9965  0.0297 -0.4606]
 [-0.9954  0.0796 -0.0535 70.2127]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00333
Mean Error Translation: 0.72904

```

```

== [Result] Frame: 186, Matches 248, Inliers: 69.76
Saved at vis_preFeature/frame186.jpg
[[-0.0511 -0.0246  0.9984 49.0253]
 [ 0.077   0.9966  0.0285 -0.4527]
 [-0.9957  0.0783 -0.049   70.2031]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00332
Mean Error Translation: 0.72611
== [Result] Frame: 187, Matches 239, Inliers: 70.71
Saved at vis_preFeature/frame187.jpg
[[-0.042   -0.024   0.9988 49.5014]
 [ 0.0775   0.9966  0.0272 -0.4478]
 [-0.9961   0.0786 -0.04    70.18   ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00332
Mean Error Translation: 0.72296
== [Result] Frame: 188, Matches 238, Inliers: 69.75
Saved at vis_preFeature/frame188.jpg
[[-0.0289 -0.0242  0.9993 49.94   ]
 [ 0.0783   0.9966  0.0264 -0.4462]
 [-0.9965   0.079   -0.0269 70.1477]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00332
Mean Error Translation: 0.71991
== [Result] Frame: 189, Matches 262, Inliers: 69.47
Saved at vis_preFeature/frame189.jpg
[[-0.0159 -0.0235  0.9996 50.3952]
 [ 0.0769   0.9967  0.0247 -0.44   ]
 [-0.9969   0.0773 -0.0141 70.1544]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00331
Mean Error Translation: 0.71676
== [Result] Frame: 190, Matches 270, Inliers: 75.93
Saved at vis_preFeature/frame190.jpg
[[ 0.0001 -0.0221  0.9998 50.8263]
 [ 0.0747   0.997   0.022   -0.4416]
 [-0.9972   0.0747  0.0018 70.1829]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00331
Mean Error Translation: 0.71367
== [Result] Frame: 191, Matches 278, Inliers: 75.90
Saved at vis_preFeature/frame191.jpg
[[ 0.0213 -0.0194  0.9996 51.4479]
 [ 0.0761   0.9969  0.0177 -0.4359]
 [-0.9969   0.0756  0.0227 70.2193]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00330
Mean Error Translation: 0.71048

```

```

== [Result] Frame: 192, Matches 274, Inliers: 70.44
Saved at vis_preFeature/frame192.jpg
[[ 0.044 -0.0155 0.9989 52.1811]
 [ 0.0736 0.9972 0.0122 -0.4293]
 [-0.9963 0.073 0.045 70.3089]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00330
Mean Error Translation: 0.70796
== [Result] Frame: 193, Matches 286, Inliers: 72.38
Saved at vis_preFeature/frame193.jpg
[[ 0.0731 -0.014 0.9972 52.5688]
 [ 0.0743 0.9972 0.0086 -0.4312]
 [-0.9946 0.0734 0.074 70.3491]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00330
Mean Error Translation: 0.70503
== [Result] Frame: 194, Matches 281, Inliers: 71.89
Saved at vis_preFeature/frame194.jpg
[[ 0.1035 -0.0138 0.9945 53.2462]
 [ 0.0705 0.9975 0.0065 -0.439 ]
 [-0.9921 0.0694 0.1042 70.4929]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00331
Mean Error Translation: 0.70237
== [Result] Frame: 195, Matches 284, Inliers: 73.24
Saved at vis_preFeature/frame195.jpg
[[ 0.1426 -0.0171 0.9896 53.603 ]
 [ 0.0719 0.9974 0.0069 -0.4496]
 [-0.9872 0.0702 0.1435 70.5473]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00331
Mean Error Translation: 0.69961
== [Result] Frame: 196, Matches 293, Inliers: 69.62
Saved at vis_preFeature/frame196.jpg
[[ 0.1809 -0.0195 0.9833 53.947 ]
 [ 0.0664 0.9978 0.0075 -0.459 ]
 [-0.9813 0.0639 0.1818 70.6664]
 [ 0. 0. 0. 1. ]]

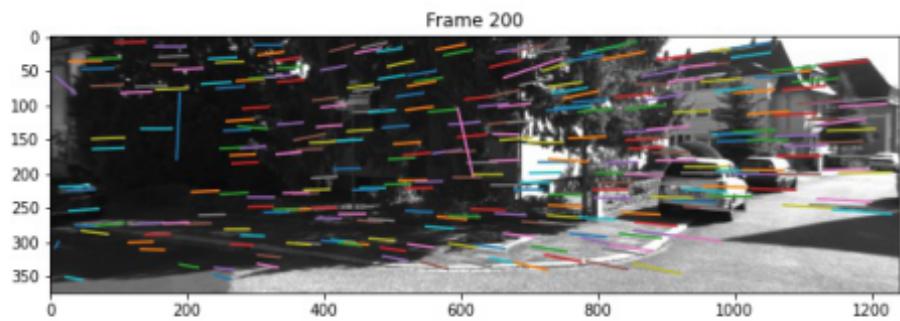
Mean Error Rotation: 0.00334
Mean Error Translation: 0.69692
== [Result] Frame: 197, Matches 282, Inliers: 69.15
Saved at vis_preFeature/frame197.jpg
[[ 0.2233 -0.0226 0.9745 54.2871]
 [ 0.0643 0.9979 0.0084 -0.4572]
 [-0.9726 0.0608 0.2243 70.7873]
 [ 0. 0. 0. 1. ]]

Mean Error Rotation: 0.00334
Mean Error Translation: 0.69422

```

```
== [Result] Frame: 198, Matches 278, Inliers: 68.71
Saved at vis_preFeature/frame198.jpg
[[ 0.2715 -0.0256  0.9621 54.6189]
 [ 0.0612  0.9981  0.0093 -0.462 ]
 [-0.9605  0.0563  0.2725 70.9009]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00333
Mean Error Translation: 0.69158
== [Result] Frame: 199, Matches 267, Inliers: 73.03
Saved at vis_preFeature/frame199.jpg
[[ 0.3218 -0.0259  0.9465 54.9566]
 [ 0.0578  0.9983  0.0077 -0.4626]
 [-0.945   0.0522  0.3227 71.0461]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00332
Mean Error Translation: 0.68880
== [Result] Frame: 200, Matches 281, Inliers: 72.95
Saved at vis_preFeature/frame200.jpg

<Figure size 432x288 with 0 Axes>
```



```

[[ 0.3742 -0.0255  0.927  55.2867]
 [ 0.0567  0.9984  0.0045 -0.4674]
 [-0.9256  0.0509  0.375  71.222 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00331
Mean Error Translation: 0.68603
== [Result] Frame: 201, Matches 301, Inliers: 73.75
Saved at vis_preFeature/frame201.jpg
[[ 0.4298 -0.0243  0.9026 55.6075]
 [ 0.0582  0.9983 -0.0009 -0.4758]
 [-0.901   0.0529  0.4305 71.4145]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00330
Mean Error Translation: 0.68326
== [Result] Frame: 202, Matches 326, Inliers: 77.30
Saved at vis_preFeature/frame202.jpg
[[ 0.488   -0.0189  0.8726 55.9135]
 [ 0.0571  0.9983 -0.0104 -0.4782]
 [-0.871   0.0549  0.4883 71.6212]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00331
Mean Error Translation: 0.68041
== [Result] Frame: 203, Matches 327, Inliers: 65.75
Saved at vis_preFeature/frame203.jpg
[[ 0.5468 -0.0161  0.8371 56.1952]
 [ 0.0584  0.9981 -0.019  -0.496 ]
 [-0.8352  0.0593  0.5467 71.8287]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00331
Mean Error Translation: 0.67772
== [Result] Frame: 204, Matches 325, Inliers: 60.92
Saved at vis_preFeature/frame204.jpg
[[ 0.6007 -0.0079  0.7994 56.4387]
 [ 0.05     0.9984 -0.0277 -0.5016]
 [-0.7979  0.0566  0.6001 72.0874]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00333
Mean Error Translation: 0.67499
== [Result] Frame: 205, Matches 327, Inliers: 62.39
Saved at vis_preFeature/frame205.jpg
[[ 0.6531 -0.004   0.7572 56.6689]
 [ 0.0439  0.9985 -0.0326 -0.523 ]
 [-0.756   0.0546  0.6523 72.3473]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00333
Mean Error Translation: 0.67236

```

```

== [Result] Frame: 206, Matches 326, Inliers: 54.91
Saved at vis_preFeature/frame206.jpg
[[ 0.7007  0.0026  0.7134 56.8482]
 [ 0.0363  0.9986 -0.0394 -0.5318]
 [-0.7125  0.0535  0.6996 72.6297]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00336
Mean Error Translation: 0.66988
== [Result] Frame: 207, Matches 298, Inliers: 60.07
Saved at vis_preFeature/frame207.jpg
[[ 0.7459  0.0029  0.6661 57.0302]
 [ 0.0332  0.9986 -0.0414 -0.5478]
 [-0.6653  0.053   0.7447 72.9124]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00337
Mean Error Translation: 0.66727
== [Result] Frame: 208, Matches 295, Inliers: 62.37
Saved at vis_preFeature/frame208.jpg
[[ 0.7868  0.0056  0.6172 57.1622]
 [ 0.025   0.9989 -0.0408 -0.5545]
 [-0.6167  0.0475  0.7858 73.2019]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00340
Mean Error Translation: 0.66491
== [Result] Frame: 209, Matches 296, Inliers: 64.19
Saved at vis_preFeature/frame209.jpg
[[ 0.8252  0.0015  0.5648 57.3026]
 [ 0.0227  0.9991 -0.0357 -0.5731]
 [-0.5644  0.0423  0.8244 73.4888]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00340
Mean Error Translation: 0.66252
== [Result] Frame: 210, Matches 283, Inliers: 66.08
Saved at vis_preFeature/frame210.jpg
[[ 0.8598 -0.0003  0.5106 57.4424]
 [ 0.0195  0.9993 -0.0322 -0.5824]
 [-0.5102  0.0377  0.8592 73.7979]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00339
Mean Error Translation: 0.65995
== [Result] Frame: 211, Matches 292, Inliers: 71.58
Saved at vis_preFeature/frame211.jpg
[[ 0.8889 -0.0019  0.4581 57.5539]
 [ 0.0158  0.9995 -0.0265 -0.5991]
 [-0.4578  0.0308  0.8885 74.1124]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00339
Mean Error Translation: 0.65754

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```

== [Result] Frame: 212, Matches 292, Inliers: 69.86
Saved at vis_preFeature/frame212.jpg
[[ 0.9125  0.0009  0.409   57.65   ]
 [ 0.0097  0.9997 -0.0239 -0.6056]
 [-0.4089  0.0258  0.9122  74.4482]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00339
Mean Error Translation: 0.65510
== [Result] Frame: 213, Matches 274, Inliers: 71.17
Saved at vis_preFeature/frame213.jpg
[[ 0.9307  0.0079  0.3658  57.7206]
 [ 0.0002  0.9998 -0.0222 -0.6227]
 [-0.3659  0.0207  0.9304  74.7933]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00342
Mean Error Translation: 0.65263
== [Result] Frame: 214, Matches 277, Inliers: 70.76
Saved at vis_preFeature/frame214.jpg
[[ 0.9449  0.0134  0.3272  57.7979]
 [-0.0072  0.9998 -0.0203 -0.6367]
 [-0.3274  0.0168  0.9447  75.1449]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00342
Mean Error Translation: 0.65021
== [Result] Frame: 215, Matches 274, Inliers: 66.79
Saved at vis_preFeature/frame215.jpg
[[ 0.9561  0.0176  0.2924  57.8768]
 [-0.0116  0.9997 -0.022   -0.6464]
 [-0.2927  0.0177  0.956   75.5046]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00341
Mean Error Translation: 0.64771
== [Result] Frame: 216, Matches 284, Inliers: 72.89
Saved at vis_preFeature/frame216.jpg
[[ 0.9651  0.0192  0.2613  57.9647]
 [-0.0136  0.9996 -0.0234 -0.6492]
 [-0.2617  0.019   0.965   75.8888]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00340
Mean Error Translation: 0.64518
== [Result] Frame: 217, Matches 280, Inliers: 71.07
Saved at vis_preFeature/frame217.jpg
[[ 0.9707  0.0154  0.2399  58.0401]
 [-0.01    0.9997 -0.0239 -0.6601]
 [-0.2402  0.0208  0.9705  76.2655]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00340
Mean Error Translation: 0.64273

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== [Result] Frame: 218, Matches 285, Inliers: 71.23
Saved at vis_preFeature/frame218.jpg
[[ 0.9743  0.014   0.2247 58.1173]
 [-0.0089  0.9997 -0.0238 -0.6726]
 [-0.225   0.0212  0.9741 76.6385]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00340
Mean Error Translation: 0.64032
== [Result] Frame: 219, Matches 277, Inliers: 67.51
Saved at vis_preFeature/frame219.jpg
[[ 0.9771  0.0187  0.2121 58.188 ]
 [-0.0137  0.9996 -0.0246 -0.6818]
 [-0.2125  0.0211  0.9769 77.0272]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00339
Mean Error Translation: 0.63792
== [Result] Frame: 220, Matches 290, Inliers: 73.45
Saved at vis_preFeature/frame220.jpg
[[ 0.9787  0.0253  0.2036 58.2424]
 [-0.0207  0.9995 -0.0246 -0.6904]
 [-0.2041  0.0199  0.9787 77.4289]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00338
Mean Error Translation: 0.63557
== [Result] Frame: 221, Matches 290, Inliers: 67.24
Saved at vis_preFeature/frame221.jpg
[[ 0.9798  0.0308  0.1974 58.378 ]
 [-0.0262  0.9993 -0.0259 -0.7118]
 [-0.1981  0.0202  0.98   78.1572]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00338
Mean Error Translation: 0.63367
== [Result] Frame: 222, Matches 302, Inliers: 73.84
Saved at vis_preFeature/frame222.jpg
[[ 0.9802  0.037   0.1945 58.4913]
 [-0.0319  0.9991 -0.0295 -0.7357]
 [-0.1954  0.0227  0.9805 78.8461]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00336
Mean Error Translation: 0.63157
== [Result] Frame: 223, Matches 314, Inliers: 70.38
Saved at vis_preFeature/frame223.jpg
[[ 0.9802  0.04    0.1938 58.6419]
 [-0.0345  0.9989 -0.0315 -0.7755]
 [-0.1948  0.0242  0.9805 79.6324]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00336
Mean Error Translation: 0.62989

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== [Result] Frame: 224, Matches 314, Inliers: 71.02
Saved at vis_preFeature/frame224.jpg
[[ 0.9799  0.0374  0.1958 58.729 ]
 [-0.0311  0.9989 -0.0349 -0.796 ]
 [-0.1969  0.0281  0.98   80.0366]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00336
Mean Error Translation: 0.62773
== [Result] Frame: 225, Matches 316, Inliers: 73.73
Saved at vis_preFeature/frame225.jpg
[[ 0.979   0.0372  0.2004 58.8161]
 [-0.0294  0.9987 -0.0417 -0.8091]
 [-0.2017  0.035   0.9788 80.4685]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00335
Mean Error Translation: 0.62551
== [Result] Frame: 226, Matches 312, Inliers: 73.40
Saved at vis_preFeature/frame226.jpg
[[ 0.9781  0.0367  0.2049 58.9332]
 [-0.0277  0.9985 -0.0466 -0.8299]
 [-0.2063  0.0399  0.9777 81.0587]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00334
Mean Error Translation: 0.62291
== [Result] Frame: 227, Matches 302, Inliers: 72.52
Saved at vis_preFeature/frame227.jpg
[[ 0.9766  0.044   0.2107 59.0085]
 [-0.035   0.9983 -0.0466 -0.85   ]
 [-0.2124  0.0381  0.9764 81.491 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00335
Mean Error Translation: 0.62088
== [Result] Frame: 228, Matches 307, Inliers: 68.73
Saved at vis_preFeature/frame228.jpg
[[ 0.975   0.0484  0.2168 59.0975]
 [-0.0401  0.9983 -0.0426 -0.8722]
 [-0.2185  0.0328  0.9753 81.9609]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00334
Mean Error Translation: 0.61874
== [Result] Frame: 229, Matches 293, Inliers: 75.77
Saved at vis_preFeature/frame229.jpg
[[ 0.9738  0.0479  0.2224 59.1986]
 [-0.0403  0.9984 -0.0385 -0.8908]
 [-0.2239  0.0286  0.9742 82.4177]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00334
Mean Error Translation: 0.61673

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```

== [Result] Frame: 230, Matches 281, Inliers: 69.40
Saved at vis_preFeature/frame230.jpg
[[ 0.9728  0.0448  0.2271 59.3083]
 [-0.0382  0.9987 -0.0336 -0.9076]
 [-0.2283  0.024   0.9733 82.917 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00333
Mean Error Translation: 0.61460
== [Result] Frame: 231, Matches 277, Inliers: 71.12
Saved at vis_preFeature/frame231.jpg
[[ 0.9714  0.0456  0.2331 59.4093]
 [-0.0399  0.9988 -0.0293 -0.9293]
 [-0.2342  0.0192  0.972  83.4363]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00335
Mean Error Translation: 0.61249
== [Result] Frame: 232, Matches 276, Inliers: 75.72
Saved at vis_preFeature/frame232.jpg
[[ 0.9706  0.0429  0.2368 59.5247]
 [-0.0371  0.9989 -0.0287 -0.9483]
 [-0.2378  0.0191  0.9711 83.9427]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00334
Mean Error Translation: 0.61044
== [Result] Frame: 233, Matches 274, Inliers: 76.64
Saved at vis_preFeature/frame233.jpg
[[ 0.971   0.0373  0.2361 59.6767]
 [-0.0305  0.999  -0.0322 -0.9709]
 [-0.2371  0.0241  0.9712 84.5065]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00334
Mean Error Translation: 0.60816
== [Result] Frame: 234, Matches 270, Inliers: 77.78
Saved at vis_preFeature/frame234.jpg
[[ 0.971   0.0364  0.2362 59.8495]
 [-0.0278  0.9988 -0.0395 -1.0016]
 [-0.2374  0.0318  0.9709 85.239 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00334
Mean Error Translation: 0.60595
== [Result] Frame: 235, Matches 267, Inliers: 77.15
Saved at vis_preFeature/frame235.jpg
[[ 0.9712  0.0377  0.2353 60.051 ]
 [-0.0275  0.9986 -0.0462 -1.0413]
 [-0.2367  0.0384  0.9708 86.0934]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00333
Mean Error Translation: 0.60424

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== [Result] Frame: 236, Matches 275, Inliers: 72.36
Saved at vis_preFeature/frame236.jpg
[[ 0.9716  0.041   0.2333  60.2498]
 [-0.03     0.9983 -0.0503 -1.0778]
 [-0.2349  0.0419  0.9711  87.0211]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00332
Mean Error Translation: 0.60278
== [Result] Frame: 237, Matches 272, Inliers: 65.07
Saved at vis_preFeature/frame237.jpg
[[ 0.9718  0.0425  0.2319  60.4417]
 [-0.0327  0.9984 -0.046  -1.1282]
 [-0.2335  0.0371  0.9716  87.9622]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00333
Mean Error Translation: 0.60130
== [Result] Frame: 238, Matches 274, Inliers: 66.06
Saved at vis_preFeature/frame238.jpg
[[ 0.9724  0.0382  0.2304  60.6109]
 [-0.0301  0.9988 -0.0388 -1.1643]
 [-0.2316  0.0308  0.9723  88.6798]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00331
Mean Error Translation: 0.59886
== [Result] Frame: 239, Matches 271, Inliers: 70.11
Saved at vis_preFeature/frame239.jpg
[[ 0.9718  0.0462  0.2312  60.7771]
 [-0.0396  0.9987 -0.0331 -1.2156]
 [-0.2324  0.023   0.9723  89.6642]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00335
Mean Error Translation: 0.59748
== [Result] Frame: 240, Matches 278, Inliers: 60.43
Saved at vis_preFeature/frame240.jpg
[[ 0.972   0.0504  0.2295  60.9955]
 [-0.0435  0.9984 -0.0349 -1.2504]
 [-0.2309  0.024   0.9727  90.6754]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00334
Mean Error Translation: 0.59622
== [Result] Frame: 241, Matches 265, Inliers: 60.75
Saved at vis_preFeature/frame241.jpg
[[ 0.9722  0.0565  0.2274  61.234 ]
 [-0.0486  0.998  -0.0399 -1.2991]
 [-0.2292  0.0278  0.973   91.7775]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00333
Mean Error Translation: 0.59532

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== [Result] Frame: 242, Matches 274, Inliers: 71.90
Saved at vis_preFeature/frame242.jpg
[[ 0.973  0.0575  0.2237 61.4895]
 [-0.0485  0.9978 -0.0453 -1.3469]
 [-0.2258  0.0332  0.9736 92.9591]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00332
Mean Error Translation: 0.59472
== [Result] Frame: 243, Matches 276, Inliers: 67.75
Saved at vis_preFeature/frame243.jpg
[[ 0.9736  0.0573  0.2207 61.681 ]
 [-0.0477  0.9977 -0.0488 -1.3845]
 [-0.223   0.0369  0.9741 93.8869]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00331
Mean Error Translation: 0.59301
== [Result] Frame: 244, Matches 260, Inliers: 65.00
Saved at vis_preFeature/frame244.jpg
[[ 0.9745  0.0562  0.2171 61.8665]
 [-0.047   0.9978 -0.0473 -1.4299]
 [-0.2193  0.0359  0.975   94.7437]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00331
Mean Error Translation: 0.59095
== [Result] Frame: 245, Matches 250, Inliers: 72.40
Saved at vis_preFeature/frame245.jpg
[[ 0.9752  0.0527  0.2149 62.0309]
 [-0.0439  0.998   -0.0456 -1.4738]
 [-0.2169  0.035   0.9756 95.5519]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00330
Mean Error Translation: 0.58871
== [Result] Frame: 246, Matches 265, Inliers: 68.30
Saved at vis_preFeature/frame246.jpg
[[ 0.9758  0.0505  0.2129 62.2218]
 [-0.0424  0.9982 -0.0425 -1.5245]
 [-0.2147  0.0324  0.9761 96.4041]
 [ 0.       0.       0.       1.      ]]

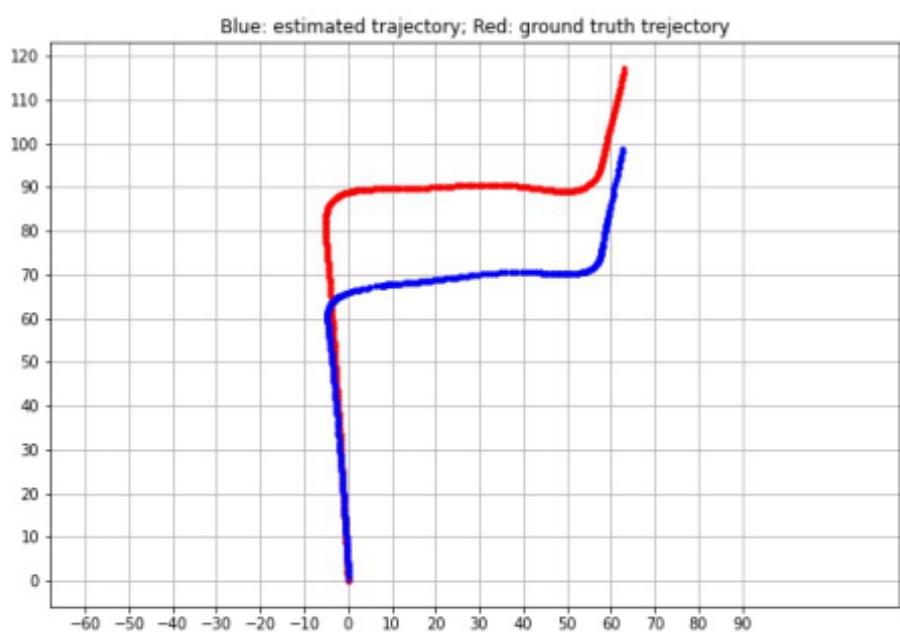
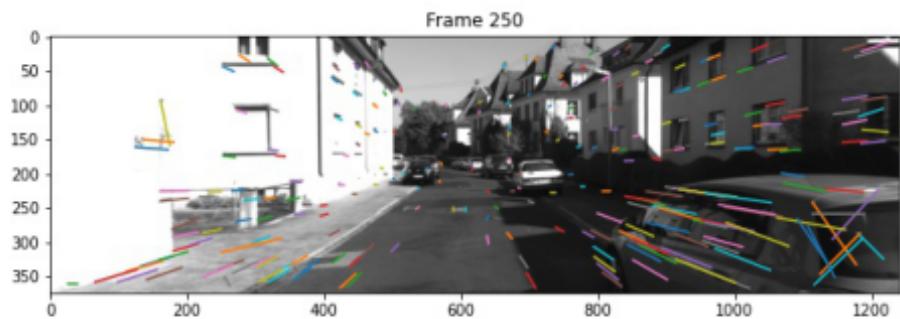
Mean Error Rotation: 0.00329
Mean Error Translation: 0.58658
== [Result] Frame: 247, Matches 248, Inliers: 70.16
Saved at vis_preFeature/frame247.jpg
[[ 0.9764  0.0448  0.2113 62.3762]
 [-0.0372  0.9985 -0.04   -1.558 ]
 [-0.2127  0.0312  0.9766 97.0632]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00329
Mean Error Translation: 0.58484

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```
== [Result] Frame: 248, Matches 260, Inliers: 68.08
Saved at vis_preFeature/frame248.jpg
[[ 0.9767  0.0405  0.211   62.6364]
 [-0.033   0.9987 -0.0387 -1.6125]
 [-0.2123  0.0309  0.9767  98.2233]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00329
Mean Error Translation: 0.58393
== [Result] Frame: 249, Matches 255, Inliers: 69.80
Saved at vis_preFeature/frame249.jpg
[[ 0.9766  0.0423  0.211   62.7626]
 [-0.0354  0.9987 -0.0366 -1.6484]
 [-0.2123  0.0283  0.9768  98.8515]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00328
Mean Error Translation: 0.58239
== [Result] Frame: 250, Matches 251, Inliers: 66.14
Saved at vis_preFeature/frame250.jpg

<Figure size 432x288 with 0 Axes>
```



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[[ 0.9765  0.0454  0.2108 62.8976]
 [-0.038   0.9985 -0.0389 -1.676 ]
 [-0.2123  0.03     0.9767 99.5062]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00328
Mean Error Translation: 0.58075
== [Result] Frame: 251, Matches 250, Inliers: 71.60
Saved at vis_preFeature/frame251.jpg
[[ 0.9758  0.0531  0.2121 63.0161]
 [-0.0451  0.9981 -0.0424 -1.7068]
 [-0.2139  0.0318  0.9763 100.1034]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00328
Mean Error Translation: 0.57938
== [Result] Frame: 252, Matches 268, Inliers: 71.27
Saved at vis_preFeature/frame252.jpg
[[ 0.9753  0.0611  0.2124 63.1405]
 [-0.0529  0.9976 -0.0441 -1.7355]
 [-0.2146  0.0318  0.9762 100.698 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00327
Mean Error Translation: 0.57804
== [Result] Frame: 253, Matches 237, Inliers: 78.06
Saved at vis_preFeature/frame253.jpg
[[ 0.9736  0.0692  0.2174 63.2466]
 [-0.0609  0.9971 -0.0446 -1.7589]
 [-0.2199  0.0302  0.9751 101.3243]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00327
Mean Error Translation: 0.57664
== [Result] Frame: 254, Matches 240, Inliers: 81.67
Saved at vis_preFeature/frame254.jpg
[[ 0.9728  0.0717  0.2204 63.3763]
 [-0.064   0.9971 -0.042  -1.8012]
 [-0.2228  0.0267  0.9745 101.9512]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00326
Mean Error Translation: 0.57525
== [Result] Frame: 255, Matches 227, Inliers: 75.33
Saved at vis_preFeature/frame255.jpg
[[ 0.9722  0.0724  0.2227 63.5242]
 [-0.0644  0.997   -0.043  -1.8368]
 [-0.2251  0.0274  0.9739 102.6043]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00325
Mean Error Translation: 0.57375

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```

== [Result] Frame: 256, Matches 230, Inliers: 76.09
Saved at vis_preFeature/frame256.jpg
[[ 0.9724  0.0672  0.2235  63.6754]
 [-0.0586  0.9973  -0.045   -1.8785]
 [-0.2259  0.0307  0.9737  103.1973]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00327
Mean Error Translation: 0.57249
== [Result] Frame: 257, Matches 229, Inliers: 75.55
Saved at vis_preFeature/frame257.jpg
[[ 0.9728  0.06    0.2238  63.8262]
 [-0.0515  0.9977  -0.0435 -1.9138]
 [-0.2259  0.0308  0.9737  103.8135]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00326
Mean Error Translation: 0.57123
== [Result] Frame: 258, Matches 237, Inliers: 78.06
Saved at vis_preFeature/frame258.jpg
[[ 0.9734  0.0516  0.2231  63.9853]
 [-0.0425  0.9981  -0.045   -1.9493]
 [-0.225   0.0344  0.9737  104.4201]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00326
Mean Error Translation: 0.56997
== [Result] Frame: 259, Matches 241, Inliers: 77.18
Saved at vis_preFeature/frame259.jpg
[[ 0.9733  0.0499  0.224   64.1361]
 [-0.0409  0.9982  -0.0448 -1.9894]
 [-0.2258  0.0345  0.9736  105.0355]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00325
Mean Error Translation: 0.56869
== [Result] Frame: 260, Matches 239, Inliers: 80.75
Saved at vis_preFeature/frame260.jpg
[[ 0.9726  0.0538  0.2261  64.266 ]
 [-0.0454  0.9981  -0.042   -2.0242]
 [-0.2279  0.0306  0.9732  105.6572]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00325
Mean Error Translation: 0.56743
== [Result] Frame: 261, Matches 238, Inliers: 79.41
Saved at vis_preFeature/frame261.jpg
[[ 0.9719  0.0568  0.2283  64.4015]
 [-0.0496  0.9981  -0.037   -2.053 ]
 [-0.23    0.0247  0.9729  106.3103]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00325
Mean Error Translation: 0.56606

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```

== [Result] Frame: 262, Matches 245, Inliers: 80.41
Saved at vis_preFeature/frame262.jpg
[[ 0.9716  0.0594  0.2291  64.5527]
 [-0.0533  0.998   -0.0324  -2.0911]
 [-0.2306  0.0193  0.9729  106.9704]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.56463
== [Result] Frame: 263, Matches 238, Inliers: 77.31
Saved at vis_preFeature/frame263.jpg
[[ 0.9714  0.0588  0.2302  64.7068]
 [-0.0512  0.9979  -0.0386  -2.1298]
 [-0.232   0.0257  0.9724  107.6477]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00323
Mean Error Translation: 0.56307
== [Result] Frame: 264, Matches 246, Inliers: 75.61
Saved at vis_preFeature/frame264.jpg
[[ 0.9713  0.0572  0.231   64.8591]
 [-0.046   0.9975  -0.0536  -2.1642]
 [-0.2335  0.0414  0.9715  108.3397]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00323
Mean Error Translation: 0.56145
== [Result] Frame: 265, Matches 250, Inliers: 78.00
Saved at vis_preFeature/frame265.jpg
[[ 0.9718  0.0544  0.2296  65.0765]
 [-0.041   0.9972  -0.0628  -2.2157]
 [-0.2324  0.0516  0.9712  109.2175]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00323
Mean Error Translation: 0.55960
== [Result] Frame: 266, Matches 264, Inliers: 73.48
Saved at vis_preFeature/frame266.jpg
[[ 0.9723  0.0508  0.2282  65.3047]
 [-0.0395  0.9978  -0.0539  -2.2642]
 [-0.2304  0.0434  0.9721  110.1268]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.55782
== [Result] Frame: 267, Matches 266, Inliers: 69.55
Saved at vis_preFeature/frame267.jpg
[[ 0.9725  0.0459  0.2285  65.44 ]
 [-0.0395  0.9987  -0.0325  -2.3067]
 [-0.2297  0.0226  0.973   110.7496]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.55661

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== [Result] Frame: 268, Matches 271, Inliers: 68.27
Saved at vis_preFeature/frame268.jpg
[[ 0.9724  0.0465  0.2287  65.6148]
 [-0.0436  0.9989  -0.0174  -2.3545]
 [-0.2293  0.007   0.9733  111.5711]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00325
Mean Error Translation: 0.55468
== [Result] Frame: 269, Matches 263, Inliers: 71.86
Saved at vis_preFeature/frame269.jpg
[[ 0.9726  0.0495  0.227   65.8231]
 [-0.0453  0.9987  -0.0237  -2.3893]
 [-0.2278  0.0128  0.9736  112.4283]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.55281
== [Result] Frame: 270, Matches 269, Inliers: 68.77
Saved at vis_preFeature/frame270.jpg
[[ 0.9728  0.0584  0.2243  65.9899]
 [-0.0507  0.9979  -0.04    -2.4189]
 [-0.2262  0.0275  0.9737  113.1553]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.55105
== [Result] Frame: 271, Matches 271, Inliers: 70.85
Saved at vis_preFeature/frame271.jpg
[[ 0.9727  0.0598  0.2241  66.1286]
 [-0.0504  0.9976  -0.0473  -2.4528]
 [-0.2264  0.0347  0.9734  113.8436]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.54950
== [Result] Frame: 272, Matches 258, Inliers: 76.36
Saved at vis_preFeature/frame272.jpg
[[ 0.9737  0.0535  0.2214  66.2903]
 [-0.0438  0.9979  -0.0484  -2.4921]
 [-0.2235  0.0374  0.974   114.5226]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.54797
== [Result] Frame: 273, Matches 251, Inliers: 72.51
Saved at vis_preFeature/frame273.jpg
[[ 0.9744  0.0529  0.2185  66.45  ]
 [-0.0436  0.9979  -0.0469  -2.5399]
 [-0.2205  0.0362  0.9747  115.2366]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.54635

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== [Result] Frame: 274, Matches 250, Inliers: 72.40
Saved at vis_preFeature/frame274.jpg
[[ 0.9749  0.055   0.2156  66.616 ]
 [ -0.0457  0.9978 -0.0479 -2.5923]
 [ -0.2177  0.0368  0.9753 116.0915]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.54460
== [Result] Frame: 275, Matches 257, Inliers: 69.26
Saved at vis_preFeature/frame275.jpg
[[ 0.9763  0.0536  0.2097  66.8141]
 [ -0.0443  0.9978 -0.0489 -2.6517]
 [ -0.2119  0.0384  0.9765 116.9661]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.54295
== [Result] Frame: 276, Matches 260, Inliers: 69.23
Saved at vis_preFeature/frame276.jpg
[[ 0.9761  0.0622  0.2082  66.9771]
 [ -0.053   0.9974 -0.0494 -2.7079]
 [ -0.2107  0.0372  0.9768 117.9814]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00325
Mean Error Translation: 0.54173
== [Result] Frame: 277, Matches 271, Inliers: 60.15
Saved at vis_preFeature/frame277.jpg
[[ 0.9761  0.069   0.2059  67.163 ]
 [ -0.06    0.997   -0.0495 -2.7668]
 [ -0.2087  0.036   0.9773 118.9687]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00325
Mean Error Translation: 0.54052
== [Result] Frame: 278, Matches 264, Inliers: 68.18
Saved at vis_preFeature/frame278.jpg
[[ 0.9763  0.0715  0.2044  67.3318]
 [ -0.0632  0.9969 -0.047   -2.8272]
 [ -0.2071  0.033   0.9778 119.8477]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.53889
== [Result] Frame: 279, Matches 272, Inliers: 63.97
Saved at vis_preFeature/frame279.jpg
[[ 0.9768  0.0678  0.2031  67.5064]
 [ -0.0604  0.9973 -0.0427 -2.8746]
 [ -0.2054  0.0294  0.9782 120.7069]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.53719

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```

== [Result] Frame: 280, Matches 274, Inliers: 69.34
Saved at vis_preFeature/frame280.jpg
[[ 0.9774  0.0651  0.2012  67.6791]
 [-0.0577  0.9974 -0.0427 -2.9223]
 [-0.2034  0.0302  0.9786 121.5614]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.53550
== [Result] Frame: 281, Matches 280, Inliers: 68.57
Saved at vis_preFeature/frame281.jpg
[[ 0.9776  0.0656  0.1998  67.8475]
 [-0.0577  0.9973 -0.0454 -2.983 ]
 [-0.2022  0.0328  0.9788 122.5119]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.53418
== [Result] Frame: 282, Matches 280, Inliers: 65.00
Saved at vis_preFeature/frame282.jpg
[[ 0.9787  0.0625  0.1958  68.0414]
 [-0.0538  0.9973 -0.0495 -3.0369]
 [-0.1983  0.0379  0.9794 123.5317]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.53313
== [Result] Frame: 283, Matches 279, Inliers: 61.29
Saved at vis_preFeature/frame283.jpg
[[ 0.98     0.0609  0.1896  68.2501]
 [-0.0522  0.9974 -0.0504 -3.1055]
 [-0.1922  0.0394  0.9806 124.6816]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.53253
== [Result] Frame: 284, Matches 307, Inliers: 60.91
Saved at vis_preFeature/frame284.jpg
[[ 0.9813   0.06     0.183   68.4705]
 [-0.0528   0.9976 -0.0441 -3.1789]
 [-0.1852   0.0336  0.9821 125.8523]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.53198
== [Result] Frame: 285, Matches 299, Inliers: 56.52
Saved at vis_preFeature/frame285.jpg
[[ 0.9831   0.0531  0.175   68.7146]
 [-0.0474   0.9982 -0.0364 -3.2212]
 [-0.1766   0.0275  0.9839 126.9564]
 [ 0.        0.        0.        1.      ]]

Mean Error Rotation: 0.00326
Mean Error Translation: 0.53122

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```

== [Result] Frame: 286, Matches 282, Inliers: 57.45
Saved at vis_preFeature/frame286.jpg
[[ 0.984   0.049   0.1712  68.9186]
 [-0.0452  0.9986 -0.0262 -3.2904]
 [-0.1723  0.018   0.9849 128.0658]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00325
Mean Error Translation: 0.53047
== [Result] Frame: 287, Matches 288, Inliers: 61.81
Saved at vis_preFeature/frame287.jpg
[[ 0.9842  0.0559  0.168   69.0643]
 [-0.0527  0.9983 -0.0234 -3.3415]
 [-0.169   0.0142  0.9855 129.2272]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00325
Mean Error Translation: 0.52988
== [Result] Frame: 288, Matches 288, Inliers: 64.58
Saved at vis_preFeature/frame288.jpg
[[ 0.9849  0.0591  0.1628  69.1646]
 [-0.0554  0.9981 -0.0276 -3.3715]
 [-0.1641  0.0182  0.9863 129.8448]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.52866
== [Result] Frame: 289, Matches 268, Inliers: 69.03
Saved at vis_preFeature/frame289.jpg
[[ 0.9859  0.06    0.1559  69.2507]
 [-0.0547  0.9978 -0.0376 -3.4003]
 [-0.1578  0.0285  0.9871 130.4423]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.52751
== [Result] Frame: 290, Matches 269, Inliers: 74.72
Saved at vis_preFeature/frame290.jpg
[[ 0.9875  0.0549  0.1474  69.3552]
 [-0.0491  0.9979 -0.0429 -3.4265]
 [-0.1495  0.0351  0.9881 131.0045]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00324
Mean Error Translation: 0.52650
== [Result] Frame: 291, Matches 280, Inliers: 79.29
Saved at vis_preFeature/frame291.jpg
[[ 0.9887  0.0526  0.1405  69.4311]
 [-0.0471  0.998   -0.0419 -3.4518]
 [-0.1424  0.0348  0.9892 131.564 ]
 [ 0.       0.       0.       1.      ]]

Mean Error Rotation: 0.00323
Mean Error Translation: 0.52556

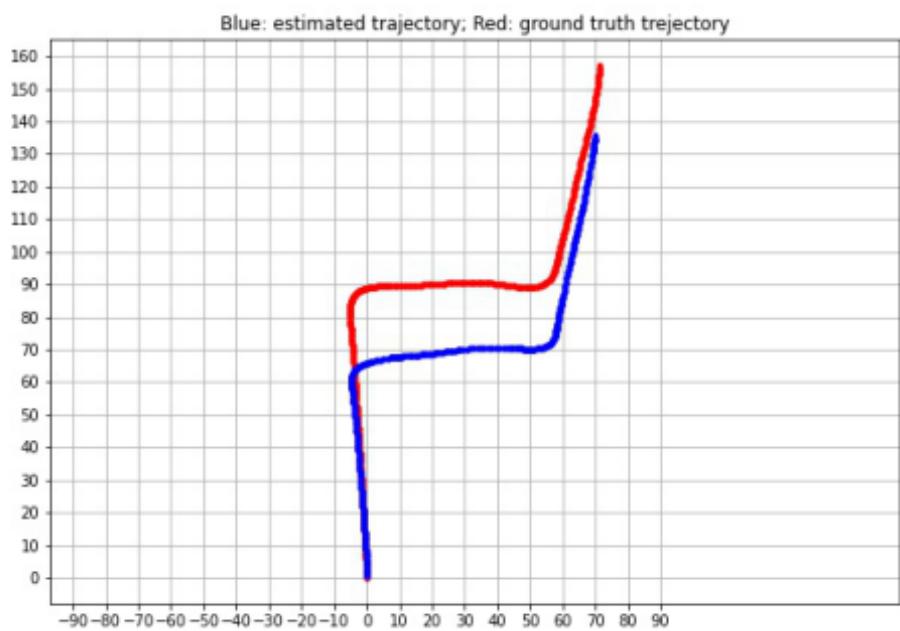
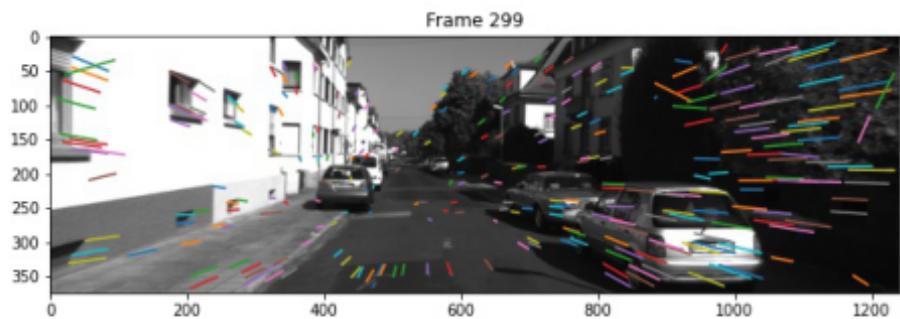
```

```

== [Result] Frame: 292, Matches 277, Inliers: 75.09
Saved at vis_preFeature/frame292.jpg
[[ 0.9897  0.0574  0.1314  69.512 ]
 [ -0.0528  0.9979  -0.0383  -3.4842]
 [ -0.1333  0.031   0.9906  132.1364]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.52459
== [Result] Frame: 293, Matches 267, Inliers: 81.27
Saved at vis_preFeature/frame293.jpg
[[ 0.9901  0.0645  0.125   69.5561]
 [ -0.06    0.9974  -0.0395  -3.5171]
 [ -0.1272  0.0316  0.9914  132.7152]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00324
Mean Error Translation: 0.52362
== [Result] Frame: 294, Matches 272, Inliers: 81.62
Saved at vis_preFeature/frame294.jpg
[[ 0.9912  0.066   0.1146  69.615 ]
 [ -0.0611  0.9971  -0.0453  -3.5429]
 [ -0.1173  0.0379  0.9924  133.2879]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00323
Mean Error Translation: 0.52265
== [Result] Frame: 295, Matches 273, Inliers: 81.68
Saved at vis_preFeature/frame295.jpg
[[ 0.9924  0.0636  0.1057  69.6794]
 [ -0.0589  0.9971  -0.0473  -3.5727]
 [ -0.1084  0.0407  0.9933  133.8696]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00322
Mean Error Translation: 0.52166
== [Result] Frame: 296, Matches 282, Inliers: 82.98
Saved at vis_preFeature/frame296.jpg
[[ 0.993   0.0645  0.0987  69.7241]
 [ -0.0603  0.9972  -0.0445  -3.6021]
 [ -0.1013  0.0382  0.9941  134.4546]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00322
Mean Error Translation: 0.52070
== [Result] Frame: 297, Matches 264, Inliers: 74.62
Saved at vis_preFeature/frame297.jpg
[[ 0.9935  0.0679  0.0913  69.7666]
 [ -0.0648  0.9972  -0.0369  -3.635 ]
 [ -0.0936  0.0308  0.9951  135.0557]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00321
Mean Error Translation: 0.51971

```

```
== [Result] Frame: 298, Matches 274, Inliers: 81.39
Saved at vis_preFeature/frame298.jpg
[[ 0.9941  0.0692  0.0833  69.8133]
 [-0.0668  0.9973 -0.0316 -3.6618]
 [-0.0853  0.0258  0.996   135.7058]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00321
Mean Error Translation: 0.51857
== [Result] Frame: 299, Matches 282, Inliers: 71.63
Saved at vis_preFeature/frame299.jpg
<Figure size 432x288 with 0 Axes>
```



1. Report the final rotation and translation error. (**2 points**)

1.4.1 SuperPoint result

Mean Error Rotation: 0.00321

Mean Error Translation: 0.51857

Matches 282, Inliers: 71.63

libviso2 result

Mean Error Rotation: 0.00299

Mean Error Translation: 0.53948

Matches 295, Inliers: 85.42

Next, answer the following questions:

2. Does SuperPoint yield higher accuracy than the original libviso2? If so, why? If not, what steps can you take to improve? (**5 points**)

SuperPoint yields lower error when estimating translation but higher error when estimating rotation. The number of matches and inlier for SuperPoint is lower than libviso2. This can explained why SuperPoint is not better than libviso2 in both translation and rotation estimation. Since SIFT feature points are better at estimating translation and is worse in estimating rotation, we can combine the feature detected by SuperPoint and SIFT to improve performance.

3. Explain briefly how the following issues are being handled in SuperPoint: (**3 points**)
 - a. Obtaining ground truth for keypoints.
 - b. Cheaply obtaining accurate ground truth matches, as compared to LIDAR in UCN or SFM in LIFT.
 - c. Learning a correlated feature representation for keypoint detection and description?

- a. Obtaining ground truth for keypoints.

SuperPoint trains an initial interest point detector on synthetic data, then apply a Homographic Adaptation procedure to label images from a target, unlabeled domain with interest points. A fully-convolutional network is trained to predict the generated label.

- b. Cheaply obtaining accurate ground truth matches, as compared to LIDAR in UCN or SFM in LIFT.

SuperPoint warps the image and applies the same warping operations to the interest points to obtain growth truth matches. The homography used for warping includes translation, scale, in-plane rotation, and symmetric perspective distortion.

- c. Learning a correlated feature representation for keypoint detection and description?

The keypoint detection and description share an initial feature extractor network, whose output is fed into 2 separate network for keypoint detection and keypoint description.

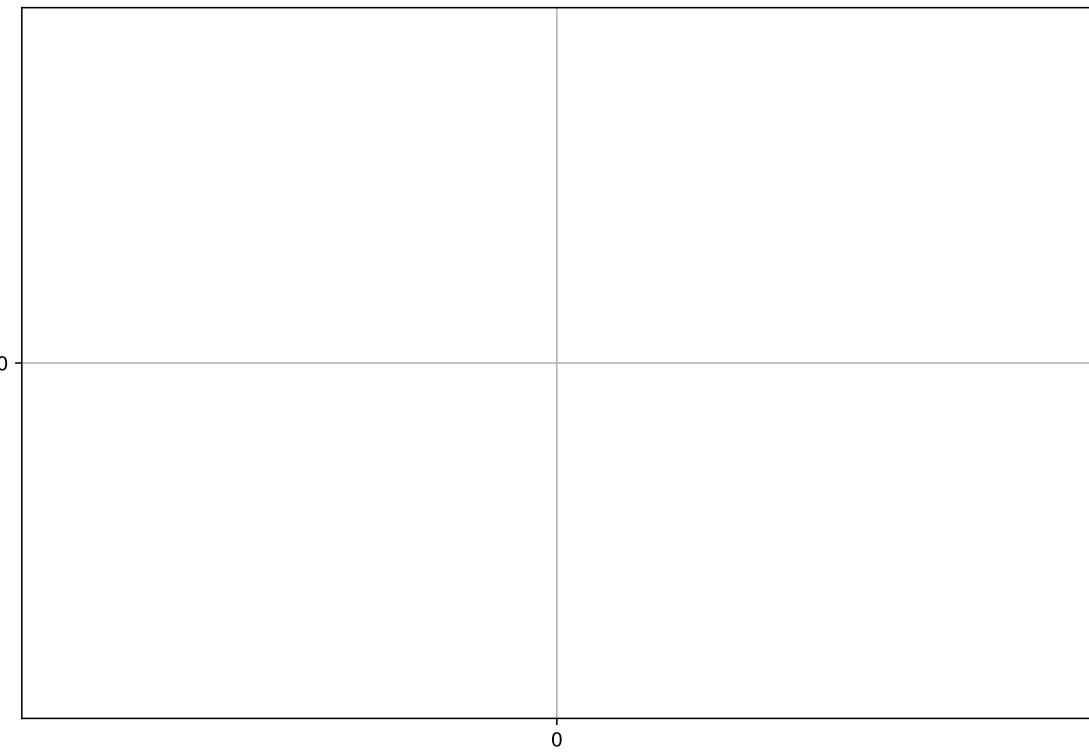
1.5 Question 4: Using SPyNet [5] for SfM

Now we will compute camera motion from optical flow computed using SPyNet. We first uniformly sample points in an image, then consider the flow-displaced point in the other image as a match. A modified PyTorch implementation of SPyNet is provided in directory Flow.

(A) Go to Flow and run `demo_spynet.py`.

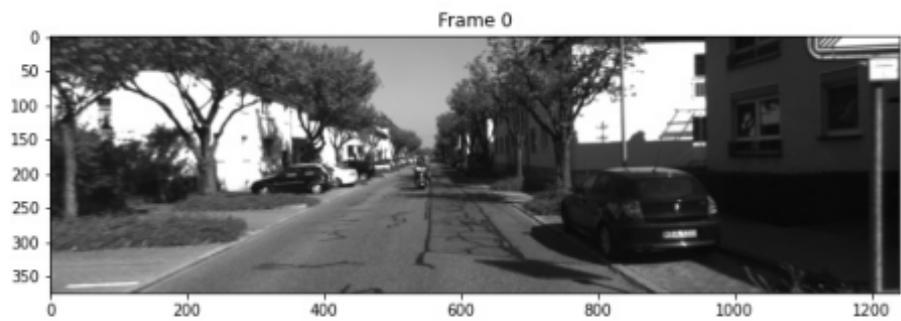
(B) Run the following script.

```
[12]: import runMatch
dataset_path = '/Users/QV/code-project/datasets/dataset_SfM'
feature_dir = 'Flow'
runMatch.runSfM(dataset_path, feature_dir )
```

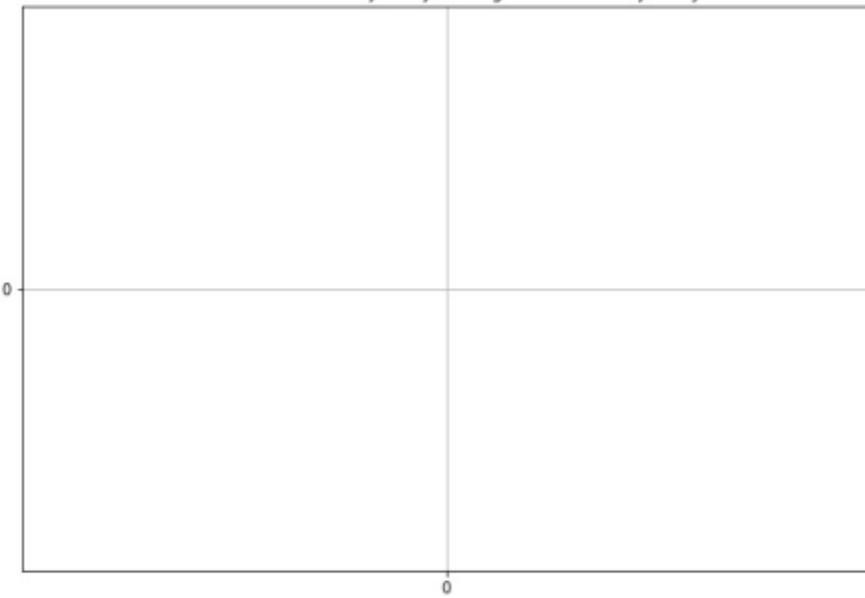


```
Mean Error Rotation: inf
Mean Error Translation: inf
== [Result] Frame: 0, Matches 0, Inliers: 0.00
<Figure size 432x288 with 0 Axes>
```

Saved at vis_preFeature/frame000.jpg



Blue: estimated trajectory; Red: ground truth trajectory



```
(1463, 4)
[[ 1.      -0.0032 -0.0038  0.001 ]
 [ 0.0032   1.      -0.0021 -0.0071]
 [ 0.0038   0.002    1.      0.4649]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.07540
Mean Error Translation: 97.58477
== [Result] Frame: 1, Matches 1463, Inliers: 97.74
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame001.jpg
(1463, 4)
[[ 1.      -0.0011 -0.0081 -0.0071]
 [ 0.0011   1.      -0.0033 -0.0153]
 [ 0.0081   0.0033  1.      0.9386]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.03963
Mean Error Translation: 48.98556
== [Result] Frame: 2, Matches 1463, Inliers: 96.65
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame002.jpg
(1463, 4)
[[ 0.9999 -0.0001 -0.012  -0.0176]
 [ 0.       1.      -0.0045 -0.0217]
 [ 0.012    0.0045  0.9999  1.4016]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.02731
Mean Error Translation: 32.78971
== [Result] Frame: 3, Matches 1463, Inliers: 95.28
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame003.jpg
(1463, 4)
[[ 0.9998  0.0009 -0.0174 -0.0261]
 [-0.001   1.      -0.0049 -0.0278]
 [ 0.0174  0.005   0.9998  1.8681]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.02170
Mean Error Translation: 24.69069
== [Result] Frame: 4, Matches 1463, Inliers: 94.60
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame004.jpg
(1463, 4)
[[ 0.9998 -0.0002 -0.0219 -0.0386]
 [ 0.0001  1.       -0.0051 -0.0351]
 [ 0.0219  0.0051  0.9997  2.3425]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01823
Mean Error Translation: 19.82983
== [Result] Frame: 5, Matches 1463, Inliers: 91.73

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame005.jpg
(1463, 4)
[[ 0.9997  0.0022 -0.0261 -0.0588]
 [-0.0024  1.       -0.0061 -0.0426]
 [ 0.0261  0.0062  0.9996  2.8178]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01586
Mean Error Translation: 16.58883
== [Result] Frame: 6, Matches 1463, Inliers: 92.00

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame006.jpg
(1463, 4)
[[ 0.9995  0.0056 -0.0306 -0.0854]
 [-0.0058  1.       -0.0069 -0.0466]
 [ 0.0306  0.0071  0.9995  3.3064]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01437
Mean Error Translation: 14.27208
== [Result] Frame: 7, Matches 1463, Inliers: 90.29

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame007.jpg
(1463, 4)
[[ 0.9994  0.0078 -0.0341 -0.1167]
 [-0.008   1.       -0.0053 -0.053 ]
 [ 0.034   0.0056  0.9994  3.813 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01319
Mean Error Translation: 12.53209
== [Result] Frame: 8, Matches 1463, Inliers: 90.29

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame008.jpg
(1463, 4)
[[ 0.9993  0.0126 -0.0352 -0.1715]
 [-0.0127  0.9999 -0.0028 -0.0599]
 [ 0.0351  0.0033  0.9994  4.3272]
 [ 0.        0.        1.        ]]
Mean Error Rotation: 0.01260
Mean Error Translation: 11.17798
== [Result] Frame: 9, Matches 1463, Inliers: 90.02
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame009.jpg
(1463, 4)
[[ 0.9992  0.0156 -0.0374 -0.2087]
 [-0.0157  0.9999 -0.0001 -0.0674]
 [ 0.0374  0.0007  0.9993  4.8767]
 [ 0.        0.        1.        ]]
Mean Error Rotation: 0.01199
Mean Error Translation: 10.09120
== [Result] Frame: 10, Matches 1463, Inliers: 89.20
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame010.jpg
(1463, 4)
[[ 0.999    0.0192 -0.0393 -0.246 ]
 [-0.0192  0.9998 -0.0005 -0.0773]
 [ 0.0393  0.0012  0.9992  5.4449]
 [ 0.        0.        1.        ]]
Mean Error Rotation: 0.01131
Mean Error Translation: 9.20018
== [Result] Frame: 11, Matches 1463, Inliers: 93.37
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame011.jpg
(1463, 4)
[[ 0.999    0.0149 -0.0427 -0.2616]
 [-0.0149  0.9999 -0.0008 -0.0796]
 [ 0.0427  0.0015  0.9991  6.0208]
 [ 0.        0.        1.        ]]
Mean Error Rotation: 0.01096
Mean Error Translation: 8.45731
== [Result] Frame: 12, Matches 1463, Inliers: 92.14
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame012.jpg
(1463, 4)
[[ 0.999  0.0136 -0.0436 -0.2948]
 [-0.0136  0.9999 -0.0015 -0.0845]
 [ 0.0436  0.0021  0.999   6.584 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.01036
Mean Error Translation: 7.82956
== [Result] Frame: 13, Matches 1463, Inliers: 89.61
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame013.jpg
(1463, 4)
[[ 0.9989  0.0139 -0.0451 -0.3272]
 [-0.0139  0.9999 -0.0007 -0.0912]
 [ 0.045   0.0013  0.999   7.1556]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00984
Mean Error Translation: 7.29084
== [Result] Frame: 14, Matches 1463, Inliers: 94.81
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame014.jpg
(1463, 4)
[[ 0.9989  0.0118 -0.0463 -0.3571]
 [-0.0119  0.9999 -0.0012 -0.0958]
 [ 0.0463  0.0017  0.9989  7.7454]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00928
Mean Error Translation: 6.82250
== [Result] Frame: 15, Matches 1463, Inliers: 95.83
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame015.jpg
(1463, 4)
[[ 0.9988  0.0159 -0.0465 -0.4043]
 [-0.0161  0.9999 -0.0032 -0.1095]
 [ 0.0465  0.0039  0.9989  8.3272]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00895
Mean Error Translation: 6.41363
== [Result] Frame: 16, Matches 1463, Inliers: 95.56
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame016.jpg
(1463, 4)
[[ 0.9987  0.0208 -0.0459 -0.4589]
 [-0.021   0.9998 -0.0057 -0.1228]
 [ 0.0458  0.0067  0.9989  8.924 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00881
Mean Error Translation: 6.05239
== [Result] Frame: 17, Matches 1463, Inliers: 98.36
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame017.jpg
(1463, 4)
[[ 0.9985  0.0311 -0.0447 -0.5299]
 [-0.0315  0.9995 -0.0075 -0.136 ]
 [ 0.0444  0.0089  0.999   9.5351]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00891
Mean Error Translation: 5.73111
== [Result] Frame: 18, Matches 1463, Inliers: 93.71
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame018.jpg
(1463, 4)
[[ 0.9984  0.0338 -0.045  -0.5736]
 [-0.0342  0.9994 -0.0067 -0.1518]
 [ 0.0447  0.0082  0.999  10.17 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00858
Mean Error Translation: 5.44292
== [Result] Frame: 19, Matches 1463, Inliers: 87.63
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame019.jpg
(1463, 4)
[[ 0.9984  0.0352 -0.0453 -0.6244]
 [-0.0354  0.9994 -0.0049 -0.1696]
 [ 0.0451  0.0065  0.999  10.8344]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00829
Mean Error Translation: 5.18255
== [Result] Frame: 20, Matches 1463, Inliers: 87.56
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame020.jpg
(1463, 4)
[[ 0.9983  0.0354 -0.0469 -0.6598]
 [-0.0356  0.9994 -0.0034 -0.1794]
 [ 0.0468  0.0051  0.9989 11.5037]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00790
Mean Error Translation: 4.94702
== [Result] Frame: 21, Matches 1463, Inliers: 90.84
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame021.jpg
(1463, 4)
[[ 0.9982  0.0362 -0.0479 -0.7002]
 [-0.0364  0.9993 -0.0034 -0.1903]
 [ 0.0478  0.0051  0.9988 12.1626]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00763
Mean Error Translation: 4.73366
== [Result] Frame: 22, Matches 1463, Inliers: 95.28
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame022.jpg
(1463, 4)
[[ 0.9981  0.0369 -0.0491 -0.7395]
 [-0.0372  0.9993 -0.0044 -0.196 ]
 [ 0.0489  0.0062  0.9988 12.791 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00736
Mean Error Translation: 4.54028
== [Result] Frame: 23, Matches 1463, Inliers: 88.86
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame023.jpg
(1463, 4)
[[ 0.9981  0.036  -0.0499 -0.7807]
 [-0.0363  0.9993 -0.0048 -0.2126]
 [ 0.0497  0.0066  0.9987 13.4221]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00712
Mean Error Translation: 4.36302
== [Result] Frame: 24, Matches 1463, Inliers: 87.70
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame024.jpg
(1463, 4)
[[ 0.998  0.0375 -0.0502 -0.8206]
 [-0.0377  0.9993 -0.0032 -0.2192]
 [ 0.05   0.0051  0.9987 14.0298]
 [ 0.     0.     0.     1.    ]]
Mean Error Rotation: 0.00693
Mean Error Translation: 4.20130
== [Result] Frame: 25, Matches 1463, Inliers: 89.47
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame025.jpg
(1463, 4)
[[ 0.998  0.0399 -0.0495 -0.8633]
 [-0.0399  0.9992  0.0002 -0.2292]
 [ 0.0495  0.0018  0.9988 14.6257]
 [ 0.     0.     0.     1.    ]]
Mean Error Rotation: 0.00672
Mean Error Translation: 4.05275
== [Result] Frame: 26, Matches 1463, Inliers: 92.48
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame026.jpg
(1463, 4)
[[ 0.9978  0.0489 -0.0454 -0.9396]
 [-0.0488  0.9988  0.0031 -0.2363]
 [ 0.0455 -0.0009  0.999  15.2503]
 [ 0.     0.     0.     1.    ]]
Mean Error Rotation: 0.00694
Mean Error Translation: 3.91422
== [Result] Frame: 27, Matches 1463, Inliers: 91.93
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame027.jpg
(1463, 4)
[[ 0.9979  0.0484 -0.0432 -0.9791]
 [-0.0482  0.9988  0.0052 -0.2349]
 [ 0.0434 -0.0031  0.9991 15.9013]
 [ 0.     0.     0.     1.    ]]
Mean Error Rotation: 0.00674
Mean Error Translation: 3.78489
== [Result] Frame: 28, Matches 1463, Inliers: 91.25
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame028.jpg
(1463, 4)
[[ 0.9979  0.051 -0.04  -1.0291]
 [-0.0508  0.9987  0.0057 -0.2408]
 [ 0.0403 -0.0036  0.9992 16.5557]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00667
Mean Error Translation: 3.66443
== [Result] Frame: 29, Matches 1463, Inliers: 92.41
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame029.jpg
(1463, 4)
[[ 0.9977  0.0578 -0.0361 -1.0927]
 [-0.0577  0.9983  0.0023 -0.2468]
 [ 0.0362 -0.0002  0.9993 17.2161]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00679
Mean Error Translation: 3.55189
== [Result] Frame: 30, Matches 1463, Inliers: 94.12
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame030.jpg
(1463, 4)
[[ 0.9974  0.0634 -0.0336 -1.1454]
 [-0.0635  0.998 -0.0028 -0.2543]
 [ 0.0333  0.0049  0.9994 17.8749]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00680
Mean Error Translation: 3.44677
== [Result] Frame: 31, Matches 1463, Inliers: 92.14
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame031.jpg
(1463, 4)
[[ 0.9975  0.0633 -0.0321 -1.1771]
 [-0.0635  0.998 -0.0057 -0.264 ]
 [ 0.0317  0.0077  0.9995 18.5491]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00662
Mean Error Translation: 3.34798
== [Result] Frame: 32, Matches 1463, Inliers: 92.62
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame032.jpg
(1463, 4)
[[ 0.9976  0.062 -0.0302 -1.2154]
 [-0.0622  0.9981 -0.0044 -0.2788]
 [ 0.0299  0.0063  0.9995 19.2287]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00649
Mean Error Translation: 3.25529
== [Result] Frame: 33, Matches 1463, Inliers: 93.30
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame033.jpg
(1463, 4)
[[ 0.9976  0.0637 -0.0281 -1.2642]
 [-0.0637  0.998   0.0006 -0.2919]
 [ 0.028   0.0012  0.9996 19.9022]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00647
Mean Error Translation: 3.16844
== [Result] Frame: 34, Matches 1463, Inliers: 87.56
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame034.jpg
(1463, 4)
[[ 0.9977  0.0624 -0.0283 -1.2888]
 [-0.0623  0.9981  0.0044 -0.3043]
 [ 0.0285 -0.0026  0.9996 20.5656]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00637
Mean Error Translation: 3.08697
== [Result] Frame: 35, Matches 1463, Inliers: 89.68
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame035.jpg
(1463, 4)
[[ 0.998   0.0566 -0.0295 -1.3056]
 [-0.0565  0.9984  0.004  -0.3163]
 [ 0.0297 -0.0023  0.9996 21.2628]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00626
Mean Error Translation: 3.00910
== [Result] Frame: 36, Matches 1463, Inliers: 83.39
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame036.jpg
(1463, 4)
[[ 0.998  0.0554 -0.0301 -1.3397]
 [-0.0554  0.9985 -0.0007 -0.3147]
 [ 0.03    0.0024  0.9995 21.9553]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00618
Mean Error Translation: 2.93555
== [Result] Frame: 37, Matches 1463, Inliers: 85.37
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame037.jpg
(1463, 4)
[[ 0.9978  0.0588 -0.0313 -1.3724]
 [-0.059   0.9982 -0.005  -0.3196]
 [ 0.0309  0.0068  0.9995 22.6444]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00612
Mean Error Translation: 2.86611
== [Result] Frame: 38, Matches 1463, Inliers: 93.16
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame038.jpg
(1463, 4)
[[ 0.9975  0.062  -0.0333 -1.4278]
 [-0.0622  0.998  -0.0057 -0.337 ]
 [ 0.0329  0.0077  0.9994 23.8551]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00606
Mean Error Translation: 2.79778
== [Result] Frame: 39, Matches 1463, Inliers: 94.12
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame039.jpg
(1463, 4)
[[ 0.9977  0.0588 -0.0346 -1.4849]
 [-0.059   0.9982 -0.0051 -0.3511]
 [ 0.0342  0.0071  0.9994 25.6818]
 [ 0.      0.      0.      1.      ]]
Mean Error Rotation: 0.00603
Mean Error Translation: 2.74713
== [Result] Frame: 40, Matches 1463, Inliers: 90.02
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame040.jpg
(1463, 4)
[[ 0.9975  0.0618 -0.035  -1.6075]
 [-0.0619  0.9981 -0.0026 -0.3883]
 [ 0.0347  0.0048  0.9994 27.7567]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00591
Mean Error Translation: 2.70539
== [Result] Frame: 41, Matches 1463, Inliers: 84.48
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame041.jpg
(1463, 4)
[[ 0.9973  0.0646 -0.0354 -1.6484]
 [-0.0647  0.9979 -0.002   -0.3991]
 [ 0.0352  0.0043  0.9994 28.365 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00586
Mean Error Translation: 2.65139
== [Result] Frame: 42, Matches 1463, Inliers: 77.72
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame042.jpg
(1463, 4)
[[ 0.9972  0.0657 -0.0367 -1.6761]
 [-0.0657  0.9978  0.0008 -0.42  ]
 [ 0.0367  0.0016  0.9993 28.9835]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00575
Mean Error Translation: 2.59941
== [Result] Frame: 43, Matches 1463, Inliers: 84.14
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame043.jpg
(1463, 4)
[[ 0.997   0.0695 -0.0347 -1.7233]
 [-0.0695  0.9976  0.0031 -0.4253]
 [ 0.0348 -0.0007  0.9994 29.6032]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00578
Mean Error Translation: 2.54981
== [Result] Frame: 44, Matches 1463, Inliers: 80.66
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame044.jpg
(1463, 4)
[[ 0.9963  0.0793 -0.034  -1.7689]
 [-0.0791  0.9968  0.0061  -0.4431]
 [ 0.0344 -0.0034  0.9994  30.2301]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00578
Mean Error Translation: 2.50197
== [Result] Frame: 45, Matches 1463, Inliers: 80.52
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame045.jpg
(1463, 4)
[[ 0.996   0.0827 -0.0325 -1.8147]
 [-0.0826  0.9966  0.0048 -0.4458]
 [ 0.0328 -0.0021  0.9995  30.8889]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00576
Mean Error Translation: 2.45552
== [Result] Frame: 46, Matches 1463, Inliers: 90.29
<Figure size 432x288 with 0 Axes>
```

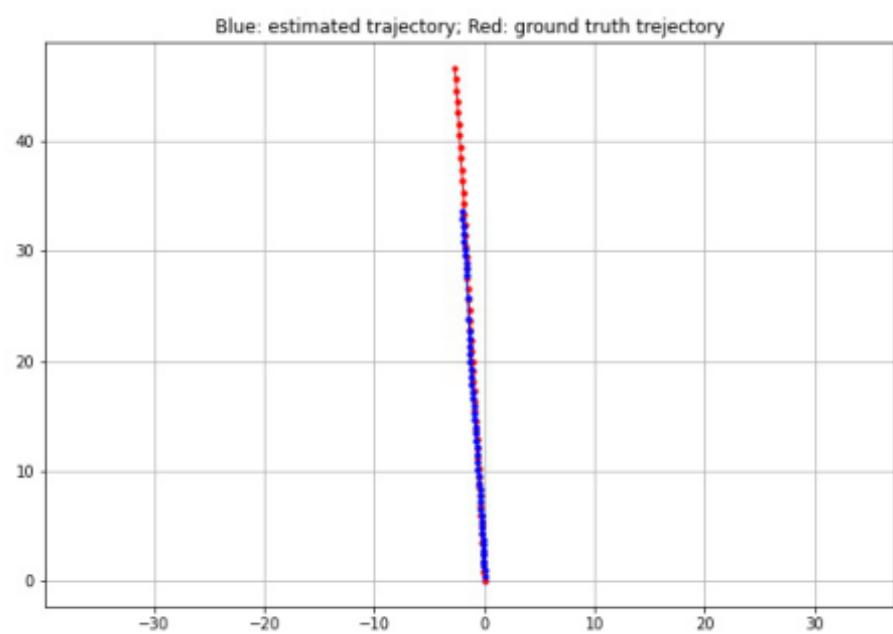
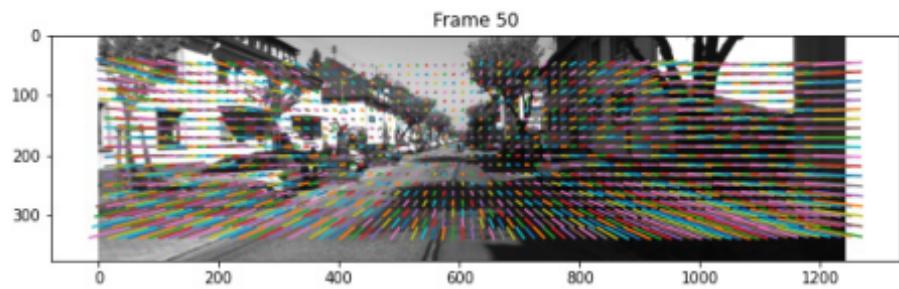
```
Saved at vis_preFeature/frame046.jpg
(1463, 4)
[[ 0.9959  0.085  -0.0312 -1.8574]
 [-0.085   0.9964  0.0029 -0.452 ]
 [ 0.0314 -0.0002  0.9995  31.5703]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00573
Mean Error Translation: 2.41030
== [Result] Frame: 47, Matches 1463, Inliers: 92.48
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame047.jpg
(1463, 4)
[[ 0.9952  0.0931 -0.0293 -1.9172]
 [-0.0932  0.9956  0.0003 -0.4606]
 [ 0.0292  0.0024  0.9996  32.2551]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00579
Mean Error Translation: 2.36678
== [Result] Frame: 48, Matches 1463, Inliers: 87.90
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame048.jpg
(1463, 4)
[[ 0.9948  0.0975 -0.0284 -1.9681]
 [-0.0975  0.9952  0.0001 -0.471 ]
 [ 0.0282  0.0026  0.9996 32.9445]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00582
Mean Error Translation: 2.32487
== [Result] Frame: 49, Matches 1463, Inliers: 85.37
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame049.jpg
(1463, 4)
[[ 0.9949  0.097  -0.0284 -2.0076]
 [-0.0971  0.9953  0.0008 -0.4761]
 [ 0.0284  0.0019  0.9996 33.6755]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00576
Mean Error Translation: 2.28378
== [Result] Frame: 50, Matches 1463, Inliers: 84.01
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame050.jpg
```



```

(1463, 4)
[[ 0.9948  0.0981 -0.0285 -2.0468]
 [-0.0981  0.9952  0.0017 -0.4859]
 [ 0.0285  0.0011  0.9996 34.4631]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00568
Mean Error Translation: 2.24313
== [Result] Frame: 51, Matches 1463, Inliers: 84.28

<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame051.jpg
(1463, 4)
[[ 0.9941  0.1049 -0.0266 -2.11   ]
 [-0.105   0.9945 -0.0023 -0.4997]
 [ 0.0262  0.0051  0.9996 35.2567]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00571
Mean Error Translation: 2.20372
== [Result] Frame: 52, Matches 1463, Inliers: 85.71

<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame052.jpg
(1463, 4)
[[ 0.9937  0.1085 -0.0265 -2.1668]
 [-0.1087  0.9941 -0.0063 -0.5207]
 [ 0.0256  0.0091  0.9996 36.1392]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00570
Mean Error Translation: 2.16396
== [Result] Frame: 53, Matches 1463, Inliers: 90.91

<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame053.jpg
(1463, 4)
[[ 0.9935  0.1103 -0.0269 -2.2061]
 [-0.1106  0.9938 -0.0075 -0.5379]
 [ 0.0259  0.0105  0.9996 37.0711]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00563
Mean Error Translation: 2.12497
== [Result] Frame: 54, Matches 1463, Inliers: 89.41

<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame054.jpg
(1463, 4)
[[ 0.9939  0.1071 -0.0272 -2.2291]
 [-0.1072  0.9942 -0.004  -0.5609]
 [ 0.0266  0.0069  0.9996 38.0382]
 [ 0.        0.        1.        ]]
Mean Error Rotation: 0.00560
Mean Error Translation: 2.08717
== [Result] Frame: 55, Matches 1463, Inliers: 90.36
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame055.jpg
(1463, 4)
[[ 0.9942  0.1038 -0.0281 -2.2496]
 [-0.1039  0.9946 -0.0006 -0.5864]
 [ 0.0279  0.0035  0.9996 39.059 ]
 [ 0.        0.        1.        ]]
Mean Error Rotation: 0.00553
Mean Error Translation: 2.05101
== [Result] Frame: 56, Matches 1463, Inliers: 89.68
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame056.jpg
(1463, 4)
[[ 0.994   0.1054 -0.0276 -2.3054]
 [-0.1055  0.9944  0.0002 -0.6121]
 [ 0.0275  0.0027  0.9996 40.1905]
 [ 0.        0.        1.        ]]
Mean Error Rotation: 0.00551
Mean Error Translation: 2.01787
== [Result] Frame: 57, Matches 1463, Inliers: 92.89
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame057.jpg
(1463, 4)
[[ 0.9938  0.1073 -0.0277 -2.3632]
 [-0.1074  0.9942 -0.0007 -0.6393]
 [ 0.0274  0.0037  0.9996 41.4357]
 [ 0.        0.        1.        ]]
Mean Error Rotation: 0.00553
Mean Error Translation: 1.98794
== [Result] Frame: 58, Matches 1463, Inliers: 96.31
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame058.jpg
(1463, 4)
[[ 0.994  0.1055 -0.0286 -2.4072]
 [-0.1056  0.9944 -0.0021 -0.6621]
 [ 0.0282  0.0051  0.9996 42.8894]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00548
Mean Error Translation: 1.96256
== [Result] Frame: 59, Matches 1463, Inliers: 93.23

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame059.jpg
(1463, 4)
[[ 0.9939  0.1064 -0.0293 -2.436 ]
 [-0.1064  0.9943 -0.0012 -0.6698]
 [ 0.029   0.0043  0.9996 43.5434]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00544
Mean Error Translation: 1.93496
== [Result] Frame: 60, Matches 1463, Inliers: 92.00

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame060.jpg
(1463, 4)
[[ 0.9937  0.108  -0.0286 -2.4758]
 [-0.108   0.9942  0.0025 -0.6771]
 [ 0.0287  0.0006  0.9996 44.2026]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00546
Mean Error Translation: 1.90823
== [Result] Frame: 61, Matches 1463, Inliers: 89.61

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame061.jpg
(1463, 4)
[[ 0.993   0.1156 -0.0261 -2.5333]
 [-0.1155  0.9933  0.0064 -0.6809]
 [ 0.0267 -0.0034  0.9996 44.8795]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00560
Mean Error Translation: 1.88205
== [Result] Frame: 62, Matches 1463, Inliers: 88.24

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame062.jpg
(1463, 4)
[[ 0.9923  0.1214 -0.0257 -2.5739]
 [-0.1212  0.9926  0.0082 -0.6846]
 [ 0.0265 -0.005   0.9996 45.5832]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00561
Mean Error Translation: 1.85615
== [Result] Frame: 63, Matches 1463, Inliers: 92.96
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame063.jpg
(1463, 4)
[[ 0.992   0.1234 -0.0278 -2.6033]
 [-0.1233  0.9924  0.0049 -0.6997]
 [ 0.0282 -0.0015  0.9996 46.2485]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00555
Mean Error Translation: 1.83150
== [Result] Frame: 64, Matches 1463, Inliers: 95.97
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame064.jpg
(1463, 4)
[[ 0.9918  0.1239 -0.0314 -2.6208]
 [-0.124   0.9923 -0.0015 -0.7193]
 [ 0.0309  0.0054  0.9995 46.8865]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00552
Mean Error Translation: 1.80779
== [Result] Frame: 65, Matches 1463, Inliers: 91.39
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame065.jpg
(1463, 4)
[[ 0.9911  0.129   -0.0319 -2.6622]
 [-0.1292  0.9916 -0.0062 -0.7276]
 [ 0.0308  0.0103  0.9995 47.5227]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00553
Mean Error Translation: 1.78464
== [Result] Frame: 66, Matches 1463, Inliers: 94.33
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame066.jpg
(1463, 4)
[[ 0.9899  0.1378 -0.0321 -2.7093]
 [-0.138   0.9904 -0.0057 -0.7344]
 [ 0.031   0.01     0.9995 48.1767]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00553
Mean Error Translation: 1.76187
== [Result] Frame: 67, Matches 1463, Inliers: 94.87
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame067.jpg
(1463, 4)
[[ 0.9891  0.1435 -0.0321 -2.7524]
 [-0.1436  0.9896 -0.0037 -0.7443]
 [ 0.0312  0.0083  0.9995 48.8378]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00550
Mean Error Translation: 1.73949
== [Result] Frame: 68, Matches 1463, Inliers: 93.57
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame068.jpg
(1463, 4)
[[ 0.9884  0.1482 -0.0325 -2.7917]
 [-0.1484  0.9889 -0.0027 -0.7533]
 [ 0.0318  0.0075  0.9995 49.4839]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00547
Mean Error Translation: 1.71775
== [Result] Frame: 69, Matches 1463, Inliers: 94.05
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame069.jpg
(1463, 4)
[[ 0.9877  0.153  -0.0316 -2.8444]
 [-0.1532  0.9882 -0.0034 -0.7599]
 [ 0.0307  0.0082  0.9995 50.1    ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00550
Mean Error Translation: 1.69684
== [Result] Frame: 70, Matches 1463, Inliers: 91.18
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame070.jpg
(1463, 4)
[[ 0.9866  0.1603 -0.0308 -2.9086]
 [-0.1604  0.987  -0.0028 -0.7713]
 [ 0.0299  0.0077  0.9995 50.7405]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00555
Mean Error Translation: 1.67597
== [Result] Frame: 71, Matches 1463, Inliers: 85.51
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame071.jpg
(1463, 4)
[[ 0.9857  0.1658 -0.0287 -2.9758]
 [-0.166   0.9861 -0.0033 -0.7766]
 [ 0.0278  0.008   0.9996 51.403 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00558
Mean Error Translation: 1.65522
== [Result] Frame: 72, Matches 1463, Inliers: 91.11
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame072.jpg
(1463, 4)
[[ 0.9853  0.1685 -0.0279 -3.018 ]
 [-0.1687  0.9857 -0.0035 -0.7851]
 [ 0.0269  0.0082  0.9996 52.0028]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00559
Mean Error Translation: 1.63571
== [Result] Frame: 73, Matches 1463, Inliers: 89.95
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame073.jpg
(1463, 4)
[[ 0.985   0.1706 -0.0271 -3.0782]
 [-0.1707  0.9853 -0.0028 -0.798 ]
 [ 0.0262  0.0073  0.9996 52.8591]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00557
Mean Error Translation: 1.61417
== [Result] Frame: 74, Matches 1463, Inliers: 88.52
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame074.jpg
(1463, 4)
[[ 0.984  0.1763 -0.0264 -3.1357]
 [-0.1763  0.9843 -0.0003 -0.8117]
 [ 0.0259  0.0049  0.9997 53.6903]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00557
Mean Error Translation: 1.59306
== [Result] Frame: 75, Matches 1463, Inliers: 88.79
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame075.jpg
(1463, 4)
[[ 0.9831  0.1811 -0.0257 -3.1763]
 [-0.181   0.9835  0.0038 -0.8262]
 [ 0.026   0.0009  0.9997 54.3234]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00557
Mean Error Translation: 1.57424
== [Result] Frame: 76, Matches 1463, Inliers: 90.57
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame076.jpg
(1463, 4)
[[ 0.9827  0.1833 -0.0272 -3.2001]
 [-0.1832  0.9831  0.0055 -0.8384]
 [ 0.0277 -0.0005  0.9996 55.0136]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00550
Mean Error Translation: 1.55504
== [Result] Frame: 77, Matches 1463, Inliers: 93.57
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame077.jpg
(1463, 4)
[[ 0.982   0.1867 -0.0285 -3.2353]
 [-0.1867  0.9824  0.0014 -0.8497]
 [ 0.0283  0.0039  0.9996 55.6805]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00546
Mean Error Translation: 1.53631
== [Result] Frame: 78, Matches 1463, Inliers: 91.93
<Figure size 432x288 with 0 Axes>
```

```

Saved at vis_preFeature/frame078.jpg
(1463, 4)
[[ 0.982  0.1862 -0.0308 -3.2636]
 [-0.1865  0.9824 -0.006  -0.8603]
 [ 0.0292  0.0117  0.9995 56.3378]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00541
Mean Error Translation: 1.51793
== [Result] Frame: 79, Matches 1463, Inliers: 89.06
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame079.jpg
(1463, 4)
[[ 0.9816  0.188  -0.0328 -3.2965]
 [-0.1884  0.982  -0.012  -0.866 ]
 [ 0.0299  0.018  0.9994 56.9097]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00539
Mean Error Translation: 1.50077
== [Result] Frame: 80, Matches 1463, Inliers: 90.57
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame080.jpg
(1463, 4)
[[ 0.9819  0.1865 -0.0342 -3.3121]
 [-0.187   0.9823 -0.0133 -0.8727]
 [ 0.0311  0.0195  0.9993 57.4172]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00537
Mean Error Translation: 1.48464
== [Result] Frame: 81, Matches 1463, Inliers: 92.62
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame081.jpg
(1463, 4)
[[ 0.9818  0.1866 -0.0342 -3.3352]
 [-0.187   0.9823 -0.0103 -0.8797]
 [ 0.0317  0.0165  0.9994 57.8775]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00534
Mean Error Translation: 1.46924
== [Result] Frame: 82, Matches 1463, Inliers: 91.18
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame082.jpg
(1463, 4)
[[ 0.9816  0.1878 -0.0341 -3.367 ]
 [-0.1882  0.9821 -0.0087 -0.8872]
 [ 0.0319  0.0149  0.9994 58.3124]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00532
Mean Error Translation: 1.45425
== [Result] Frame: 83, Matches 1463, Inliers: 94.05

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame083.jpg
(1463, 4)
[[ 0.9817  0.1874 -0.0349 -3.3975]
 [-0.1879  0.9821 -0.0126 -0.893 ]
 [ 0.0319  0.019   0.9993 58.7272]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00531
Mean Error Translation: 1.43954
== [Result] Frame: 84, Matches 1463, Inliers: 89.34

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame084.jpg
(1463, 4)
[[ 0.9825  0.1829 -0.0342 -3.4266]
 [-0.1836  0.9828 -0.0185 -0.9054]
 [ 0.0302  0.0245  0.9992 59.107 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00530
Mean Error Translation: 1.42535
== [Result] Frame: 85, Matches 1463, Inliers: 91.59

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame085.jpg
(1463, 4)
[[ 0.9832  0.1796 -0.0338 -3.4359]
 [-0.1804  0.9833 -0.0232 -0.9246]
 [ 0.0291  0.0289  0.9992 59.4521]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00527
Mean Error Translation: 1.41170
== [Result] Frame: 86, Matches 1463, Inliers: 93.71

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame086.jpg
(1463, 4)
[[ 0.9832  0.1801 -0.0306 -3.4457]
 [-0.1809  0.9832 -0.0241 -0.9372]
 [ 0.0257  0.0293  0.9992 59.7804]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00523
Mean Error Translation: 1.39843
== [Result] Frame: 87, Matches 1463, Inliers: 93.64
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame087.jpg
(1463, 4)
[[ 0.9827  0.1833 -0.0262 -3.4539]
 [-0.1838  0.9827 -0.0221 -0.9492]
 [ 0.0217  0.0266  0.9994 60.1051]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00521
Mean Error Translation: 1.38538
== [Result] Frame: 88, Matches 1463, Inliers: 94.26
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame088.jpg
(1463, 4)
[[ 0.9832  0.1815 -0.0216 -3.4517]
 [-0.1819  0.9831 -0.0202 -0.9622]
 [ 0.0175  0.0238  0.9996 60.4299]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00516
Mean Error Translation: 1.37245
== [Result] Frame: 89, Matches 1463, Inliers: 94.81
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame089.jpg
(1463, 4)
[[ 0.9836  0.1799 -0.0141 -3.4589]
 [-0.1801  0.9835 -0.0178 -0.9725]
 [ 0.0107  0.02     0.9997 60.7633]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00516
Mean Error Translation: 1.35954
== [Result] Frame: 90, Matches 1463, Inliers: 95.69
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame090.jpg
(1463, 4)
[[ 0.984  0.1779 -0.0051 -3.4598]
 [-0.178  0.9839 -0.0164 -0.9852]
 [ 0.0021  0.017   0.9999 61.0989]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00515
Mean Error Translation: 1.34676
== [Result] Frame: 91, Matches 1463, Inliers: 93.92
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame091.jpg
(1463, 4)
[[ 0.9838  0.1793  0.0041 -3.4432]
 [-0.1792  0.9836 -0.0184 -1.0023]
 [-0.0073  0.0173  0.9998 61.4246]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00512
Mean Error Translation: 1.33420
== [Result] Frame: 92, Matches 1463, Inliers: 95.97
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame092.jpg
(1463, 4)
[[ 0.9823  0.1864  0.0192 -3.4407]
 [-0.186   0.9823 -0.0219 -1.0129]
 [-0.023   0.018   0.9996 61.7494]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00509
Mean Error Translation: 1.32177
== [Result] Frame: 93, Matches 1463, Inliers: 95.97
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame093.jpg
(1463, 4)
[[ 0.9809  0.1911  0.0367 -3.4229]
 [-0.1903  0.9814 -0.0246 -1.0281]
 [-0.0407  0.0171  0.999  62.0676]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00504
Mean Error Translation: 1.30954
== [Result] Frame: 94, Matches 1463, Inliers: 95.01
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame094.jpg
(1463, 4)
[[ 0.9806  0.1875  0.0574 -3.3844]
 [-0.1861  0.9821 -0.0278 -1.0466]
 [-0.0615  0.0166  0.998  62.3815]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00502
Mean Error Translation: 1.29747
== [Result] Frame: 95, Matches 1463, Inliers: 93.64
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame095.jpg
(1463, 4)
[[ 0.9796  0.1833  0.0826 -3.3378]
 [-0.1812  0.9829 -0.0314 -1.0669]
 [-0.0869  0.0158  0.9961 62.6917]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00498
Mean Error Translation: 1.28551
== [Result] Frame: 96, Matches 1463, Inliers: 96.86
<Figure size 432x288 with 0 Axes>
```

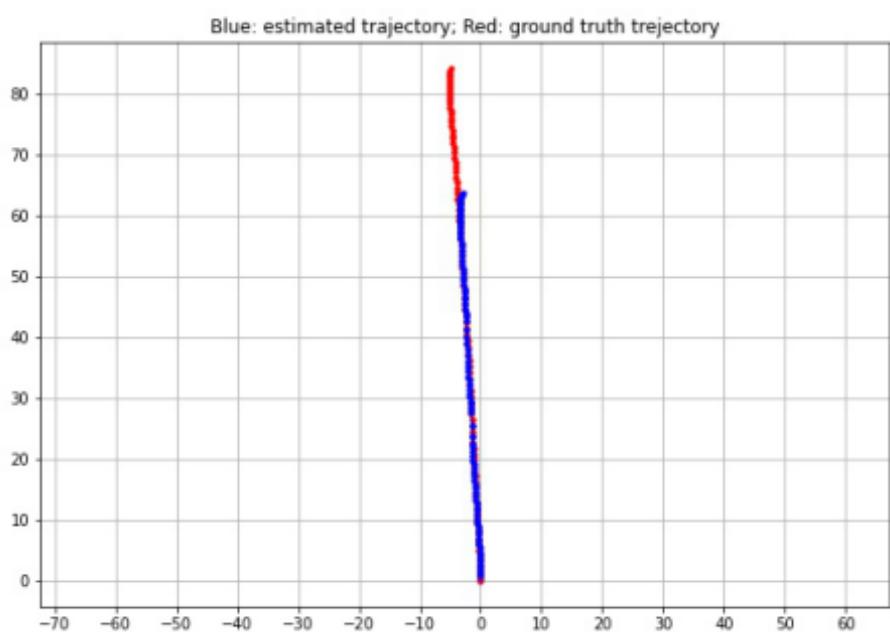
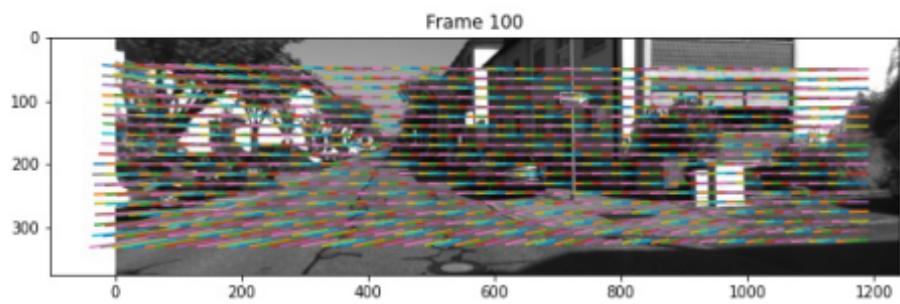
```
Saved at vis_preFeature/frame096.jpg
(1463, 4)
[[ 0.9778  0.1788  0.1095 -3.2691]
 [-0.1759  0.9838 -0.0349 -1.0923]
 [-0.114   0.0149  0.9934 62.9857]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00498
Mean Error Translation: 1.27392
== [Result] Frame: 97, Matches 1463, Inliers: 96.79
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame097.jpg
(1463, 4)
[[ 0.9745  0.1755  0.1401 -3.1906]
 [-0.1717  0.9844 -0.039  -1.1176]
 [-0.1447  0.014   0.9894 63.2803]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00497
Mean Error Translation: 1.26248
== [Result] Frame: 98, Matches 1463, Inliers: 97.06
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame098.jpg
(1463, 4)
[[ 0.9693  0.1728  0.1749 -3.1016]
 [-0.1675  0.9849 -0.0447 -1.1446]
 [-0.1799  0.014   0.9836 63.5722]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00496
Mean Error Translation: 1.25114
== [Result] Frame: 99, Matches 1463, Inliers: 96.38
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame099.jpg
(1463, 4)
[[ 0.9622  0.1699  0.2129 -2.9955]
 [-0.1625  0.9853 -0.0518 -1.1708]
 [-0.2186  0.0152  0.9757 63.8567]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00497
Mean Error Translation: 1.24007
== [Result] Frame: 100, Matches 1463, Inliers: 95.15
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame100.jpg
```



```

(1463, 4)
[[ 0.9527  0.1663  0.2543 -2.8737]
 [-0.1563  0.9859 -0.059   -1.2025]
 [-0.2605  0.0165  0.9653  64.1343]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00497
Mean Error Translation: 1.22917
== [Result] Frame: 101, Matches 1463, Inliers: 96.99

<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame101.jpg
(1463, 4)
[[ 0.9393  0.1658  0.3005 -2.7494]
 [-0.152   0.986   -0.0688 -1.2344]
 [-0.3077  0.019   0.9513  64.4095]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00497
Mean Error Translation: 1.21825
== [Result] Frame: 102, Matches 1463, Inliers: 95.63

<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame102.jpg
(1463, 4)
[[ 0.9223  0.1641  0.35   -2.6094]
 [-0.1452  0.9862 -0.0798 -1.269 ]
 [-0.3583  0.0228  0.9333  64.666 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00496
Mean Error Translation: 1.20768
== [Result] Frame: 103, Matches 1463, Inliers: 96.31

<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame103.jpg
(1463, 4)
[[ 0.8999  0.1636  0.4043 -2.4708]
 [-0.1388  0.9862 -0.0902 -1.2999]
 [-0.4135  0.0251  0.9102  64.9191]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00495
Mean Error Translation: 1.19713
== [Result] Frame: 104, Matches 1463, Inliers: 96.45

<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame104.jpg
(1463, 4)
[[ 0.8728  0.163   0.46   -2.3172]
 [-0.1314  0.9863 -0.1002 -1.3327]
 [-0.47    0.027   0.8823  65.1619]
 [ 0.      0.      0.      1.     ]]
Mean Error Rotation: 0.00494
Mean Error Translation: 1.18685
== [Result] Frame: 105, Matches 1463, Inliers: 96.92
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame105.jpg
(1463, 4)
[[ 0.8415  0.1613  0.5156 -2.143 ]
 [-0.1214  0.9864 -0.1104 -1.3651]
 [-0.5265  0.0303  0.8497  65.3904]
 [ 0.      0.      0.      1.     ]]
Mean Error Rotation: 0.00493
Mean Error Translation: 1.17671
== [Result] Frame: 106, Matches 1463, Inliers: 96.31
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame106.jpg
(1463, 4)
[[ 0.8063  0.1585  0.5698 -1.9531]
 [-0.1092  0.9868 -0.1199 -1.4056]
 [-0.5813  0.0345  0.813   65.5955]
 [ 0.      0.      0.      1.     ]]
Mean Error Rotation: 0.00492
Mean Error Translation: 1.16668
== [Result] Frame: 107, Matches 1463, Inliers: 97.13
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame107.jpg
(1463, 4)
[[ 0.7681  0.1559  0.621   -1.7499]
 [-0.0971  0.9871 -0.1276 -1.452 ]
 [-0.6329  0.0377  0.7733  65.7845]
 [ 0.      0.      0.      1.     ]]
Mean Error Rotation: 0.00491
Mean Error Translation: 1.15695
== [Result] Frame: 108, Matches 1463, Inliers: 97.20
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame108.jpg
(1463, 4)
[[ 0.717   0.161   0.6782 -1.606 ]
 [-0.094   0.9864 -0.1348 -1.4904]
 [-0.6907  0.0329  0.7224 66.0374]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00507
Mean Error Translation: 1.14758
== [Result] Frame: 109, Matches 1463, Inliers: 95.08
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame109.jpg
(1463, 4)
[[ 0.6715  0.1594  0.7237 -1.3794]
 [-0.0857  0.9867 -0.1378 -1.5403]
 [-0.736   0.0305  0.6763 66.209 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00505
Mean Error Translation: 1.13817
== [Result] Frame: 110, Matches 1463, Inliers: 94.33
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame110.jpg
(1463, 4)
[[ 0.6234  0.1591  0.7655 -1.1341]
 [-0.0764  0.9868 -0.1429 -1.5799]
 [-0.7781  0.0306  0.6273 66.3691]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00504
Mean Error Translation: 1.12878
== [Result] Frame: 111, Matches 1463, Inliers: 92.41
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame111.jpg
(1463, 4)
[[ 0.5744  0.1588  0.803   -0.8957]
 [-0.0656  0.9868 -0.1482 -1.6271]
 [-0.816   0.0325  0.5772 66.5051]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00503
Mean Error Translation: 1.11967
== [Result] Frame: 112, Matches 1463, Inliers: 91.18
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame112.jpg
(1463, 4)
[[ 0.5193  0.1594  0.8396 -0.6495]
 [-0.0556  0.9867 -0.1529 -1.6854]
 [-0.8528  0.0327  0.5212 66.6893]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00512
Mean Error Translation: 1.11066
== [Result] Frame: 113, Matches 1463, Inliers: 96.31
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame113.jpg
(1463, 4)
[[ 0.4716  0.1622  0.8668 -0.215 ]
 [-0.0506  0.9863 -0.157  -1.7637]
 [-0.8804  0.0302  0.4734 66.8427]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00511
Mean Error Translation: 1.10195
== [Result] Frame: 114, Matches 1463, Inliers: 92.34
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame114.jpg
(1463, 4)
[[ 0.4239  0.165   0.8906  0.2652]
 [-0.0464  0.9859 -0.1605 -1.8528]
 [-0.9045  0.0268  0.4256 66.9918]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00507
Mean Error Translation: 1.09372
== [Result] Frame: 115, Matches 1463, Inliers: 96.79
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame115.jpg
(1463, 4)
[[ 0.3781  0.1672  0.9106  0.7749]
 [-0.0393  0.9856 -0.1646 -1.9478]
 [-0.9249  0.0264  0.3792 67.1388]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00504
Mean Error Translation: 1.08582
== [Result] Frame: 116, Matches 1463, Inliers: 94.60
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame116.jpg
(1463, 4)
[[ 0.3367  0.1653  0.927   1.2771]
 [-0.025   0.9857 -0.1667 -2.0392]
 [-0.9413  0.033   0.336   67.2461]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00500
Mean Error Translation: 1.07794
== [Result] Frame: 117, Matches 1463, Inliers: 95.15
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame117.jpg
(1463, 4)
[[ 0.3005  0.159   0.9404  1.8339]
 [-0.0032  0.9862 -0.1657 -2.1353]
 [-0.9538  0.0467  0.2969  67.3172]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00497
Mean Error Translation: 1.07052
== [Result] Frame: 118, Matches 1463, Inliers: 95.90
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame118.jpg
(1463, 4)
[[ 0.2661  0.1555  0.9513  2.449 ]
 [ 0.0078  0.9865 -0.1635 -2.2422]
 [-0.9639  0.0509  0.2613  67.4117]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00494
Mean Error Translation: 1.06372
== [Result] Frame: 119, Matches 1463, Inliers: 97.54
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame119.jpg
(1463, 4)
[[ 0.2332  0.159   0.9594  3.0772]
 [ 0.0133  0.9859 -0.1666 -2.36   ]
 [-0.9723  0.0517  0.2278  67.5181]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00492
Mean Error Translation: 1.05715
== [Result] Frame: 120, Matches 1463, Inliers: 96.31
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame120.jpg
(1463, 4)
[[ 0.2      0.1656  0.9657  3.748 ]
 [ 0.0101   0.9852 -0.171   -2.5007]
 [-0.9797  0.0439  0.1954  67.6452]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00491
Mean Error Translation: 1.05107
== [Result] Frame: 121, Matches 1463, Inliers: 96.04
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame121.jpg
(1463, 4)
[[ 0.1711  0.1698  0.9705  4.463 ]
 [ 0.0116  0.9846 -0.1743 -2.6465]
 [-0.9852  0.0411  0.1665  67.7491]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00490
Mean Error Translation: 1.04537
== [Result] Frame: 122, Matches 1463, Inliers: 96.31
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame122.jpg
(1463, 4)
[[ 0.1458  0.1722  0.9742  5.2043]
 [ 0.0174  0.9841 -0.1765 -2.7869]
 [-0.9892  0.0427  0.1404  67.8154]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00487
Mean Error Translation: 1.03983
== [Result] Frame: 123, Matches 1463, Inliers: 96.79
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame123.jpg
(1463, 4)
[[ 0.1234  0.1745  0.9769  5.9902]
 [ 0.0291  0.9834 -0.1794 -2.9263]
 [-0.9919  0.0505  0.1163  67.858 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00485
Mean Error Translation: 1.03466
== [Result] Frame: 124, Matches 1463, Inliers: 96.79
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame124.jpg
(1463, 4)
[[ 0.1045  0.1815  0.9778  6.8668]
 [ 0.039   0.9817 -0.1864 -3.0619]
 [-0.9938  0.0576  0.0955  67.8878]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00484
Mean Error Translation: 1.03019
== [Result] Frame: 125, Matches 1463, Inliers: 96.51
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame125.jpg
(1463, 4)
[[ 0.0854  0.1883  0.9784  7.788 ]
 [ 0.0447  0.9803 -0.1926 -3.2065]
 [-0.9953  0.0602  0.0753  67.9205]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00481
Mean Error Translation: 1.02610
== [Result] Frame: 126, Matches 1463, Inliers: 92.48
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame126.jpg
(1463, 4)
[[ 0.0679  0.189   0.9796  8.8173]
 [ 0.0461  0.9802 -0.1923 -3.4017]
 [-0.9966  0.0583  0.0578  67.9597]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00479
Mean Error Translation: 1.02282
== [Result] Frame: 127, Matches 1463, Inliers: 92.28
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame127.jpg
(1463, 4)
[[ 0.053   0.1848  0.9814  9.9569]
 [ 0.0478  0.9811 -0.1873 -3.6419]
 [-0.9974  0.0569  0.0431  67.9804]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00477
Mean Error Translation: 1.02037
== [Result] Frame: 128, Matches 1463, Inliers: 90.23
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame128.jpg
(1463, 4)
[[ 0.0396  0.1821  0.9825 11.0396]
 [ 0.0503  0.9817 -0.1839 -3.856 ]
 [-0.998   0.0567  0.0297 67.9666]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00475
Mean Error Translation: 1.01743
== [Result] Frame: 129, Matches 1463, Inliers: 89.34

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame129.jpg
(1463, 4)
[[ 0.0255  0.1803  0.9833 12.2541]
 [ 0.0532  0.982  -0.1814 -4.0908]
 [-0.9983  0.0569  0.0155 67.9981]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00474
Mean Error Translation: 1.01544
== [Result] Frame: 130, Matches 1463, Inliers: 90.02

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame130.jpg
(1463, 4)
[[ 0.0132  0.1795  0.9837 12.5801]
 [ 0.0583  0.9819 -0.18   -4.1547]
 [-0.9982  0.0597  0.0025 68.0048]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00472
Mean Error Translation: 1.00905
== [Result] Frame: 131, Matches 1463, Inliers: 94.26

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame131.jpg
(1463, 4)
[[ 0.0027  0.1803  0.9836 12.9242]
 [ 0.063   0.9816 -0.1801 -4.2203]
 [-0.998   0.0624 -0.0087 68.004 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00469
Mean Error Translation: 1.00276
== [Result] Frame: 132, Matches 1463, Inliers: 95.69

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame132.jpg
(1463, 4)
[[-0.0059  0.1808  0.9835  13.2936]
 [ 0.0655  0.9815 -0.1801 -4.2916]
 [-0.9978  0.0633 -0.0177  68.0053]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00467
Mean Error Translation: 0.99649
== [Result] Frame: 133, Matches 1463, Inliers: 96.86
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame133.jpg
(1463, 4)
[[-0.0125  0.1813  0.9834  13.6678]
 [ 0.0679  0.9813 -0.18     -4.3646]
 [-0.9976  0.0645 -0.0246  68.0061]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00464
Mean Error Translation: 0.99041
== [Result] Frame: 134, Matches 1463, Inliers: 95.49
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame134.jpg
(1463, 4)
[[-0.0189  0.1824  0.983   14.046 ]
 [ 0.0705  0.981   -0.1806 -4.4376]
 [-0.9973  0.0659 -0.0314  68.0025]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00462
Mean Error Translation: 0.98452
== [Result] Frame: 135, Matches 1463, Inliers: 95.08
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame135.jpg
(1463, 4)
[[-0.0266  0.1829  0.9828  14.4451]
 [ 0.071   0.981   -0.1806 -4.516 ]
 [-0.9971  0.065   -0.0391  67.9996]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00461
Mean Error Translation: 0.97873
== [Result] Frame: 136, Matches 1463, Inliers: 92.14
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame136.jpg
(1463, 4)
[[-0.0318  0.1831  0.9826  15.1305]
 [ 0.0727  0.9809 -0.1804 -4.6459]
 [-0.9968  0.0657 -0.0445  67.9828]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00459
Mean Error Translation: 0.97263
== [Result] Frame: 137, Matches 1463, Inliers: 90.98
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame137.jpg
(1463, 4)
[[-0.0346  0.1836  0.9824  15.8592]
 [ 0.0763  0.9806 -0.1806 -4.7797]
 [-0.9965  0.0687 -0.0479  67.9497]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00457
Mean Error Translation: 0.96678
== [Result] Frame: 138, Matches 1463, Inliers: 89.13
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame138.jpg
(1463, 4)
[[-0.0375  0.1833  0.9823  16.6081]
 [ 0.0777  0.9806 -0.18    -4.9218]
 [-0.9963  0.0696 -0.051   67.9138]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00454
Mean Error Translation: 0.96106
== [Result] Frame: 139, Matches 1463, Inliers: 88.93
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame139.jpg
(1463, 4)
[[-0.0407  0.1829  0.9823  17.4694]
 [ 0.0787  0.9806 -0.1794 -5.0819]
 [-0.9961  0.07    -0.0543  67.885 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00452
Mean Error Translation: 0.95600
== [Result] Frame: 140, Matches 1463, Inliers: 89.88
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame140.jpg
(1463, 4)
[[-0.0439  0.1833  0.9821  18.4226]
 [ 0.078   0.9806  -0.1796  -5.2562]
 [-0.996   0.0687  -0.0574  67.8795]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00455
Mean Error Translation: 0.95149
== [Result] Frame: 141, Matches 1463, Inliers: 89.34
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame141.jpg
(1463, 4)
[[-0.0452  0.1841  0.9819  19.4946]
 [ 0.0763  0.9806  -0.1803  -5.4395]
 [-0.9961  0.0668  -0.0584  67.86   ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00458
Mean Error Translation: 0.94775
== [Result] Frame: 142, Matches 1463, Inliers: 93.44
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame142.jpg
(1463, 4)
[[-0.0417  0.1845  0.9819  20.0054]
 [ 0.0792  0.9803  -0.1808  -5.5332]
 [-0.996   0.0703  -0.0555  67.8288]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00457
Mean Error Translation: 0.94262
== [Result] Frame: 143, Matches 1463, Inliers: 91.11
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame143.jpg
(1463, 4)
[[-0.0348  0.1852  0.9821  20.5244]
 [ 0.0851  0.9797  -0.1818  -5.6279]
 [-0.9958  0.0773  -0.0499  67.7831]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00459
Mean Error Translation: 0.93764
== [Result] Frame: 144, Matches 1463, Inliers: 89.47
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame144.jpg
(1463, 4)
[[-0.0304  0.1843  0.9824  21.0127]
 [ 0.085   0.9798  -0.1812  -5.7299]
 [-0.9959  0.078   -0.0454  67.7669]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00457
Mean Error Translation: 0.93300
== [Result] Frame: 145, Matches 1463, Inliers: 90.02
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame145.jpg
(1463, 4)
[[-0.0245  0.1825  0.9829  21.5238]
 [ 0.0882  0.9797  -0.1798  -5.8322]
 [-0.9958  0.0823  -0.0401  67.7369]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00456
Mean Error Translation: 0.92842
== [Result] Frame: 146, Matches 1463, Inliers: 92.62
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame146.jpg
(1463, 4)
[[-0.0179  0.1812  0.9833  22.0633]
 [ 0.0911  0.9797  -0.1788  -5.935 ]
 [-0.9957  0.0864  -0.034   67.7058]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00458
Mean Error Translation: 0.92382
== [Result] Frame: 147, Matches 1463, Inliers: 96.86
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame147.jpg
(1463, 4)
[[-0.0126  0.1791  0.9837  22.6046]
 [ 0.0887  0.9801  -0.1773  -6.0374]
 [-0.996   0.085   -0.0283  67.6862]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00457
Mean Error Translation: 0.91936
== [Result] Frame: 148, Matches 1463, Inliers: 96.38
<Figure size 432x288 with 0 Axes>
```

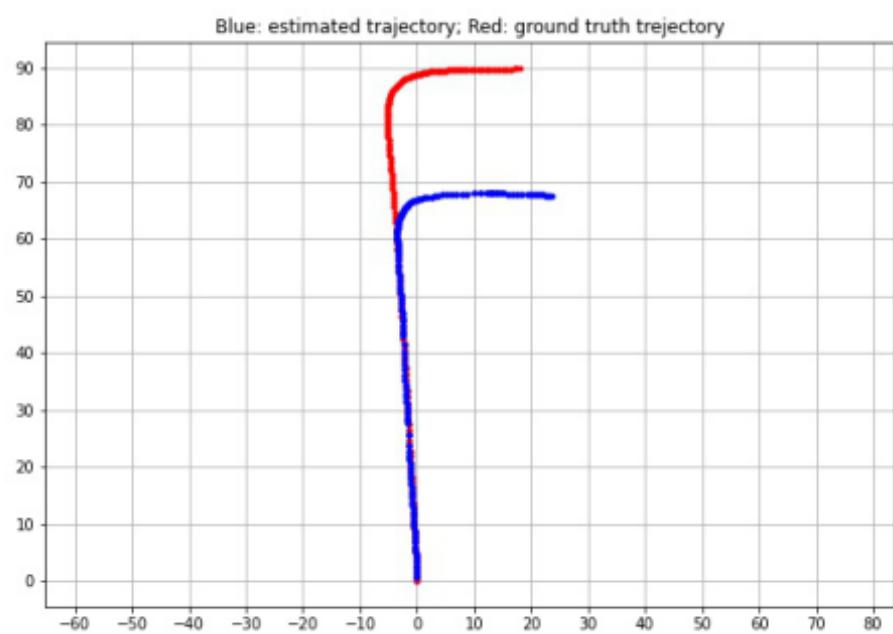
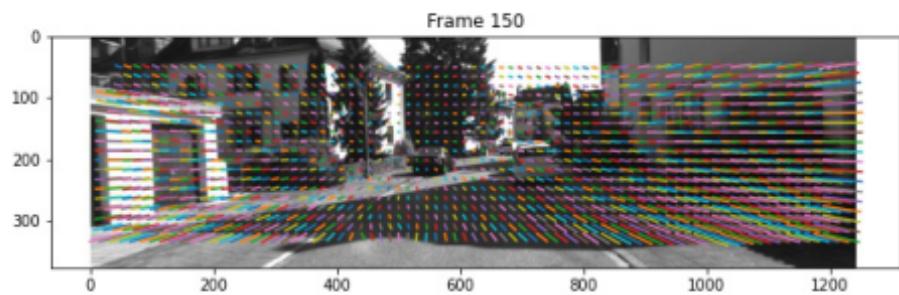
```
Saved at vis_preFeature/frame148.jpg
(1463, 4)
[[-0.0064  0.1779  0.984  23.1713]
 [ 0.0903  0.9801 -0.1767 -6.1468]
 [-0.9959  0.0878 -0.0224  67.6675]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00457
Mean Error Translation: 0.91487
== [Result] Frame: 149, Matches 1463, Inliers: 97.33

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame149.jpg
(1463, 4)
[[-0.0023  0.1789  0.9839 23.7293]
 [ 0.0883  0.9801 -0.178  -6.2547]
 [-0.9961  0.0865 -0.0181 67.6717]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00456
Mean Error Translation: 0.91050
== [Result] Frame: 150, Matches 1463, Inliers: 96.65

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame150.jpg
```



```
(1463, 4)
[[-0.0011  0.1832  0.9831 24.3012]
 [ 0.084   0.9796 -0.1824 -6.3684]
 [-0.9965  0.0824 -0.0165 67.6937]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00455
Mean Error Translation: 0.90611
== [Result] Frame: 151, Matches 1463, Inliers: 96.51

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame151.jpg
(1463, 4)
[[-0.0024  0.1887  0.982   24.8795]
 [ 0.0766  0.9792 -0.188   -6.4793]
 [-0.9971  0.0748 -0.0168 67.7205]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00454
Mean Error Translation: 0.90176
== [Result] Frame: 152, Matches 1463, Inliers: 96.38

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame152.jpg
(1463, 4)
[[-0.0025  0.192   0.9814 25.482 ]
 [ 0.0752  0.9786 -0.1913 -6.5946]
 [-0.9972  0.0733 -0.0169 67.7256]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00453
Mean Error Translation: 0.89738
== [Result] Frame: 153, Matches 1463, Inliers: 93.44

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame153.jpg
(1463, 4)
[[-0.0041  0.1918  0.9814 26.0687]
 [ 0.072   0.9789 -0.1911 -6.7144]
 [-0.9974  0.0699 -0.0178 67.7413]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00451
Mean Error Translation: 0.89316
== [Result] Frame: 154, Matches 1463, Inliers: 88.59

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame154.jpg
(1463, 4)
[[-0.0026  0.1901  0.9818  26.6713]
 [ 0.072   0.9793  -0.1894  -6.8404]
 [-0.9974  0.0702  -0.0163  67.7266]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00451
Mean Error Translation: 0.88895
== [Result] Frame: 155, Matches 1463, Inliers: 90.64
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame155.jpg
(1463, 4)
[[-0.0003  0.1892  0.9819  27.2965]
 [ 0.0768  0.979   -0.1886  -6.9687]
 [-0.997   0.0753  -0.0148  67.7049]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00453
Mean Error Translation: 0.88467
== [Result] Frame: 156, Matches 1463, Inliers: 96.17
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame156.jpg
(1463, 4)
[[ 0.0009  0.1881  0.9821  27.9184]
 [ 0.0768  0.9792  -0.1876  -7.1028]
 [-0.997   0.0756  -0.0135  67.697 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00452
Mean Error Translation: 0.88046
== [Result] Frame: 157, Matches 1463, Inliers: 94.19
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame157.jpg
(1463, 4)
[[ 0.0021  0.1886  0.9821  28.5438]
 [ 0.0778  0.979   -0.1882  -7.2329]
 [-0.997   0.0768  -0.0126  67.6878]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00452
Mean Error Translation: 0.87625
== [Result] Frame: 158, Matches 1463, Inliers: 94.87
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame158.jpg
(1463, 4)
[[ 0.0036  0.1886  0.982  29.1611]
 [ 0.0775  0.979  -0.1883 -7.367 ]
 [-0.997   0.0768 -0.0111 67.6754]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00452
Mean Error Translation: 0.87215
== [Result] Frame: 159, Matches 1463, Inliers: 96.65
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame159.jpg
(1463, 4)
[[ 0.0044  0.1895  0.9819 29.783 ]
 [ 0.077   0.9789 -0.1893 -7.4991]
 [-0.997   0.0764 -0.0102 67.6554]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00452
Mean Error Translation: 0.86807
== [Result] Frame: 160, Matches 1463, Inliers: 97.27
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame160.jpg
(1463, 4)
[[ 0.0024  0.1891  0.9819 30.4609]
 [ 0.0742  0.9792 -0.1888 -7.6392]
 [-0.9972  0.0733 -0.0117 67.643 ]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00451
Mean Error Translation: 0.86378
== [Result] Frame: 161, Matches 1463, Inliers: 96.10
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame161.jpg
(1463, 4)
[[ -0.0002  0.1876  0.9822 31.3267]
 [ 0.0724  0.9797 -0.1871 -7.8211]
 [-0.9974  0.0711 -0.0138 67.6255]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00449
Mean Error Translation: 0.85946
== [Result] Frame: 162, Matches 1463, Inliers: 96.58
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame162.jpg
(1463, 4)
[[-0.0044  0.1851  0.9827  32.28  ]
 [ 0.0692  0.9804 -0.1844 -8.0193]
 [-0.9976  0.0672 -0.0171  67.6076]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00449
Mean Error Translation: 0.85554
== [Result] Frame: 163, Matches 1463, Inliers: 95.97
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame163.jpg
(1463, 4)
[[-0.0105  0.1828  0.9831  33.4274]
 [ 0.0676  0.981   -0.1817 -8.2644]
 [-0.9977  0.0645 -0.0227  67.5903]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00447
Mean Error Translation: 0.85274
== [Result] Frame: 164, Matches 1463, Inliers: 87.15
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame164.jpg
(1463, 4)
[[-0.0169  0.183   0.983   34.6635]
 [ 0.07    0.9809 -0.1814 -8.5244]
 [-0.9974  0.0657 -0.0294  67.548 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00446
Mean Error Translation: 0.85053
== [Result] Frame: 165, Matches 1463, Inliers: 88.45
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame165.jpg
(1463, 4)
[[-0.0254  0.1835  0.9827  35.9825]
 [ 0.0704  0.9809 -0.1814 -8.8031]
 [-0.9972  0.0646 -0.0378  67.5012]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00444
Mean Error Translation: 0.84887
== [Result] Frame: 166, Matches 1463, Inliers: 91.66
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame166.jpg
(1463, 4)
[[-0.0353  0.1841  0.9823  37.131 ]
 [ 0.0714  0.9808 -0.1813 -9.0316]
 [-0.9968  0.0637 -0.0478  67.4483]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.84620
== [Result] Frame: 167, Matches 1463, Inliers: 87.35
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame167.jpg
(1463, 4)
[[-0.0464  0.1841  0.9818  38.4614]
 [ 0.0726  0.9809 -0.1805 -9.2864]
 [-0.9963  0.0629 -0.0588  67.3901]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00441
Mean Error Translation: 0.84461
== [Result] Frame: 168, Matches 1463, Inliers: 84.89
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame168.jpg
(1463, 4)
[[-0.0572  0.183   0.9815  39.5506]
 [ 0.0728  0.9812 -0.1787 -9.5075]
 [-0.9957  0.0613 -0.0695  67.318 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.84172
== [Result] Frame: 169, Matches 1463, Inliers: 89.54
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame169.jpg
(1463, 4)
[[-0.0682  0.1823  0.9809  40.6583]
 [ 0.0757  0.9813 -0.1771 -9.7291]
 [-0.9948  0.0622 -0.0807  67.2324]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00437
Mean Error Translation: 0.83897
== [Result] Frame: 170, Matches 1463, Inliers: 92.69
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame170.jpg
(1463, 4)
[[-0.0789  0.1827  0.98   41.9429]
 [ 0.0766  0.9813 -0.1768 -9.9811]
 [-0.9939  0.0611 -0.0915  67.1096]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00436
Mean Error Translation: 0.83730
== [Result] Frame: 171, Matches 1463, Inliers: 93.16
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame171.jpg
(1463, 4)
[[ -0.09     0.1832   0.979   43.2973]
 [ 0.0781   0.9812  -0.1764 -10.2556]
 [-0.9929   0.0606  -0.1026  66.9679]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00433
Mean Error Translation: 0.83612
== [Result] Frame: 172, Matches 1463, Inliers: 85.92
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame172.jpg
(1463, 4)
[[ -0.1004   0.1844   0.9777  44.7698]
 [ 0.0792   0.981    -0.1769 -10.5455]
 [-0.9918   0.0597  -0.1131  66.8055]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00431
Mean Error Translation: 0.83564
== [Result] Frame: 173, Matches 1463, Inliers: 81.34
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame173.jpg
(1463, 4)
[[ -0.111    0.1861   0.9762  46.3895]
 [ 0.081    0.9807  -0.1777 -10.8511]
 [-0.9905   0.0593  -0.124   66.6076]
 [ 0.       0.       0.       1.      ]]
Mean Error Rotation: 0.00430
Mean Error Translation: 0.83606
== [Result] Frame: 174, Matches 1463, Inliers: 76.76
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame174.jpg
(1463, 4)
[[ -0.1221   0.1873   0.9747  47.9009]
 [  0.0811   0.9806  -0.1783 -11.1385]
 [ -0.9892   0.0572  -0.1349  66.4344]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00430
Mean Error Translation: 0.83587
== [Result] Frame: 175, Matches 1463, Inliers: 78.67
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame175.jpg
(1463, 4)
[[ -0.1311   0.188    0.9734  49.0974]
 [  0.0839   0.9804  -0.178  -11.3768]
 [ -0.9878   0.0583  -0.1444  66.2514]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00428
Mean Error Translation: 0.83398
== [Result] Frame: 176, Matches 1463, Inliers: 84.69
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame176.jpg
(1463, 4)
[[ -0.1395   0.1888   0.9721  50.1829]
 [  0.0876   0.9802  -0.1778 -11.5924]
 [ -0.9863   0.0604  -0.1532  66.0702]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00427
Mean Error Translation: 0.83156
== [Result] Frame: 177, Matches 1463, Inliers: 88.52
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame177.jpg
(1463, 4)
[[ -0.1486   0.1886   0.9707  50.8552]
 [  0.0897   0.9802  -0.1767 -11.725 ]
 [ -0.9848   0.0608  -0.1626  65.9709]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.82757
== [Result] Frame: 178, Matches 1463, Inliers: 91.46
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame178.jpg
(1463, 4)
[[ -0.1531   0.1884   0.9701  51.6097]
 [  0.0966   0.9798  -0.175  -11.8774]
 [ -0.9835   0.0669  -0.1682  65.8115]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00427
Mean Error Translation: 0.82376
== [Result] Frame: 179, Matches 1463, Inliers: 95.28
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame179.jpg
(1463, 4)
[[ -0.1588   0.1871   0.9694  52.3554]
 [  0.0998   0.9799  -0.1728 -12.0253]
 [ -0.9822   0.0693  -0.1743  65.6906]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.81988
== [Result] Frame: 180, Matches 1463, Inliers: 96.31
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame180.jpg
(1463, 4)
[[ -0.1647   0.186    0.9687  52.8389]
 [  0.1005   0.9801  -0.1711 -12.1117 ]
 [ -0.9812   0.0691  -0.1801  65.6199]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.81667
== [Result] Frame: 181, Matches 1463, Inliers: 97.47
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame181.jpg
(1463, 4)
[[ -0.1696   0.1849   0.968   53.3307]
 [  0.0999   0.9804  -0.1698 -12.2112]
 [ -0.9804   0.0679  -0.1847  65.5494]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00427
Mean Error Translation: 0.81340
== [Result] Frame: 182, Matches 1463, Inliers: 91.93
<Figure size 432x288 with 0 Axes>
```

Saved at vis_preFeature/frame182.jpg
(1463, 4)
[[-0.1718 0.1846 0.9677 53.796]
[0.0998 0.9805 -0.1693 -12.2981]
[-0.9801 0.0675 -0.1869 65.4654]
[0. 0. 0. 1.]]
Mean Error Rotation: 0.00425
Mean Error Translation: 0.81020
== [Result] Frame: 183, Matches 1463, Inliers: 94.12
<Figure size 432x288 with 0 Axes>

Saved at vis_preFeature/frame183.jpg
(1463, 4)
[[-0.1708 0.1857 0.9676 54.2474]
[0.1014 0.9802 -0.1703 -12.3865]
[-0.9801 0.069 -0.1863 65.3614]
[0. 0. 0. 1.]]
Mean Error Rotation: 0.00425
Mean Error Translation: 0.80705
== [Result] Frame: 184, Matches 1463, Inliers: 92.75
<Figure size 432x288 with 0 Axes>

Saved at vis_preFeature/frame184.jpg
(1463, 4)
[[-0.1695 0.1872 0.9676 54.6889]
[0.1023 0.9798 -0.1717 -12.4721]
[-0.9802 0.0698 -0.1852 65.2748]
[0. 0. 0. 1.]]
Mean Error Rotation: 0.00423
Mean Error Translation: 0.80389
== [Result] Frame: 185, Matches 1463, Inliers: 99.38
<Figure size 432x288 with 0 Axes>

Saved at vis_preFeature/frame185.jpg
(1463, 4)
[[-0.1667 0.1895 0.9676 55.1181]
[0.1028 0.9794 -0.174 -12.5535]
[-0.9806 0.0705 -0.1828 65.1988]
[0. 0. 0. 1.]]
Mean Error Rotation: 0.00421
Mean Error Translation: 0.80073
== [Result] Frame: 186, Matches 1463, Inliers: 99.04
<Figure size 432x288 with 0 Axes>

```
Saved at vis_preFeature/frame186.jpg
(1463, 4)
[[ -0.1637   0.1902   0.968   55.5469]
 [  0.1005   0.9794  -0.1754 -12.6373]
 [ -0.9814   0.0686  -0.1794  65.1385]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00421
Mean Error Translation: 0.79753
== [Result] Frame: 187, Matches 1463, Inliers: 98.02
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame187.jpg
(1463, 4)
[[ -0.156    0.1913   0.969   55.9597]
 [  0.0993   0.9791  -0.1773 -12.7193]
 [ -0.9828   0.0685  -0.1717  65.073 ]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00420
Mean Error Translation: 0.79434
== [Result] Frame: 188, Matches 1463, Inliers: 97.95
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame188.jpg
(1463, 4)
[[ -0.1457   0.1914   0.9706  56.355 ]
 [  0.0966   0.9792  -0.1786 -12.8015]
 [ -0.9846   0.0677  -0.1611  65.0166]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00417
Mean Error Translation: 0.79117
== [Result] Frame: 189, Matches 1463, Inliers: 98.22
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame189.jpg
(1463, 4)
[[ -0.1335   0.1918   0.9723  56.7369]
 [  0.0928   0.9792  -0.1804 -12.8836]
 [ -0.9867   0.0661  -0.1486  64.9776]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00416
Mean Error Translation: 0.78800
== [Result] Frame: 190, Matches 1463, Inliers: 97.54
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame190.jpg
(1463, 4)
[[ -0.1173   0.1932   0.9741  57.1082]
 [  0.0887   0.979    -0.1835 -12.9638]
 [ -0.9891   0.0649   -0.132   64.9426]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00415
Mean Error Translation: 0.78483
== [Result] Frame: 191, Matches 1463, Inliers: 97.27
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame191.jpg
(1463, 4)
[[ -0.0964   0.1959   0.9759  57.4624]
 [  0.0848   0.9785   -0.188  -13.0401]
 [ -0.9917   0.0646   -0.1109  64.912 ]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00413
Mean Error Translation: 0.78172
== [Result] Frame: 192, Matches 1463, Inliers: 97.61
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame192.jpg
(1463, 4)
[[ -0.07      0.1995   0.9774  57.8074]
 [  0.0825   0.9776   -0.1936 -13.1111]
 [ -0.9941   0.0671   -0.0849  64.8778]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00415
Mean Error Translation: 0.77867
== [Result] Frame: 193, Matches 1463, Inliers: 96.51
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame193.jpg
(1463, 4)
[[ -0.0401   0.2014   0.9787  58.1411]
 [  0.0785   0.9771   -0.1979 -13.1833]
 [ -0.9961   0.0689   -0.055   64.8585]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00416
Mean Error Translation: 0.77567
== [Result] Frame: 194, Matches 1463, Inliers: 95.83
<Figure size 432x288 with 0 Axes>
```

```

Saved at vis_preFeature/frame194.jpg
(1463, 4)
[[ -0.0085   0.201    0.9795  58.4582]
 [  0.07     0.9773   -0.2     -13.2532]
 [ -0.9975   0.0669   -0.0224  64.8722]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00414
Mean Error Translation: 0.77278
== [Result] Frame: 195, Matches 1463, Inliers: 93.78
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame195.jpg
(1463, 4)
[[  0.0268   0.1992   0.9796  58.7775]
 [  0.0603   0.9778   -0.2004 -13.3222]
 [ -0.9978   0.0644   0.0142  64.9068]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00414
Mean Error Translation: 0.76989
== [Result] Frame: 196, Matches 1463, Inliers: 91.80
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame196.jpg
(1463, 4)
[[  0.0687   0.1951   0.9784  59.088 ]
 [  0.051    0.9787   -0.1988 -13.3996]
 [ -0.9963   0.0635   0.0573  64.9415]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00413
Mean Error Translation: 0.76703
== [Result] Frame: 197, Matches 1463, Inliers: 92.62
<Figure size 432x288 with 0 Axes>

```

```

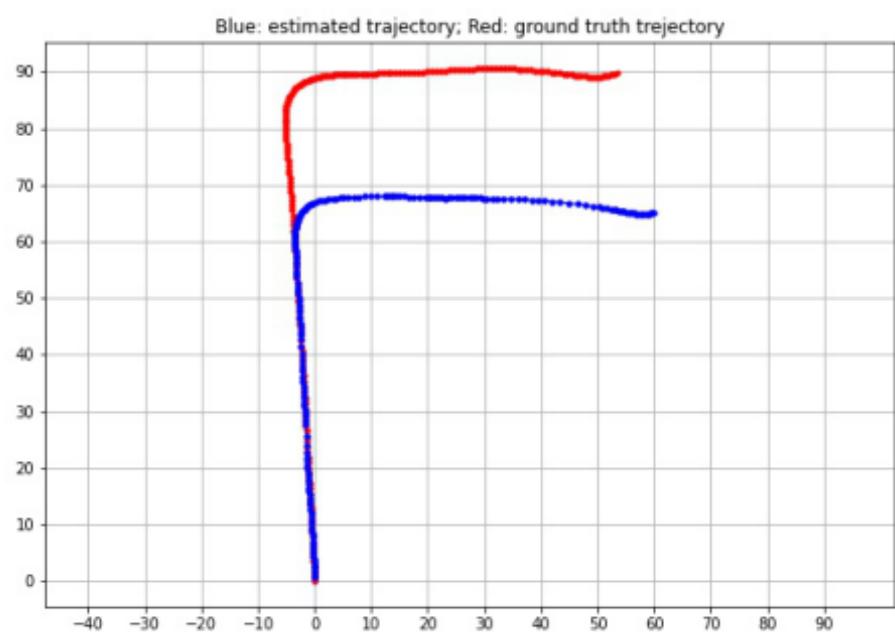
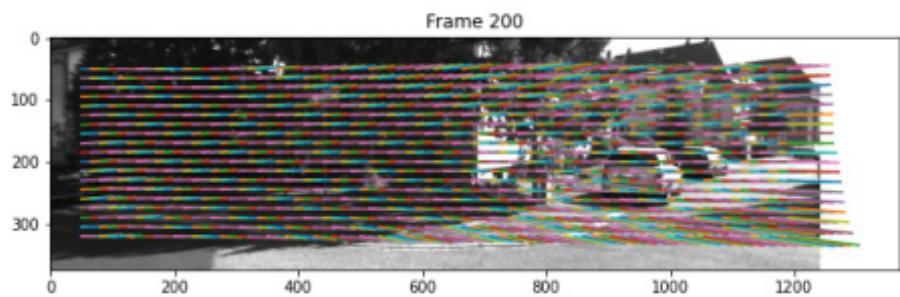
Saved at vis_preFeature/frame197.jpg
(1463, 4)
[[  0.1139   0.1908   0.975   59.4075]
 [  0.0417   0.9796   -0.1965 -13.4726]
 [ -0.9926   0.063    0.1036  64.9887]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00413
Mean Error Translation: 0.76416
== [Result] Frame: 198, Matches 1463, Inliers: 96.24
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame198.jpg
(1463, 4)
[[ 0.161    0.1875   0.969   59.7268]
 [ 0.0281   0.9805  -0.1944 -13.5462]
 [-0.9866   0.0586   0.1525  65.0625]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00411
Mean Error Translation: 0.76129
== [Result] Frame: 199, Matches 1463, Inliers: 93.10
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame199.jpg
(1463, 4)
[[ 0.2106   0.1867   0.9596  60.0421]
 [ 0.0142   0.9809  -0.1939 -13.6167]
 [-0.9775   0.0544   0.204   65.1633]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00410
Mean Error Translation: 0.75834
== [Result] Frame: 200, Matches 1463, Inliers: 98.15
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame200.jpg
```



```

(1463, 4)
[[ 0.2657  0.1864  0.9459  60.3574]
 [ 0.0038  0.9809 -0.1944 -13.6892]
 [-0.9641  0.0552  0.2599  65.2764]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00409
Mean Error Translation: 0.75542
== [Result] Frame: 201, Matches 1463, Inliers: 97.54
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame201.jpg
(1463, 4)
[[ 0.3205  0.1893  0.9281  60.6598]
 [-0.0104  0.9805 -0.1964 -13.7629]
 [-0.9472  0.0533  0.3162  65.4362]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00412
Mean Error Translation: 0.75247
== [Result] Frame: 202, Matches 1463, Inliers: 89.47
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame202.jpg
(1463, 4)
[[ 0.3787  0.1946  0.9048  60.942 ]
 [-0.0239  0.9794 -0.2006 -13.8324]
 [-0.9252  0.0543  0.3755  65.6076]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00412
Mean Error Translation: 0.74946
== [Result] Frame: 203, Matches 1463, Inliers: 97.81
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame203.jpg
(1463, 4)
[[ 0.4396  0.1978  0.8761  61.2158]
 [-0.0343  0.9784 -0.2037 -13.9047]
 [-0.8975  0.0595  0.437   65.7793]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00410
Mean Error Translation: 0.74659
== [Result] Frame: 204, Matches 1463, Inliers: 95.83
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame204.jpg
(1463, 4)
[[ 0.4928   0.2061   0.8454  61.4526]
 [ -0.0553   0.977    -0.2059 -13.9778]
 [ -0.8684   0.0547   0.4928  66.0372]
 [ 0.         0.        0.       1.      ]]
Mean Error Rotation: 0.00414
Mean Error Translation: 0.74359
== [Result] Frame: 205, Matches 1463, Inliers: 91.39
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame205.jpg
(1463, 4)
[[ 0.5458   0.211    0.8109  61.6947]
 [ -0.0736   0.9761   -0.2044 -14.0517]
 [ -0.8347   0.0519   0.5483  66.3042]
 [ 0.         0.        0.       1.      ]]
Mean Error Rotation: 0.00414
Mean Error Translation: 0.74060
== [Result] Frame: 206, Matches 1463, Inliers: 94.19
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame206.jpg
(1463, 4)
[[ 0.596    0.2154   0.7735  61.909 ]
 [ -0.0902   0.9752   -0.2021 -14.1231]
 [ -0.7979   0.0507   0.6007  66.6026]
 [ 0.         0.        0.       1.      ]]
Mean Error Rotation: 0.00417
Mean Error Translation: 0.73764
== [Result] Frame: 207, Matches 1463, Inliers: 88.59
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame207.jpg
(1463, 4)
[[ 0.645    0.2169   0.7327  62.1228]
 [ -0.1058   0.975    -0.1954 -14.2002]
 [ -0.7568   0.0485   0.6518  66.8929]
 [ 0.         0.        0.       1.      ]]
Mean Error Rotation: 0.00418
Mean Error Translation: 0.73460
== [Result] Frame: 208, Matches 1463, Inliers: 89.47
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame208.jpg
(1463, 4)
[[ 0.6929   0.2129   0.6889  62.3289]
 [ -0.1179   0.976   -0.183  -14.2646]
 [ -0.7113   0.0455   0.7014  67.1671]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00416
Mean Error Translation: 0.73175
== [Result] Frame: 209, Matches 1463, Inliers: 88.11
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame209.jpg
(1463, 4)
[[ 0.7375   0.2076   0.6427  62.4908]
 [ -0.1285   0.9773  -0.1683 -14.3134]
 [ -0.663    0.0415   0.7474  67.4239]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00415
Mean Error Translation: 0.72909
== [Result] Frame: 210, Matches 1463, Inliers: 85.24
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame210.jpg
(1463, 4)
[[ 0.7758   0.2082   0.5957  62.6191]
 [ -0.1434   0.9775  -0.1549 -14.3537]
 [ -0.6145   0.0347   0.7881  67.6895]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00416
Mean Error Translation: 0.72641
== [Result] Frame: 211, Matches 1463, Inliers: 82.02
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame211.jpg
(1463, 4)
[[ 0.8084   0.2089   0.5504  62.7194]
 [ -0.1568   0.9776  -0.1406 -14.3889]
 [ -0.5674   0.0274   0.823   67.953 ]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00417
Mean Error Translation: 0.72392
== [Result] Frame: 212, Matches 1463, Inliers: 90.77
<Figure size 432x288 with 0 Axes>
```

```

Saved at vis_preFeature/frame212.jpg
(1463, 4)
[[ 0.8342   0.2147   0.5079  62.8491]
 [ -0.1727   0.9765  -0.129  -14.4413]
 [ -0.5237   0.0199   0.8517  68.3675]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00420
Mean Error Translation: 0.72080
== [Result] Frame: 213, Matches 1463, Inliers: 95.42
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame213.jpg
(1463, 4)
[[ 0.8555   0.2203   0.4686  62.9863]
 [ -0.1856   0.9753  -0.1196 -14.4911]
 [ -0.4834   0.0153   0.8753  68.8     ]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00422
Mean Error Translation: 0.71759
== [Result] Frame: 214, Matches 1463, Inliers: 95.90
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame214.jpg
(1463, 4)
[[ 0.8733   0.2244   0.4324  63.1346]
 [ -0.1963   0.9744  -0.1093 -14.5506]
 [ -0.4459   0.0106   0.895   69.2091]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00421
Mean Error Translation: 0.71462
== [Result] Frame: 215, Matches 1463, Inliers: 92.82
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame215.jpg
(1463, 4)
[[ 0.8876   0.229    0.3996  63.2775]
 [ -0.2044   0.9734  -0.1038 -14.6007]
 [ -0.4127   0.0104   0.9108  69.6367]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00420
Mean Error Translation: 0.71160
== [Result] Frame: 216, Matches 1463, Inliers: 95.01
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame216.jpg
(1463, 4)
[[ 0.9003  0.2297  0.3698  63.4467]
 [ -0.2081  0.9732  -0.0979 -14.6505]
 [ -0.3824  0.0111  0.9239  70.0917]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00419
Mean Error Translation: 0.70865
== [Result] Frame: 217, Matches 1463, Inliers: 96.79
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame217.jpg
(1463, 4)
[[ 0.9101  0.2243  0.3485  63.6304]
 [ -0.2042  0.9744  -0.0938 -14.7069]
 [ -0.3607  0.0141  0.9326  70.5896]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00417
Mean Error Translation: 0.70576
== [Result] Frame: 218, Matches 1463, Inliers: 98.56
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame218.jpg
(1463, 4)
[[ 0.9173  0.2189  0.3326  63.8368]
 [ -0.2002  0.9756  -0.09    -14.7772]
 [ -0.3442  0.016   0.9388  71.1423]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00417
Mean Error Translation: 0.70312
== [Result] Frame: 219, Matches 1463, Inliers: 99.04
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame219.jpg
(1463, 4)
[[ 0.9222  0.2191  0.3186  64.064 ]
 [ -0.2015  0.9756  -0.0876 -14.8499]
 [ -0.33    0.0166  0.9438  71.7692]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00419
Mean Error Translation: 0.70078
== [Result] Frame: 220, Matches 1463, Inliers: 99.86
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame220.jpg
(1463, 4)
[[ 0.9258   0.2202   0.3072  64.3095]
 [ -0.204    0.9753  -0.0844 -14.9304]
 [ -0.3182   0.0155   0.9479  72.4692]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00420
Mean Error Translation: 0.69874
== [Result] Frame: 221, Matches 1463, Inliers: 96.38
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame221.jpg
(1463, 4)
[[ 0.9269   0.2244   0.3007  64.5326]
 [ -0.2087   0.9744  -0.0839 -15.0125]
 [ -0.3118   0.015    0.95    73.2129]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00420
Mean Error Translation: 0.69680
== [Result] Frame: 222, Matches 1463, Inliers: 96.10
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame222.jpg
(1463, 4)
[[ 0.927    0.2298   0.2965  64.7765]
 [ -0.2134   0.9731  -0.0868 -15.0981]
 [ -0.3084   0.0172   0.9511  74.0384]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00419
Mean Error Translation: 0.69518
== [Result] Frame: 223, Matches 1463, Inliers: 92.89
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame223.jpg
(1463, 4)
[[ 0.9277   0.2298   0.2943  65.054 ]
 [ -0.2127   0.973   -0.0891 -15.2001]
 [ -0.3068   0.02    0.9516  74.9025]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00418
Mean Error Translation: 0.69376
== [Result] Frame: 224, Matches 1463, Inliers: 94.53
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame224.jpg
(1463, 4)
[[ 0.9282  0.227   0.2948  65.3505]
 [ -0.2086  0.9736 -0.0931 -15.3002]
 [ -0.3082  0.0249  0.951   75.772 ]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00418
Mean Error Translation: 0.69235
== [Result] Frame: 225, Matches 1463, Inliers: 92.48
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame225.jpg
(1463, 4)
[[ 0.9272  0.228   0.2972  65.5753]
 [ -0.2071  0.9732 -0.1003 -15.3742]
 [ -0.3121  0.0314  0.9495  76.5038]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00418
Mean Error Translation: 0.69023
== [Result] Frame: 226, Matches 1463, Inliers: 88.17
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame226.jpg
(1463, 4)
[[ 0.9263  0.2277  0.3003  65.7955]
 [ -0.205   0.9731 -0.1055 -15.4492]
 [ -0.3162  0.0362  0.948   77.2021]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00417
Mean Error Translation: 0.68794
== [Result] Frame: 227, Matches 1463, Inliers: 93.44
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame227.jpg
(1463, 4)
[[ 0.9242  0.2325  0.3031  65.9906]
 [ -0.21    0.972   -0.1055 -15.5231]
 [ -0.3191  0.0338  0.9471  77.7844]
 [ 0.        0.       0.       1.      ]]
Mean Error Rotation: 0.00416
Mean Error Translation: 0.68527
== [Result] Frame: 228, Matches 1463, Inliers: 85.92
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame228.jpg
(1463, 4)
[[ 0.9207   0.2363   0.3107  66.1336]
 [ -0.2147   0.9713  -0.1027 -15.5805]
 [ -0.326    0.0279   0.945   78.3123]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00415
Mean Error Translation: 0.68258
== [Result] Frame: 229, Matches 1463, Inliers: 92.28
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame229.jpg
(1463, 4)
[[ 0.9197   0.2336   0.3156  66.3146]
 [ -0.2128   0.972   -0.0992 -15.6418]
 [ -0.33     0.0241   0.9437  78.8291]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00414
Mean Error Translation: 0.68003
== [Result] Frame: 230, Matches 1463, Inliers: 93.71
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame230.jpg
(1463, 4)
[[ 0.9186   0.2309   0.3209  66.4768]
 [ -0.2114   0.9728  -0.0947 -15.6967]
 [ -0.334    0.0191   0.9424  79.3228]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00414
Mean Error Translation: 0.67761
== [Result] Frame: 231, Matches 1463, Inliers: 94.87
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame231.jpg
(1463, 4)
[[ 0.9165   0.2314   0.3263  66.6585]
 [ -0.2132   0.9727  -0.0912 -15.7612]
 [ -0.3385   0.014    0.9409  79.9073]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00414
Mean Error Translation: 0.67494
== [Result] Frame: 232, Matches 1463, Inliers: 96.58
<Figure size 432x288 with 0 Axes>
```

```

Saved at vis_preFeature/frame232.jpg
(1463, 4)
[[ 0.9149   0.2316   0.3305  66.8655]
 [ -0.2133   0.9727  -0.0912 -15.8352]
 [ -0.3426   0.0129   0.9394  80.577 ]
 [ 0.          0.          0.          1.        ]]
Mean Error Rotation: 0.00416
Mean Error Translation: 0.67237
== [Result] Frame: 233, Matches 1463, Inliers: 94.26
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame233.jpg
(1463, 4)
[[ 0.9137   0.2344   0.3319  67.0939]
 [ -0.2149   0.972   -0.0949 -15.911 ]
 [ -0.3449   0.0154   0.9385  81.3286]
 [ 0.          0.          0.          1.        ]]
Mean Error Rotation: 0.00418
Mean Error Translation: 0.67008
== [Result] Frame: 234, Matches 1463, Inliers: 91.18
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame234.jpg
(1463, 4)
[[ 0.9131   0.2384   0.3308  67.365 ]
 [ -0.2165   0.9709  -0.1021 -15.998 ]
 [ -0.3455   0.0216   0.9382  82.1541]
 [ 0.          0.          0.          1.        ]]
Mean Error Rotation: 0.00419
Mean Error Translation: 0.66815
== [Result] Frame: 235, Matches 1463, Inliers: 92.55
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame235.jpg
(1463, 4)
[[ 0.9112   0.2466   0.3299  67.6528]
 [ -0.2227   0.9688  -0.109  -16.094 ]
 [ -0.3465   0.0259   0.9377  83.1103]
 [ 0.          0.          0.          1.        ]]
Mean Error Rotation: 0.00421
Mean Error Translation: 0.66672
== [Result] Frame: 236, Matches 1463, Inliers: 93.98
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame236.jpg
(1463, 4)
[[ 0.9091  0.2558  0.3287  67.9526]
 [ -0.231   0.9664  -0.113   -16.1919]
 [ -0.3466  0.0268  0.9376  84.1578]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00423
Mean Error Translation: 0.66561
== [Result] Frame: 237, Matches 1463, Inliers: 90.23
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame237.jpg
(1463, 4)
[[ 0.9105  0.2529  0.3272  68.3187]
 [ -0.2297  0.9672  -0.1084  -16.3173]
 [ -0.3439  0.0236  0.9387  85.1555]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00422
Mean Error Translation: 0.66438
== [Result] Frame: 238, Matches 1463, Inliers: 86.26
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame238.jpg
(1463, 4)
[[ 0.9109  0.25     0.3284  68.6545]
 [ -0.2293  0.9681  -0.101   -16.4401]
 [ -0.3432  0.0167  0.9391  86.1534]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00422
Mean Error Translation: 0.66304
== [Result] Frame: 239, Matches 1463, Inliers: 83.73
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame239.jpg
(1463, 4)
[[ 0.9093  0.254    0.3298  68.9395]
 [ -0.2354  0.9672  -0.0959  -16.5486]
 [ -0.3433  0.0096  0.9392  87.1377]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00423
Mean Error Translation: 0.66151
== [Result] Frame: 240, Matches 1463, Inliers: 89.61
<Figure size 432x288 with 0 Axes>
```

```

Saved at vis_preFeature/frame240.jpg
(1463, 4)
[[ 0.9077  0.2597  0.3296  69.2792]
 [ -0.2411  0.9657  -0.0967 -16.6749]
 [ -0.3433  0.0083  0.9392  88.2676]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00423
Mean Error Translation: 0.66064
== [Result] Frame: 241, Matches 1463, Inliers: 90.84
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame241.jpg
(1463, 4)
[[ 0.9068  0.2652  0.3277  69.6107]
 [ -0.2454  0.9641  -0.1012 -16.7903]
 [ -0.3428  0.0114  0.9393  89.336 ]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00422
Mean Error Translation: 0.65951
== [Result] Frame: 242, Matches 1463, Inliers: 93.37
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame242.jpg
(1463, 4)
[[ 0.9057  0.2713  0.3258  69.9692]
 [ -0.2497  0.9624  -0.1071 -16.9126]
 [ -0.3426  0.0156  0.9394  90.6768]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00424
Mean Error Translation: 0.65940
== [Result] Frame: 243, Matches 1463, Inliers: 88.45
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame243.jpg
(1463, 4)
[[ 0.9053  0.2752  0.3235  70.3352]
 [ -0.2527  0.9612  -0.1105 -17.0286]
 [ -0.3413  0.0183  0.9398  91.9324]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00425
Mean Error Translation: 0.65893
== [Result] Frame: 244, Matches 1463, Inliers: 89.47
<Figure size 432x288 with 0 Axes>

```

Saved at vis_preFeature/frame244.jpg
(1463, 4)
[[0.9092 0.268 0.3186 70.7534]
[-0.2459 0.9632 -0.1084 -17.1732]
[-0.3359 0.0202 0.9417 93.0109]
[0. 0. 0. 1.]]
Mean Error Rotation: 0.00427
Mean Error Translation: 0.65790
== [Result] Frame: 245, Matches 1463, Inliers: 87.83
<Figure size 432x288 with 0 Axes>

Saved at vis_preFeature/frame245.jpg
(1463, 4)
[[0.9111 0.2644 0.3161 71.0557]
[-0.2431 0.9642 -0.1059 -17.2895]
[-0.3328 0.0197 0.9428 93.9211]
[0. 0. 0. 1.]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.65603
== [Result] Frame: 246, Matches 1463, Inliers: 87.42
<Figure size 432x288 with 0 Axes>

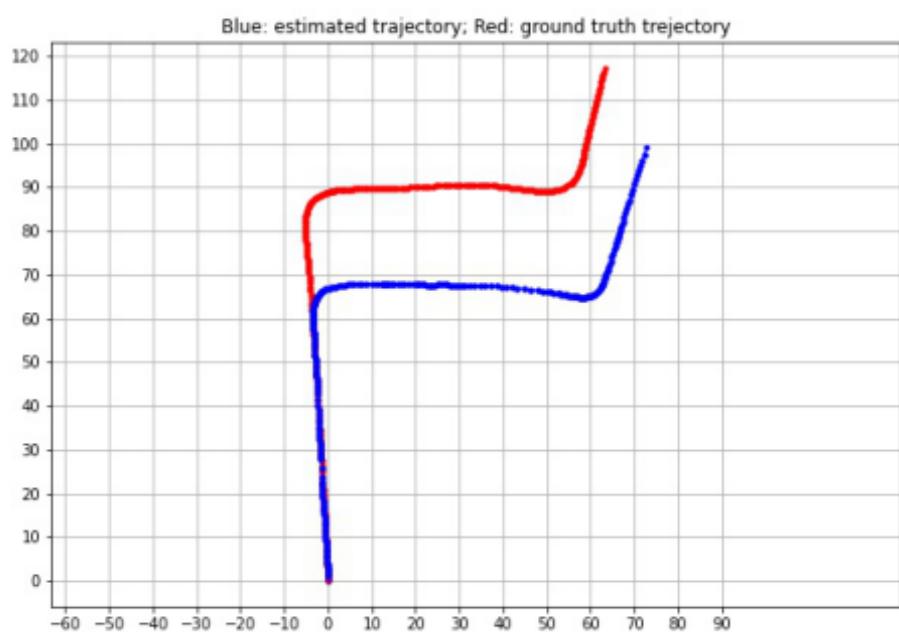
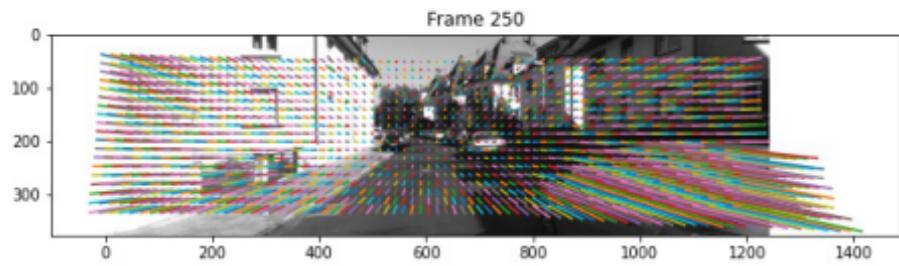
Saved at vis_preFeature/frame246.jpg
(1463, 4)
[[0.9111 0.2647 0.3159 71.3751]
[-0.2444 0.9642 -0.1031 -17.4178]
[-0.3319 0.0168 0.9432 94.9541]
[0. 0. 0. 1.]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.65456
== [Result] Frame: 247, Matches 1463, Inliers: 81.07
<Figure size 432x288 with 0 Axes>

Saved at vis_preFeature/frame247.jpg
(1463, 4)
[[0.9155 0.2528 0.313 71.8235]
[-0.2329 0.9673 -0.1001 -17.5854]
[-0.3281 0.0187 0.9445 96.1377]
[0. 0. 0. 1.]]
Mean Error Rotation: 0.00430
Mean Error Translation: 0.65384
== [Result] Frame: 248, Matches 1463, Inliers: 82.02
<Figure size 432x288 with 0 Axes>

```
Saved at vis_preFeature/frame248.jpg
(1463, 4)
[[ 0.9162  0.2491  0.3139  72.2576]
 [ -0.2293  0.9683  -0.0989 -17.7522]
 [ -0.3286  0.0186  0.9443  97.5176]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00429
Mean Error Translation: 0.65377
== [Result] Frame: 249, Matches 1463, Inliers: 78.13
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame249.jpg
(1463, 4)
[[ 0.9157  0.2506  0.3143  72.7343]
 [ -0.2314  0.9679  -0.0976 -17.9222]
 [ -0.3287  0.0166  0.9443  99.0624]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00428
Mean Error Translation: 0.65433
== [Result] Frame: 250, Matches 1463, Inliers: 78.81
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame250.jpg
```



```
(1463, 4)
[[ 0.9151  0.2531  0.3138  73.2595]
 [-0.2333  0.9673  -0.0998 -18.1116]
 [-0.3288  0.0181  0.9442  100.6272]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00428
Mean Error Translation: 0.65506
== [Result] Frame: 251, Matches 1463, Inliers: 80.79

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame251.jpg
(1463, 4)
[[ 0.9127  0.2605  0.3147  73.4082]
 [-0.2399  0.9653  -0.1034 -18.1729]
 [-0.3307  0.0189  0.9435  101.1544]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00427
Mean Error Translation: 0.65365
== [Result] Frame: 252, Matches 1463, Inliers: 85.65

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame252.jpg
(1463, 4)
[[ 0.9096  0.2709  0.3152  73.5691]
 [-0.2501  0.9625  -0.1054 -18.2315]
 [-0.3319  0.017   0.9432  101.6888]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00428
Mean Error Translation: 0.65224
== [Result] Frame: 253, Matches 1463, Inliers: 89.13

<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame253.jpg
(1463, 4)
[[ 0.9068  0.2753  0.3193  73.738 ]
 [-0.2544  0.9612  -0.1065 -18.291 ]
 [-0.3362  0.0154  0.9417  102.2548]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00428
Mean Error Translation: 0.65075
== [Result] Frame: 254, Matches 1463, Inliers: 95.49

<Figure size 432x288 with 0 Axes>
```

```

Saved at vis_preFeature/frame254.jpg
(1463, 4)
[[ 0.9043   0.278    0.3239  73.919 ]
 [ -0.2571   0.9605   -0.1066 -18.3543]
 [ -0.3407   0.0131    0.9401 102.8542]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00427
Mean Error Translation: 0.64914
== [Result] Frame: 255, Matches 1463, Inliers: 89.34
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame255.jpg
(1463, 4)
[[ 0.9036   0.2774   0.3265  74.1138]
 [ -0.2556   0.9607   -0.1088 -18.4207]
 [ -0.3438   0.0149    0.9389 103.4419]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00427
Mean Error Translation: 0.64759
== [Result] Frame: 256, Matches 1463, Inliers: 91.87
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame256.jpg
(1463, 4)
[[ 0.902     0.278    0.3302  74.2878]
 [ -0.2546   0.9604   -0.1131 -18.4865]
 [ -0.3486   0.0179    0.9371 104.0378]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00427
Mean Error Translation: 0.64604
== [Result] Frame: 257, Matches 1463, Inliers: 94.26
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame257.jpg
(1463, 4)
[[ 0.9031   0.2708   0.3332  74.4829]
 [ -0.2471   0.9624   -0.1125 -18.566 ]
 [ -0.3512   0.0192    0.9361 104.6151]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.64463
== [Result] Frame: 258, Matches 1463, Inliers: 92.34
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame258.jpg
(1463, 4)
[[ 0.9043   0.2656   0.3342  74.6788]
 [ -0.2407   0.9638  -0.1147 -18.6424]
 [ -0.3526   0.0233   0.9355 105.1859]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.64323
== [Result] Frame: 259, Matches 1463, Inliers: 85.65
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame259.jpg
(1463, 4)
[[ 0.9024   0.2677   0.3377  74.8511]
 [ -0.2425   0.9632  -0.1157 -18.7187]
 [ -0.3563   0.0225   0.9341 105.7455]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.64188
== [Result] Frame: 260, Matches 1463, Inliers: 83.53
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame260.jpg
(1463, 4)
[[ 0.9009   0.269    0.3407  75.0514]
 [ -0.2443   0.9629  -0.1144 -18.7891]
 [ -0.3588   0.0198   0.9332 106.3304]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.64045
== [Result] Frame: 261, Matches 1463, Inliers: 83.25
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame261.jpg
(1463, 4)
[[ 0.8985   0.2713   0.3451  75.2373]
 [ -0.2483   0.9624  -0.1101 -18.8598]
 [ -0.362    0.0133   0.9321 106.9184]
 [  0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00426
Mean Error Translation: 0.63902
== [Result] Frame: 262, Matches 1463, Inliers: 87.49
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame262.jpg
(1463, 4)
[[ 0.8993  0.2681  0.3455  75.4761]
 [ -0.2462  0.9633  -0.1067 -18.9448]
 [ -0.3614  0.0109  0.9323 107.5241]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00428
Mean Error Translation: 0.63754
== [Result] Frame: 263, Matches 1463, Inliers: 82.23
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame263.jpg
(1463, 4)
[[ 0.9039  0.2574  0.3416  75.7608]
 [ -0.2319  0.966   -0.1142 -19.0401]
 [ -0.3594  0.024   0.9329 108.1625]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00434
Mean Error Translation: 0.63590
== [Result] Frame: 264, Matches 1463, Inliers: 79.90
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame264.jpg
(1463, 4)
[[ 0.9077  0.2516  0.336   76.0573]
 [ -0.2206  0.9669  -0.1282 -19.151 ]
 [ -0.3571  0.0422  0.9331 108.8749]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00436
Mean Error Translation: 0.63403
== [Result] Frame: 265, Matches 1463, Inliers: 81.95
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame265.jpg
(1463, 4)
[[ 0.9109  0.2467  0.3308  76.423 ]
 [ -0.2124  0.9676  -0.1368 -19.2849]
 [ -0.3538  0.0544  0.9337 109.7497]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00436
Mean Error Translation: 0.63234
== [Result] Frame: 266, Matches 1463, Inliers: 78.06
<Figure size 432x288 with 0 Axes>
```

```

Saved at vis_preFeature/frame266.jpg
(1463, 4)
[[ 0.9156  0.2333  0.3274  76.8566]
 [ -0.2016  0.971   -0.1283 -19.4342]
 [ -0.3479  0.0515  0.9361 110.7259]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00441
Mean Error Translation: 0.63105
== [Result] Frame: 267, Matches 1463, Inliers: 82.37
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame267.jpg
(1463, 4)
[[ 0.9168  0.2235  0.331   77.2193]
 [ -0.1982  0.9741  -0.1088 -19.5795]
 [ -0.3467  0.0341  0.9373 111.7687]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.62971
== [Result] Frame: 268, Matches 1463, Inliers: 78.61
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame268.jpg
(1463, 4)
[[ 0.9163  0.2197  0.3349  77.6239]
 [ -0.1993  0.9754  -0.0946 -19.7694]
 [ -0.3474  0.02     0.9375 113.0552]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.62927
== [Result] Frame: 269, Matches 1463, Inliers: 77.65
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame269.jpg
(1463, 4)
[[ 0.9142  0.2282  0.3349  78.0345]
 [ -0.206   0.9733  -0.1007 -19.9492]
 [ -0.3489  0.0231  0.9369 114.4283]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00444
Mean Error Translation: 0.62925
== [Result] Frame: 270, Matches 1463, Inliers: 81.48
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame270.jpg
(1463, 4)
[[ 0.9139  0.2374  0.3291  78.2436]
 [ -0.2102  0.9707  -0.1164 -20.0211]
 [ -0.3471  0.0372  0.9371  115.0329]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00443
Mean Error Translation: 0.62766
== [Result] Frame: 271, Matches 1463, Inliers: 85.92
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame271.jpg
(1463, 4)
[[ 0.9136  0.2407  0.3278  78.4252]
 [ -0.211   0.9696  -0.1238 -20.1026]
 [ -0.3476  0.0439  0.9366  115.6241]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00443
Mean Error Translation: 0.62615
== [Result] Frame: 272, Matches 1463, Inliers: 83.19
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame272.jpg
(1463, 4)
[[ 0.9144  0.2389  0.3267  78.6046]
 [ -0.2091  0.97    -0.124   -20.1855]
 [ -0.3466  0.0451  0.9369  116.1906]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.62474
== [Result] Frame: 273, Matches 1463, Inliers: 92.41
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame273.jpg
(1463, 4)
[[ 0.9146  0.2388  0.3263  78.7835]
 [ -0.2096  0.9701  -0.1224 -20.2693]
 [ -0.3457  0.0436  0.9373  116.778 ]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.62330
== [Result] Frame: 274, Matches 1463, Inliers: 94.94
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame274.jpg
(1463, 4)
[[ 0.9153   0.2392   0.324   79.0452]
 [ -0.2098   0.9699  -0.1235 -20.3804]
 [ -0.3438   0.045    0.938   117.6338]
 [ 0.         0.        0.       1.      ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.62150
== [Result] Frame: 275, Matches 1463, Inliers: 94.67
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame275.jpg
(1463, 4)
[[ 0.9154   0.2428   0.321   79.3375]
 [ -0.2133   0.969   -0.1248 -20.5117]
 [ -0.3413   0.0458   0.9388 118.6097]
 [ 0.         0.        0.       1.      ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.62011
== [Result] Frame: 276, Matches 1463, Inliers: 94.87
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame276.jpg
(1463, 4)
[[ 0.9153   0.2468   0.3183  79.6721]
 [ -0.2177   0.968   -0.1246 -20.6705]
 [ -0.3389   0.0447   0.9398 119.6625]
 [ 0.         0.        0.       1.      ]]
Mean Error Rotation: 0.00441
Mean Error Translation: 0.61901
== [Result] Frame: 277, Matches 1463, Inliers: 86.53
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame277.jpg
(1463, 4)
[[ 0.916    0.2495   0.3143  80.0629]
 [ -0.2207   0.9673  -0.1246 -20.8422]
 [ -0.3351   0.0447   0.9411 120.7547]
 [ 0.         0.        0.       1.      ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.61825
== [Result] Frame: 278, Matches 1463, Inliers: 86.19
<Figure size 432x288 with 0 Axes>
```

```

Saved at vis_preFeature/frame278.jpg
(1463, 4)
[[ 0.9181   0.246    0.3107  80.4644]
 [ -0.2179   0.9682   -0.1227 -21.0063]
 [ -0.331    0.045    0.9425 121.8481]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00444
Mean Error Translation: 0.61744
== [Result] Frame: 279, Matches 1463, Inliers: 83.25
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame279.jpg
(1463, 4)
[[ 0.9188   0.2439   0.3103  80.7841]
 [ -0.2174   0.9689   -0.1179 -21.1498]
 [ -0.3295   0.0409   0.9433 122.8226]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.61614
== [Result] Frame: 280, Matches 1463, Inliers: 86.26
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame280.jpg
(1463, 4)
[[ 0.9189   0.244    0.3098  81.0568]
 [ -0.2173   0.9689   -0.1185 -21.271 ]
 [ -0.3291   0.0416   0.9434 123.7231]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00442
Mean Error Translation: 0.61455
== [Result] Frame: 281, Matches 1463, Inliers: 84.07
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame281.jpg
(1463, 4)
[[ 0.9209   0.2416   0.3059  81.4036]
 [ -0.2141   0.9693   -0.1212 -21.4231]
 [ -0.3258   0.0461   0.9443 124.7598]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00441
Mean Error Translation: 0.61352
== [Result] Frame: 282, Matches 1463, Inliers: 90.50
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame282.jpg
(1463, 4)
[[ 0.9235   0.238    0.301   81.7264]
 [ -0.2096   0.9699   -0.1241  -21.5673]
 [ -0.3214   0.0516    0.9455  125.8012]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00440
Mean Error Translation: 0.61249
== [Result] Frame: 283, Matches 1463, Inliers: 84.21
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame283.jpg
(1463, 4)
[[ 0.9266   0.2334   0.2949  82.1249]
 [ -0.2051   0.9709   -0.1239  -21.7461]
 [ -0.3152   0.0544    0.9475  127.0746]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.61228
== [Result] Frame: 284, Matches 1463, Inliers: 74.23
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame284.jpg
(1463, 4)
[[ 0.9287   0.2298   0.2909  82.5068]
 [ -0.2034   0.9719   -0.1182  -21.9227]
 [ -0.3099   0.0506    0.9494  128.3841]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.61216
== [Result] Frame: 285, Matches 1463, Inliers: 70.75
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame285.jpg
(1463, 4)
[[ 0.9304   0.2273   0.2875  82.8838]
 [ -0.2036   0.9728   -0.1101  -22.0909]
 [ -0.3047   0.0439    0.9514  129.7418]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00438
Mean Error Translation: 0.61216
== [Result] Frame: 286, Matches 1463, Inliers: 70.54
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame286.jpg
(1463, 4)
[[ 0.932    0.2226   0.2861  83.2842]
 [ -0.2017   0.9742  -0.101  -22.2553]
 [ -0.3012   0.0364   0.9529 131.1191]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00437
Mean Error Translation: 0.61228
== [Result] Frame: 287, Matches 1463, Inliers: 75.32
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame287.jpg
(1463, 4)
[[ 0.9321   0.227    0.2823  83.7284]
 [ -0.2074   0.9733  -0.098  -22.445 ]
 [ -0.297    0.0328   0.9543 132.6809]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00437
Mean Error Translation: 0.61307
== [Result] Frame: 288, Matches 1463, Inliers: 73.96
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame288.jpg
(1463, 4)
[[ 0.9346   0.2246   0.2759  84.0335]
 [ -0.204    0.9737  -0.1015 -22.5817]
 [ -0.2914   0.0386   0.9558 133.6735]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.61197
== [Result] Frame: 289, Matches 1463, Inliers: 88.86
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame289.jpg
(1463, 4)
[[ 0.936    0.2281   0.2682  84.1675]
 [ -0.2052   0.9724  -0.111  -22.6401]
 [ -0.2861   0.0488   0.9569 134.2182]
 [ 0.         0.        0.        1.      ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.61070
== [Result] Frame: 290, Matches 1463, Inliers: 93.71
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame290.jpg
(1463, 4)
[[ 0.9384  0.2257  0.2616  84.3083]
 [ -0.2017  0.9726  -0.1157 -22.6987]
 [ -0.2806  0.0558  0.9582  134.7522]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00438
Mean Error Translation: 0.60952
== [Result] Frame: 291, Matches 1463, Inliers: 91.25
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame291.jpg
(1463, 4)
[[ 0.9421  0.2191  0.2539  84.4654]
 [ -0.1959  0.974   -0.1136 -22.7683]
 [ -0.2722  0.0573  0.9605  135.2724]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.60843
== [Result] Frame: 292, Matches 1463, Inliers: 95.97
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame292.jpg
(1463, 4)
[[ 0.9432  0.2224  0.2469  84.6013]
 [ -0.2009  0.9735  -0.1094 -22.8365]
 [ -0.2647  0.0536  0.9629  135.8205]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.60728
== [Result] Frame: 293, Matches 1463, Inliers: 89.41
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame293.jpg
(1463, 4)
[[ 0.944   0.2266  0.2399  84.7179]
 [ -0.2053  0.9724  -0.1105 -22.8995]
 [ -0.2584  0.055   0.9645  136.3771]
 [ 0.        0.        0.        1.      ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.60609
== [Result] Frame: 294, Matches 1463, Inliers: 90.77
<Figure size 432x288 with 0 Axes>
```

```

Saved at vis_preFeature/frame294.jpg
(1463, 4)
[[ 0.9459   0.2291   0.2299  84.8345]
 [ -0.2072   0.9714  -0.1157 -22.9583]
 [ -0.2499   0.0618   0.9663 136.922 ]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.60493
== [Result] Frame: 295, Matches 1463, Inliers: 93.16
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame295.jpg
(1463, 4)
[[ 0.9486   0.2255   0.2219  84.9567]
 [ -0.2036   0.972   -0.1171 -23.0246]
 [ -0.2421   0.0659   0.968  137.4714]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.60378
== [Result] Frame: 296, Matches 1463, Inliers: 95.22
<Figure size 432x288 with 0 Axes>

```

```

Saved at vis_preFeature/frame296.jpg
(1463, 4)
[[ 0.9512   0.2215   0.2151  85.0806]
 [ -0.2008   0.973   -0.1138 -23.0916]
 [ -0.2344   0.065   0.97   138.0412]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00439
Mean Error Translation: 0.60260
== [Result] Frame: 297, Matches 1463, Inliers: 95.69
<Figure size 432x288 with 0 Axes>

```

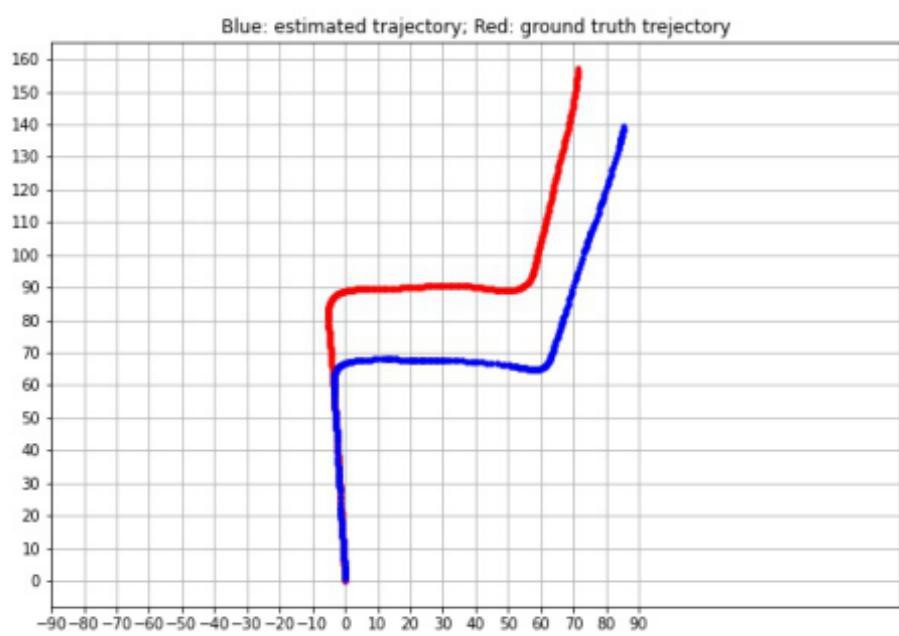
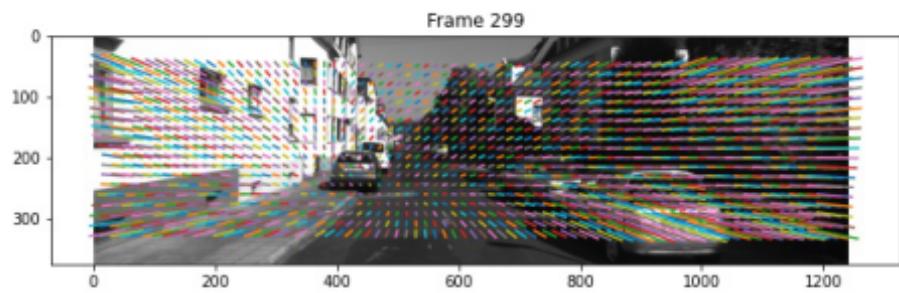
```

Saved at vis_preFeature/frame297.jpg
(1463, 4)
[[ 0.955    0.2126   0.2069  85.2454]
 [ -0.1941   0.9752  -0.1059 -23.1801]
 [ -0.2243   0.061    0.9726 138.6858]
 [ 0.         0.         0.         1.       ]]
Mean Error Rotation: 0.00443
Mean Error Translation: 0.60130
== [Result] Frame: 298, Matches 1463, Inliers: 89.06
<Figure size 432x288 with 0 Axes>

```

```
Saved at vis_preFeature/frame298.jpg
(1463, 4)
[[ 0.9566   0.212    0.2     85.3798]
 [ -0.1953   0.9757  -0.0998 -23.2565]
 [ -0.2163   0.0564   0.9747 139.3796]
 [  0.        0.        0.       1.      ]]
Mean Error Rotation: 0.00444
Mean Error Translation: 0.59983
== [Result] Frame: 299, Matches 1463, Inliers: 89.00
<Figure size 432x288 with 0 Axes>
```

```
Saved at vis_preFeature/frame299.jpg
```



1. Report the final rotation and translation error. (**2 points**)

SpyNet result:

Mean Error Rotation: 0.00444

Mean Error Translation: 0.59983

libviso2 result

Mean Error Rotation: 0.00299

Mean Error Translation: 0.53948

Next, answer the following questions:

2. Does SPyNet yield higher accuracy than the original `libviso2`? Why or why not? If not, what steps can you take to improve? (**5 points**)

SPyNET yields worse results compared to libviso2 when comparing in terms of both rotation and translation. This is despite SPyNET having many more matched correspondence compared to libviso2.

SPyNET:

Matches 1463, Inliers: 89.00

libviso2:

Matches 295, Inliers: 85.42

By looking at the visualization of estimation using SPyNET correspondence compared with the ground truth. We can see that there is significant drift in using SPyNET as compared to using libviso2. As explained in the libviso2 paper, this is due to bias in the correspondence, such as belonging to the same objects on screen. Further investigation is needed to determine if this is really the root cause of the drift in SPyNET. If it is, then we can use the same bucket processing steps in libviso2 to alleviate the drift.

3. Explain how SPyNet achieves accurate flow with significantly lower computational cost. (**3 points**)

SPyNet only predicts the residual flow field in each upsampling stage. Since this is a much simpler task compared to predicting the flow directly, they can use a network with smaller capacity to learn it, leading to much fewer trainable parameters and lower computational cost.

1.6 Question 5: Using Sfm-learner for SFM

Now we will use deep neural networks for SFM. Please follow the open-source Sfm-learner repository (<https://github.com/ClementPinard/SfmLearner-Pytorch>) and the paper (https://people.eecs.berkeley.edu/~tinghuiz/projects/SfmLearner/cvpr17_sfm_final.pdf) to answer the following questions.

1. Describe how photometric loss is implemented in Sfmlearner? Please refer to the paper and the code. (**5 points**)

The photometric loss is used to train the CNNs in the paper.

Given a sequence of images I_1, \dots, I_N , we can choose one image as the target image and the nearby images as the source images.

A depth network takes as input the depth image and outputs per-pixel depth map. A pose network takes both the target and source images as input and outputs the relative camera poses. The camera poses, depth image and given camera intrinsic are used to inverse warp the source images to reconstruct the target images.

The photometric loss is then the sum of the per-pixel norm difference between the target image and the reconstructed target images.

We can also choose different images in I_1, \dots, I_N to be the target image and sum over the per-target image photometric loss to obtain a photometric loss for the entire sequence of images.

2. Train the model and show the training curve, validation curve, and visualization of predicted depth and warped images? Which loss is decreasing and which is increasing? Why? **(10 points)**

Visualize the specific images: `val_Depth_Output_Normalized/0`, `val_Warped_Outputs/0` from tensorboard.

Training data: `/datasets/cse152-252-sp20-public/sfmlearner_h128w416`.

Install the environment `pip install -r requirements.txt` - fix scipy version problem:

```
pip install scipy==1.1.0 --user
```

Training script `cd SfmLearner-Pytorch`

```
python3 train.py /datasets/cse152-252-sp20-public/sfmlearner_h128w416 -b4 -m0.2 -s0.1 --epoch-size 3000 --sequence-length 3 --log-output
```

```
[11]: %matplotlib inline
import os
import os.path as osp
import matplotlib.pyplot as plt
from IPython.display import Image
from IPython.core.display import HTML

path = "SfmLearner-Pytorch/tb_img/"

for img_name in os.listdir(path):
    img_rel_path = osp.join(path, img_name)

    print(f"! [{img_name}] ({img_rel_path})")
```

```
![val_Warped_Outputs_0.png] (SfmLearner-Pytorch/tb_img/val_Warped_Outputs_0.png)
![qns2_photometric_error.png] (SfmLearner-
```

```
Pytorch/tb_img/qns2_photometric_error.png)
![qns_2_total_loss.png](SfmLearner-Pytorch/tb_img/qns_2_total_loss.png)
![qns2_explainability_loss.png](SfmLearner-
Pytorch/tb_img/qns2_explainability_loss.png)
![qns2_disparity_smoothness_loss.png](SfmLearner-
Pytorch/tb_img/qns2_disparity_smoothness_loss.png)
![qns2_val_Depth_Output_Normalized_0.png](SfmLearner-
Pytorch/tb_img/qns2_val_Depth_Output_Normalized_0.png)
![qns2_validation_total_loss.png](SfmLearner-
Pytorch/tb_img/qns2_validation_total_loss.png)
![qns2_validation_exp_loss.png](SfmLearner-
Pytorch/tb_img/qns2_validation_exp_loss.png)
![qns2_validation_photo_loss.png](SfmLearner-
Pytorch/tb_img/qns2_validation_photo_loss.png)
```

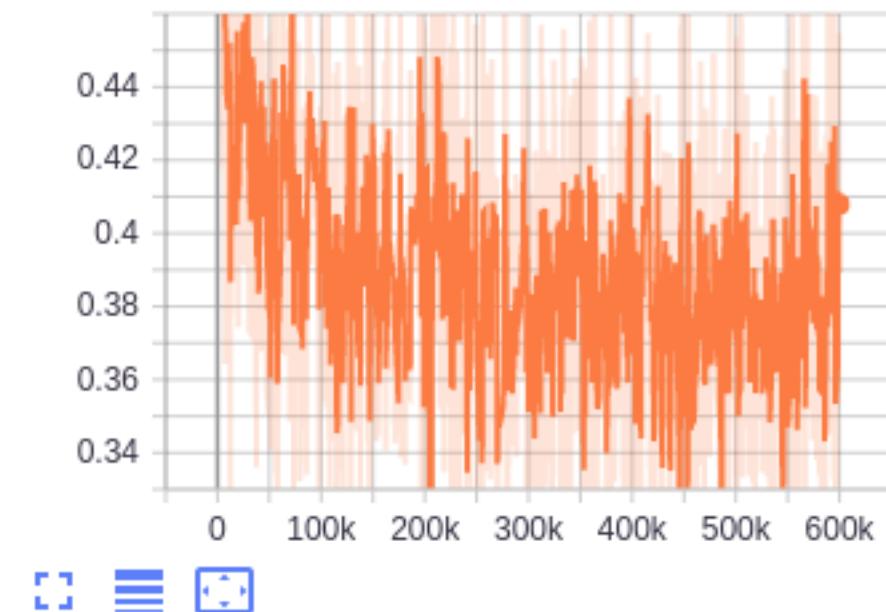
val_Warped_Outputs_0/0

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Sat May 02 2020 17:10:02 Pacific Daylight Time

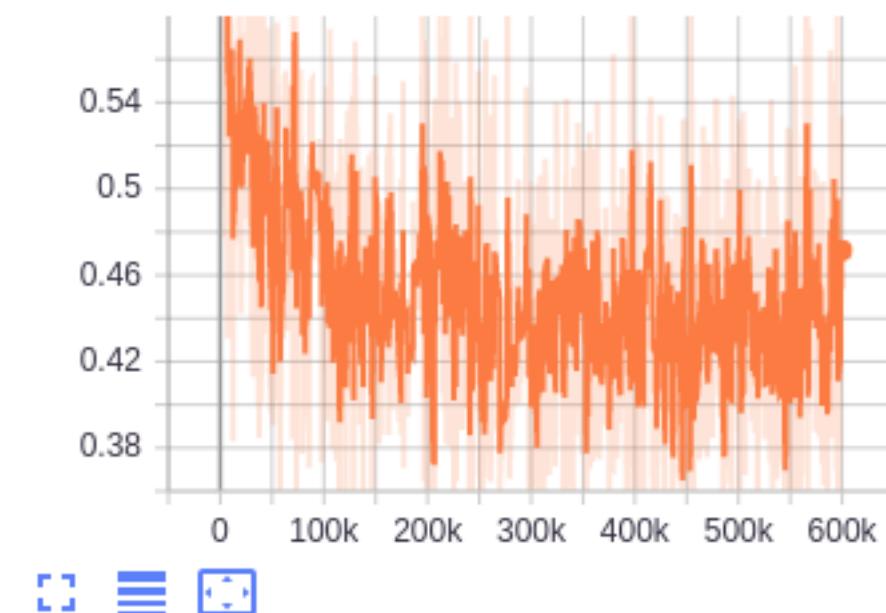


photometric_error



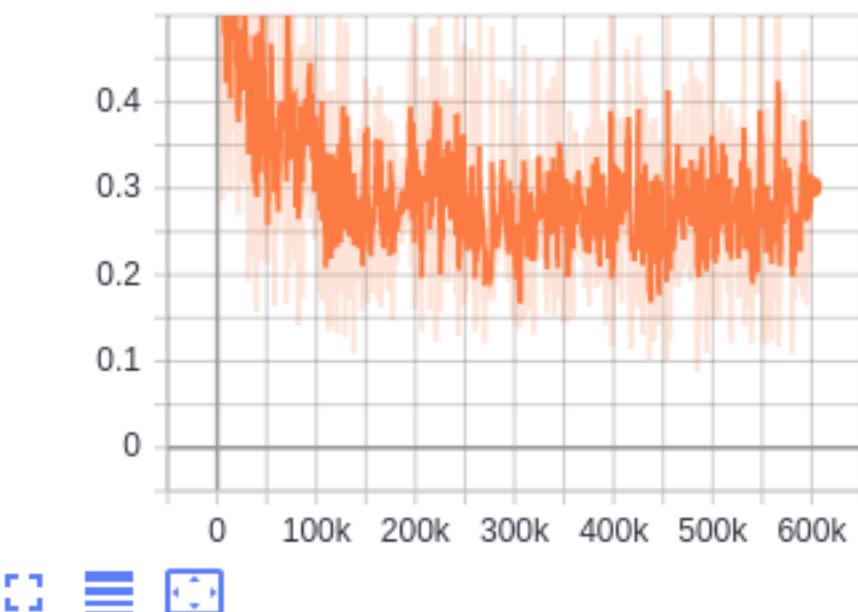
[] [] []

total_loss

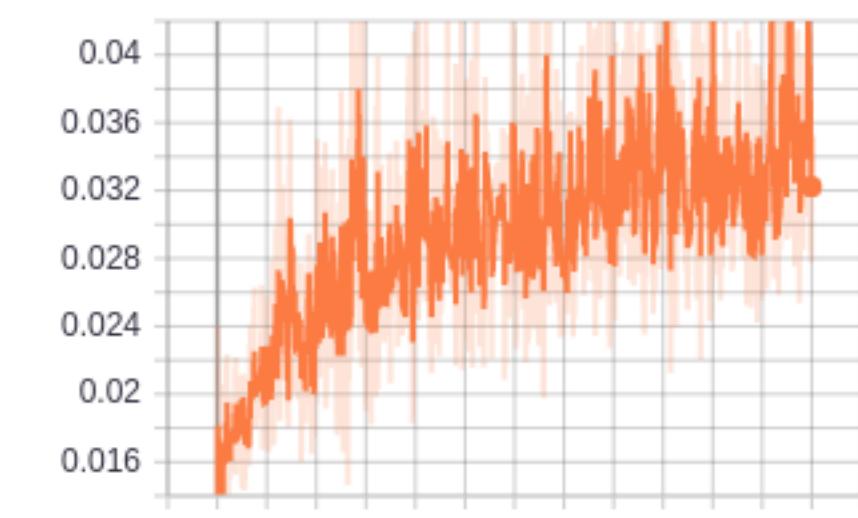


[] [] []

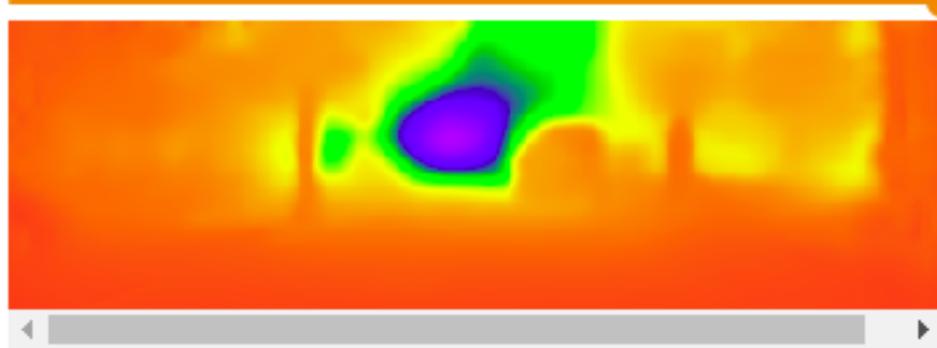
explanability_loss



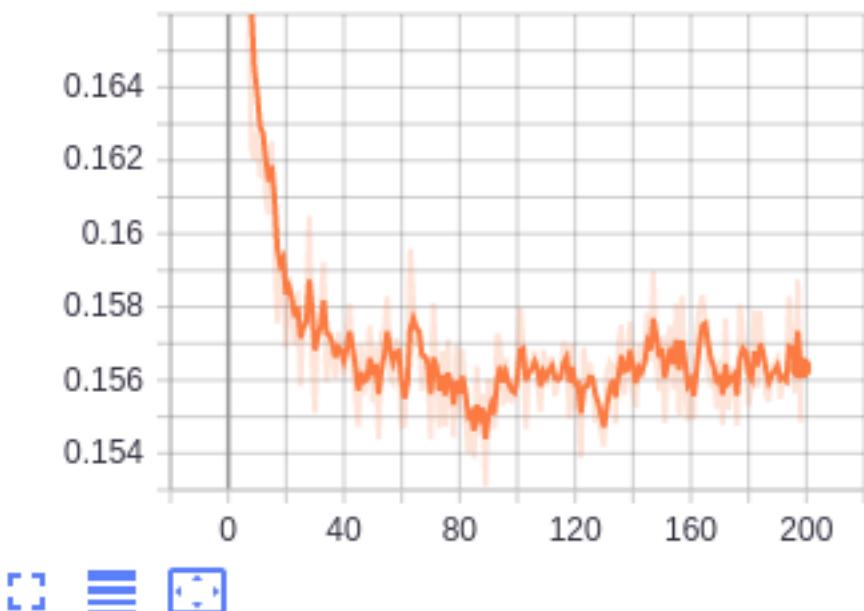
disparity_smoothness_loss



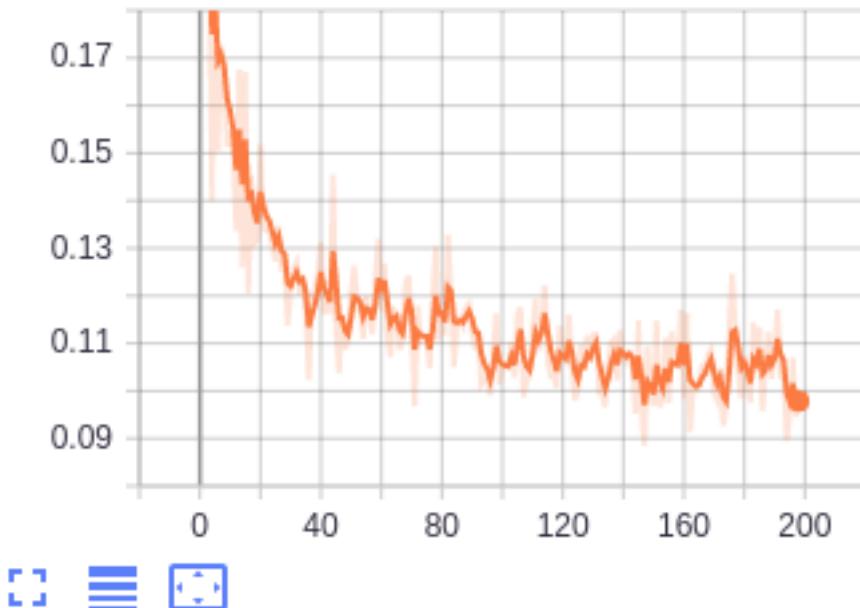
val_Depth_Output_Normalized/0
step 198 Sat May 02 2020 17:10:02 Pacific Daylight Time



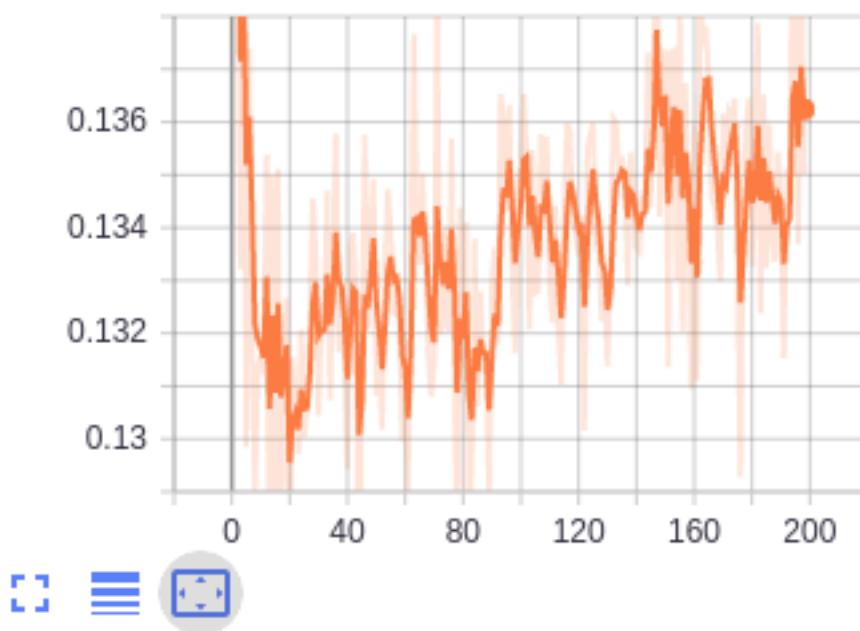
Validation_Total_loss



Validation_Exp_loss



Validation_Photo_loss



The following losses are decreasing:

- Photometric error
- Total loss
- Explainability loss
- Validation total loss

- Validation Explainability loss

These losses decrease because training is performed to minimize them. Their decreasing trend shows that there is no serious error in the code.

The following loss is increasing:

- Disparity smoothing loss

The disparity loss is the L1 norm of the second-order gradients for the predicted depth maps. This is used to handle the local gradient issue. It makes sense that this loss increases as training progresses, which shows that the predicted depth map is heavily dependent on the input image.

The following loss decreases and then increases:

- Validation Photometric loss

This shows that the model might have overfitting to the training data for minimizing the Photometric loss.

Note to self, not part of answer:

This is being run on nautilus on pod quan-sfm-qns2-q2dq2

The root directory is at /cephfs/quan/252c/cse252c_hw1/SfmLearner-Pytorch

=> will save everything to checkpoints/sfmlearner_h128w416,epoch_size3000,m0.2/05-01-22:09

- When training the model, we use 3 consecutive frames. Now, you will use the photometric consistency between the 1st and the 3rd frame. To be more specific, you can get the pose $T_{1,3} = T_{2,3}@T_{1,2}$, where $T_{1,2}, T_{2,3}$ have already been computed in the original code. Add the constraint to the total loss and report the results in the same manner as in part 2 above. **(10 points)**

```
[13]: %matplotlib inline
import os
import os.path as osp
import matplotlib.pyplot as plt
from IPython.display import Image
from IPython.core.display import HTML

path = "SfmLearner-Pytorch-qns3/tb_img/"

for img_name in os.listdir(path):

    img_rel_path = osp.join(path, img_name)

    print(f"! [{img_name}] ({img_rel_path})")
```

```
![qns3_val_Warped_Outputs_0.png] (SfmLearner-Pytorch-
qns3/tb_img/qns3_val_Warped_Outputs_0.png)
![qns3_val_Depth_Output_Normalized.png] (SfmLearner-Pytorch-
qns3/tb_img/qns3_val_Depth_Output_Normalized.png)
![qns3_photometric_error.png] (SfmLearner-Pytorch-
```

```
qns3/tb_img/qns3_photometric_error.png)
![qns3_explainability_loss.png](SfmLearner-Pytorch-
qns3/tb_img/qns3_explainability_loss.png)
![qns3_validation_exp_loss.png](SfmLearner-Pytorch-
qns3/tb_img/qns3_validation_exp_loss.png)
![qns3_disparity_smoothness_loss.png](SfmLearner-Pytorch-
qns3/tb_img/qns3_disparity_smoothness_loss.png)
![qns3_total_loss.png](SfmLearner-Pytorch-qns3/tb_img/qns3_total_loss.png)
![qns3_validation_photo_loss.png](SfmLearner-Pytorch-
qns3/tb_img/qns3_validation_photo_loss.png)
![qns3_validation_total_loss.png](SfmLearner-Pytorch-
qns3/tb_img/qns3_validation_total_loss.png)
```

val_Warped_Outputs_0/0

step 198

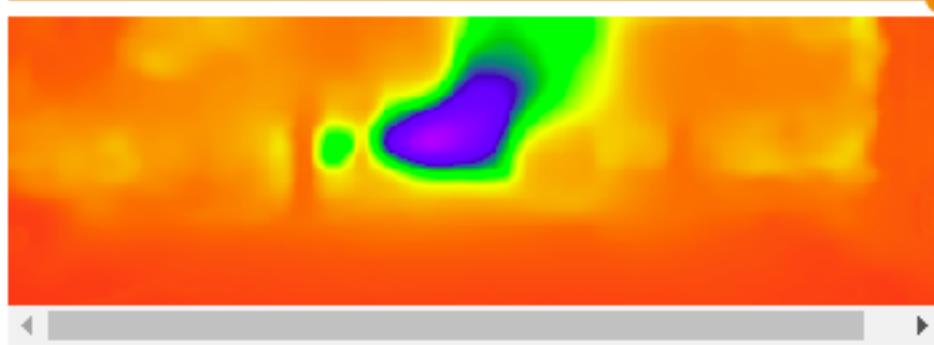
Sun May 03 2020 08:38:10 Pacific Daylight Time



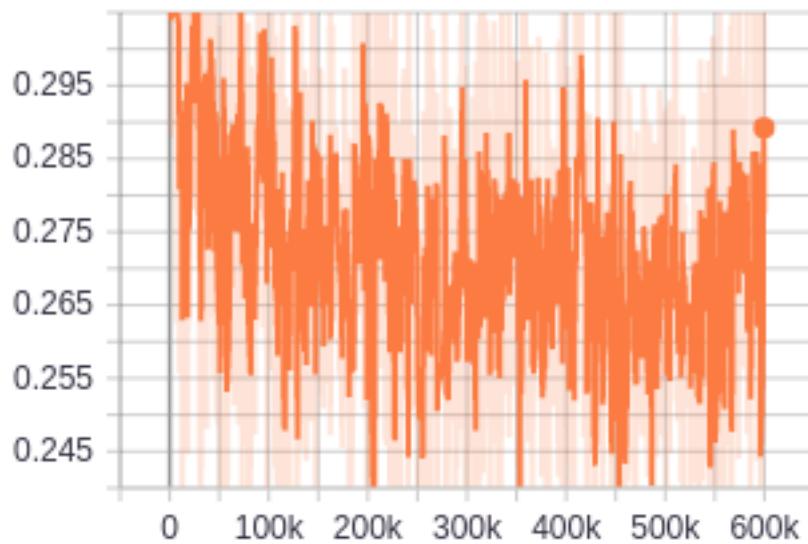
val_Depth_Output_Normalized/0

step 198

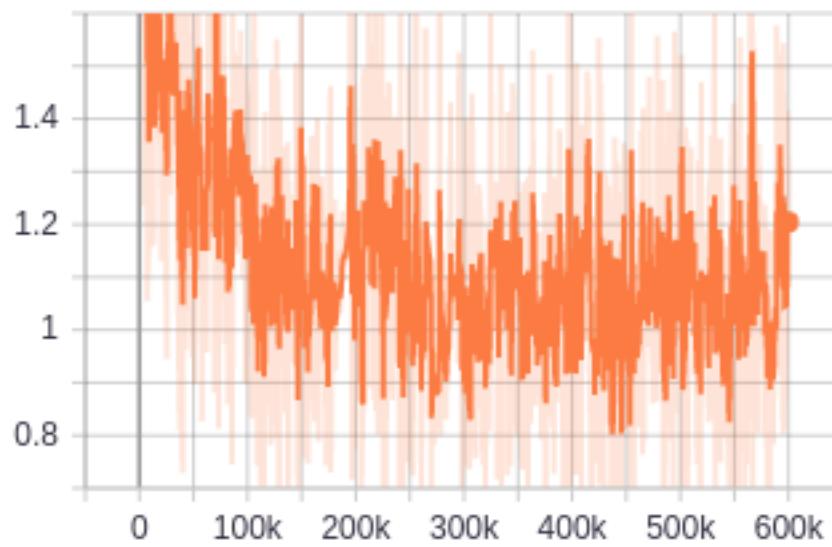
Sun May 03 2020 08:38:10 Pacific Daylight Time



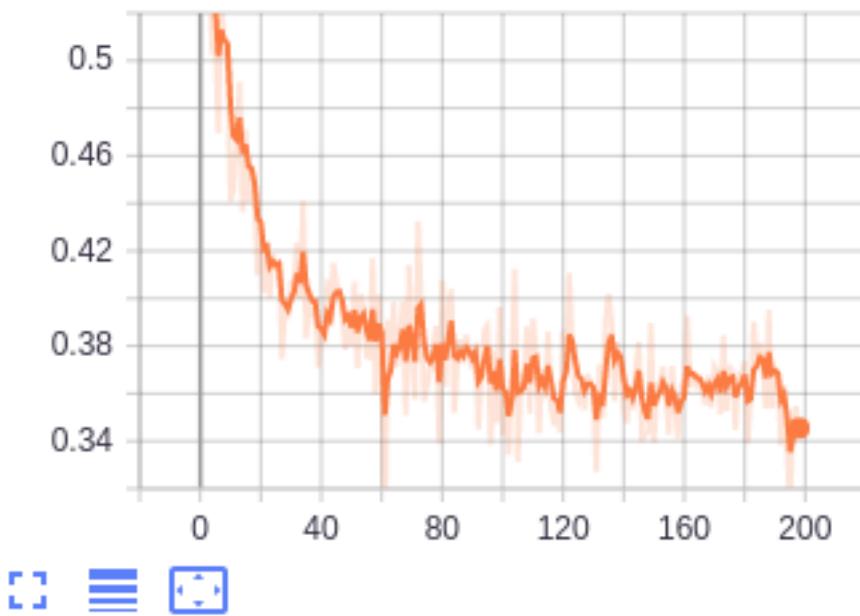
photometric_error



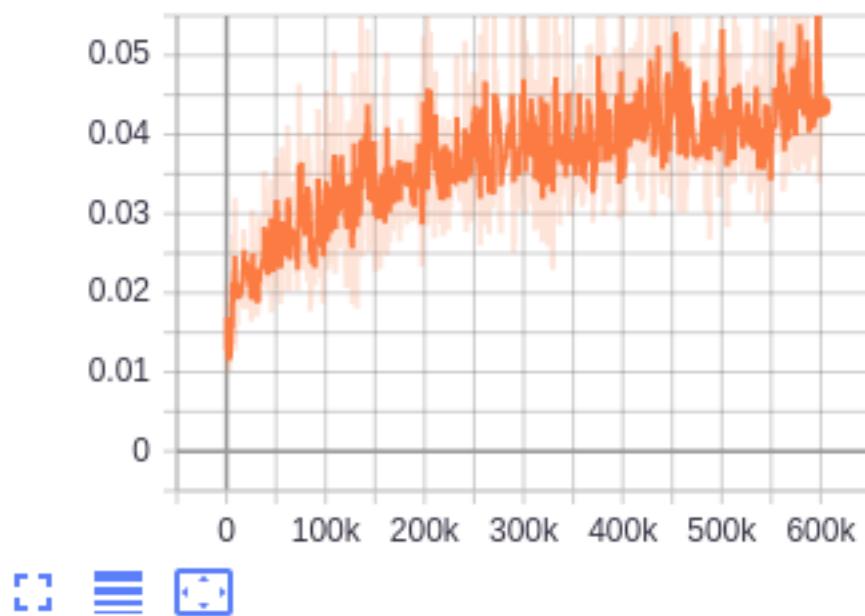
explanability_loss



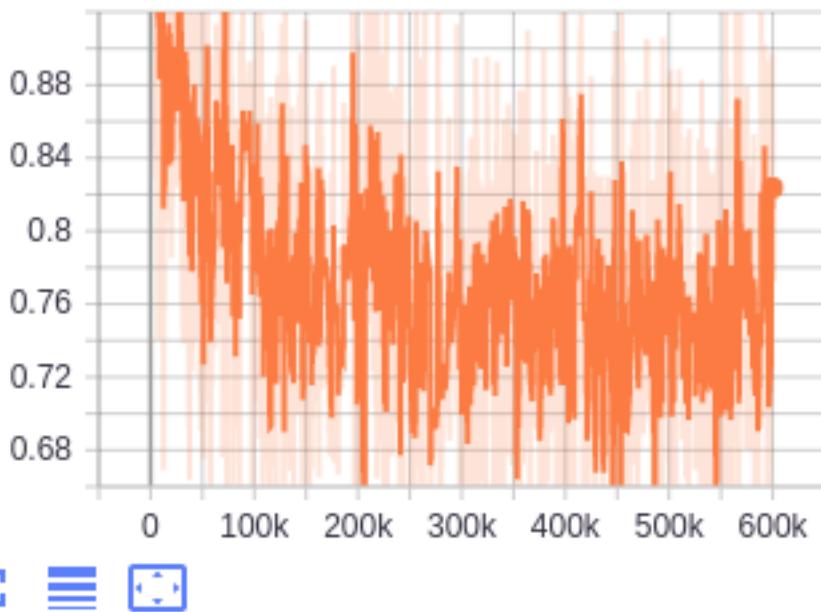
Validation_Exp_loss



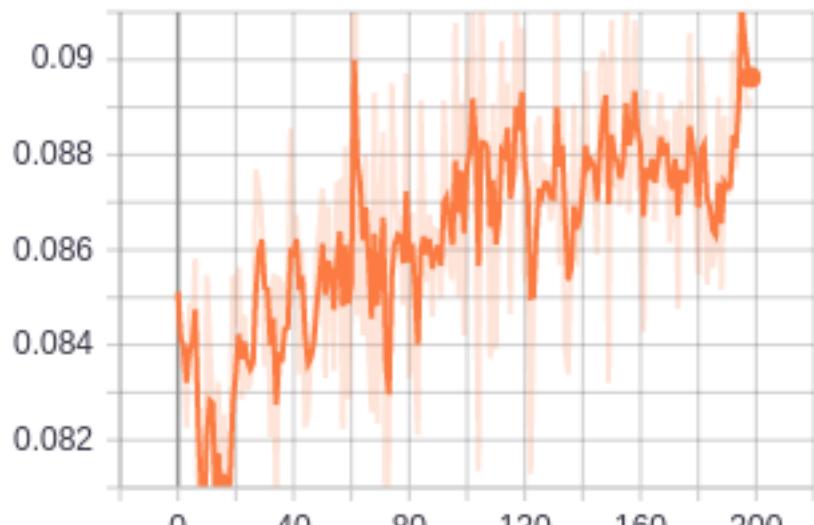
disparity_smoothness_loss



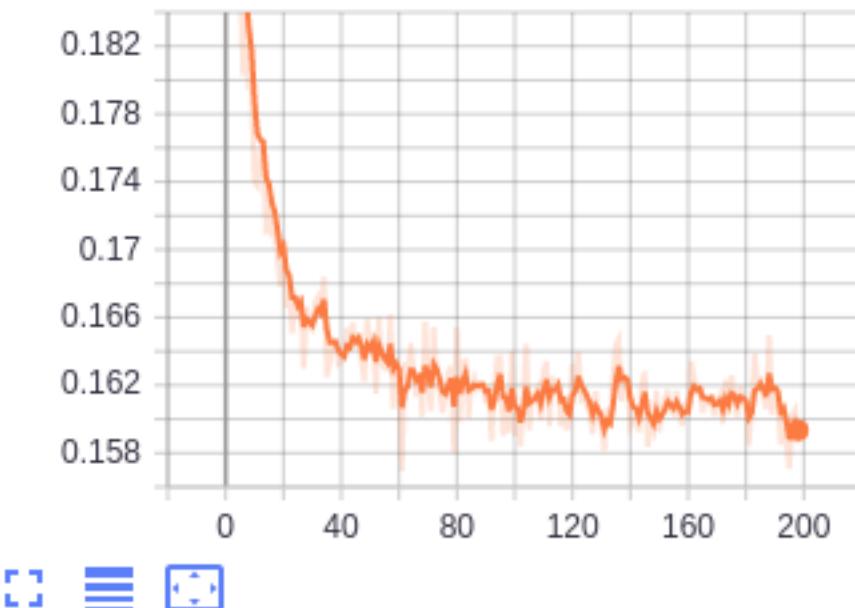
total_loss



Validation_Photo_loss



Validation_Total_loss



Generally, the trends in the loss are similar to those seen in question 2. However, the model seems to overfit more to the training data.

The following losses are decreasing:

- Photometric error
- Total loss
- Explainability loss
- Validation total loss
- Validation Explainability loss

(Same reason as in question 2) These losses decrease because training is performed to minimize them. Their decreasing trend shows that there is no serious error in the code.

The following loss is increasing:

- Disparity smoothing loss

(Same reason as in question 2) The disparity loss is the L1 norm of the second-order gradients for the predicted depth maps. This is used to handle the local gradient issue. It makes sense that this loss increases as training progresses, which shows that the predicted depth map is heavily dependent on the input image.

The following loss decreases and then increases:

- Validation Photometric loss

This shows that the model might have overfitting to the training data for minimizing the Photometric loss. However, the model overfits in fewer epochs compared to the original code in question 2.

Note to self, not part of answer:

This is running on pod quan-sfm-qns3-7jx4s

The root directory is /cephfs/quan/252c/SfmLearner-Pytorch-qns3

Result: checkpoints/sfmlearner_h128w416,epoch_size3000,m0.2/05-01-23:50

4. Now, you will evaluate your models from parts (2), (3) on the KITTI odometry dataset.
What are the error metrics used in Sfm-learner? Please report the ATE and RE for sequence 09 and 10. **(5 points)**

Data: /datasets/cse152-252-sp20-public/kitti.

```
Evaluation script python3 test_pose.py /path/to/posenet --dataset-dir
/datasets/cse152-252-sp20-public/kitti --sequences 09
```

ATE is the Absolute Trajectory Error (ATE). ATE is computed on 5-frame snippets and averaged over the full sequence. It is the norm of the difference between the ground truth and the scaled prediction averaged over the snippet length.

RE measures the difference in terms of the rotational aspect of the ground truth pose and predicted pose.

MODEL FROM PART 2

SEQUENCE 09

Command: python test_pose.py checkpoints/sfmlearner_h128w416,epoch_size3000,m0.2/05-01-22:09/exp_pose_model_best.pth.tar --dataset-dir ../../dataset/kitti --sequence 09

Results ATE, RE

mean 0.0120, 0.0021

std 0.0069, 0.0010

SEQUENCE 10

Command: python test_pose.py checkpoints/sfmlearner_h128w416,epoch_size3000,m0.2/05-01-22:09/exp_pose_model_best.pth.tar --dataset-dir ../../dataset/kitti --sequence 10

Results ATE, RE

mean 0.0092, 0.0021

std 0.0074, 0.0013

MODEL FROM PART 3

SEQUENCE 09

Command: python test_pose.py checkpoints/sfmlearner_h128w416,epoch_size3000,m0.2/05-01-23:50/exp_pose_model_best.pth.tar --dataset-dir ../../dataset/kitti --sequences 09

Results ATE, RE

mean 0.0127, 0.0027

std 0.0080, 0.0017

SEQUENCE 10

Command: python test_pose.py checkpoints/sfmlearner_h128w416,epoch_size3000,m0.2/05-01-23:50/exp_pose_model_best.pth.tar --dataset-dir .. /dataset/kitti --sequences 10

Results ATE, RE

mean 0.0119, 0.0029

std 0.0081, 0.0023

1.6.1 Notes:

- scp data to local machines:

```
scp -r <USERNAME>@dsmlp-login.ucsd.edu:/datasets/cse152-252-sp20-public/sfmlearner_h128w416.zip
```

```
scp -r <USERNAME>@dsmlp-login.ucsd.edu:/datasets/cse152-252-sp20-public/kitti.zip  
... - tensorboard: open jupyter notebook from the link after launch-scipy-ml-gpu.sh. Click new Tensorboard ..
```

answer here

2 References

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4. David G Lowe. Distinctive image features from scale-invariant keypoints. IJCV, 60(2):91–110, 2004.
5. Anurag Ranjan and Michael J Black. Optical flow estimation using a spatial pyramid network. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, pages 4161–4170, 2017.
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7. Lucas, Bruce D., and Takeo Kanade. “An iterative image registration technique with an application to stereo vision.” (1981): 674.
8. B. Kitt, A. Geiger, and H. Lategahn, “Visual odometry based on stereo image sequences with RANSAC-based outlier rejection scheme,” in 2010 IEEE Intelligent Vehicles Symposium, La Jolla, CA, USA, Jun. 2010, pp. 486–492, doi: 10.1109/IVS.2010.5548123.
9. A. Geiger, J. Ziegler, and C. Stiller, “StereoScan: Dense 3d reconstruction in real-time,” in 2011 IEEE Intelligent Vehicles Symposium (IV), Baden-Baden, Germany, Jun. 2011, pp. 963–968, doi: 10.1109/IVS.2011.5940405.