Hanwen_Zhang_a5_p1

December 8, 2022

[311]:
```
import pandas as pd
import numpy as np
from scipy.linalg import fractional_matrix_power
import matplotlib.pyplot as plt
import math
from PIL import Image
```

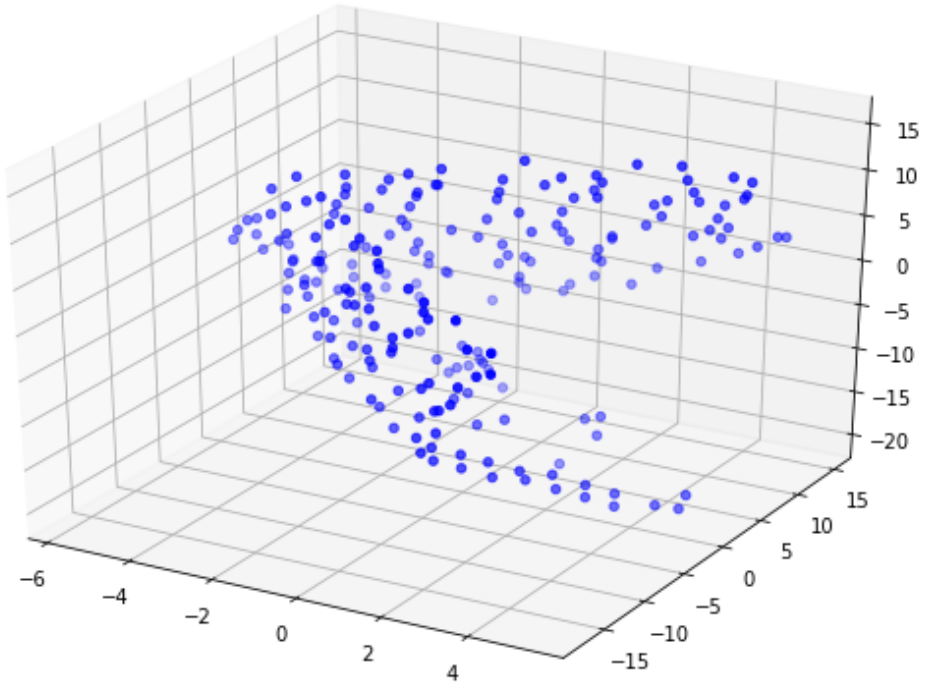
[312]:
```
path = 'measurement_matrix.txt'
data = np.loadtxt(path, dtype=float)
m, n = data.shape
norm_data = np.zeros((m, n))
```

[313]:
```
from numpy.core.fromnumeric import mean
for i in range(0, m):
  norm_data[i, :] = data[i, :] - np.mean(data[i, :])
```

[314]:
```
U, S, V =np.linalg.svd(norm_data)
U3 = U[:, 0:3]

S_temp = np.zeros((m, n))
for i in range(m) :
    for j in range(n) :
        if i == j : S_temp[i,j] = S[j]

W3 = S_temp[0:3, 0:3]
V3 = V[0:3, :]
M = np.dot(U3, fractional_matrix_power(W3, 0.5))
S = np.dot(fractional_matrix_power(W3, 0.5), V3)
```

[315]:
```
# Creating figure
fig = plt.figure(figsize = (10, 7))
ax = plt.axes(projection ="3d")

# Creating plot
ax.scatter3D(S[2, :], S[1, :], S[0, :], color = "blue")

# show plot
```

```
plt.show()
```



[316]:
```
estimated_D = np.dot(M, S)
per_frame_residual = np.zeros((int(m/2), 1))
```

[317]:
```
def sumsqr(test_list):
  return sum(map(lambda i : i * i, test_list))
```

[318]:
```
estimated_D.shape
```

[318]: (202, 215)

[319]:
```
estimated_D[50:51, 1]
```

[319]: array([-118.40707933])

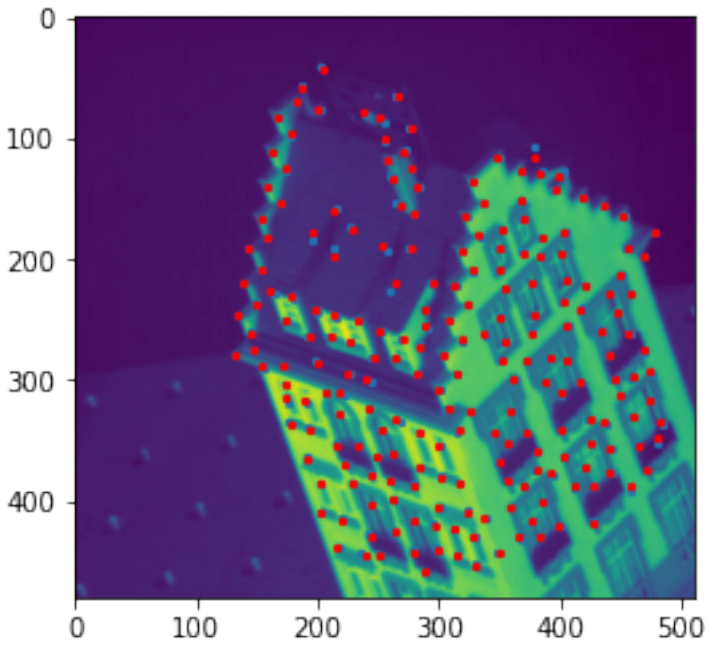
[320]:
```
for i in range(1, int(m/2) + 1):
  for j in range(0, n):
    temp = (estimated_D[2*i-2:2*i, j-1] - norm_data[2*i-2:2*i, j-1]).tolist()
    a = sumsqr(temp)
    b = math.sqrt(a)
```

```
    per_frame_residual[i-1, 0] = per_frame_residual[i-1, 0] + b
```

[321]:
```
selected_frame = [1,50,100]
```

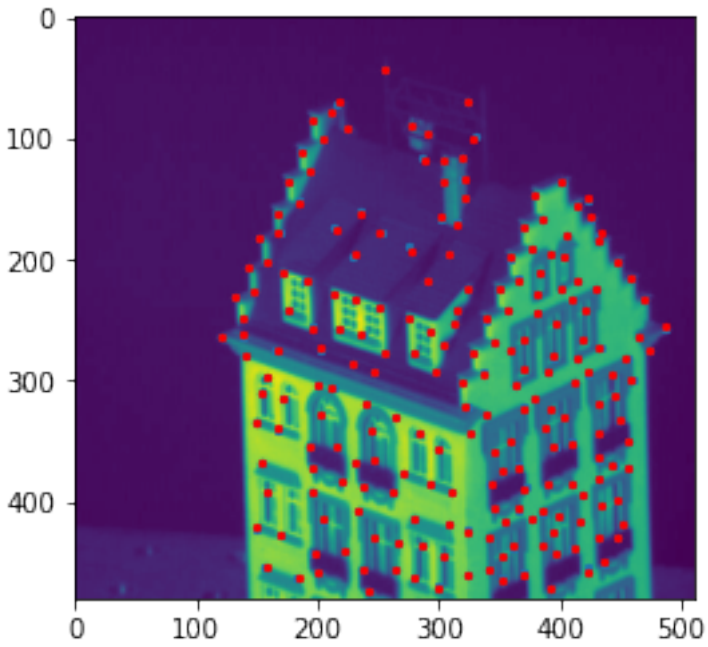
[322]:
```
index = selected_frame[0]
image_name = 'frame00000' + '{0:03}'.format(index) + '.jpg'
im = plt.imread(image_name)
implot = plt.imshow(im)
plt.scatter(data[2*index-2, :], data[2*index-1, :], s = 5)
plt.scatter(x=(estimated_D[2*index-2, :] + mean(data[2*index-2, :])),␣
 ↪y=estimated_D[2*index-1, :] + mean(data[2*index-1,:]), c='r', s = 5)
```

[322]: <matplotlib.collections.PathCollection at 0x7f8906220580>



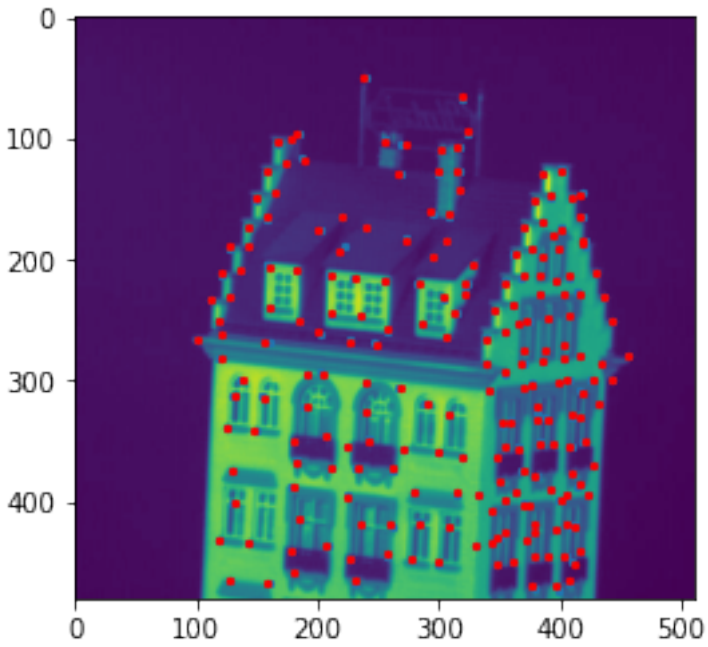
[323]:
```
index = selected_frame[1]
image_name = 'frame00000' + '{0:03}'.format(index) + '.jpg'
im = plt.imread(image_name)
implot = plt.imshow(im)
plt.scatter(data[2*index-2, :], data[2*index-1, :], s = 5)
plt.scatter(x=(estimated_D[2*index-2, :] + mean(data[2*index-2, :])),␣
 ↪y=estimated_D[2*index-1, :] + mean(data[2*index-1,:]), c='r', s = 5)
```

[323]: <matplotlib.collections.PathCollection at 0x7f8905f87be0>



[324]:
```
index = selected_frame[2]
image_name = 'frame00000' + '{0:03}'.format(index) + '.jpg'
im = plt.imread(image_name)
implot = plt.imshow(im)
plt.scatter(data[2*index-2, :], data[2*index-1, :], s = 5)
plt.scatter(x=(estimated_D[2*index-2, :] + mean(data[2*index-2, :])),␣
 ↪y=estimated_D[2*index-1, :] + mean(data[2*index-1,:]), c='r', s = 5)
```

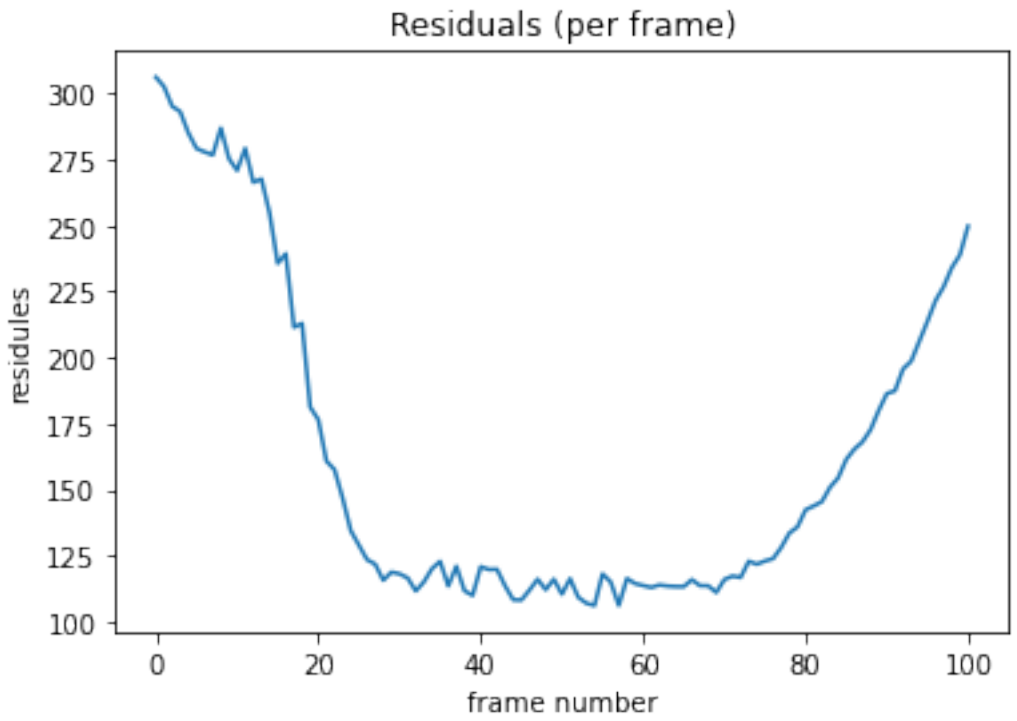
[324]:
```
<matplotlib.collections.PathCollection at 0x7f8906249640>
```



[325]:
```
print('Total residual: {}'.format(sum(per_frame_residual)))
```

```
Total residual: [16428.33206303]
```

[326]:
```
x = per_frame_residual.shape[0]
x_axis = [i for i in range(x)]
y_axis = per_frame_residual.tolist()
plt.plot(x_axis, y_axis)
plt.title('Residuals (per frame)')
plt.xlabel('frame number')
plt.ylabel('residules')
plt.show()
```



[327]:
```
y_axis = per_frame_residual.tolist()
type(y_axis)
```

[327]:
```
list
```