f-27-jupyter-pca

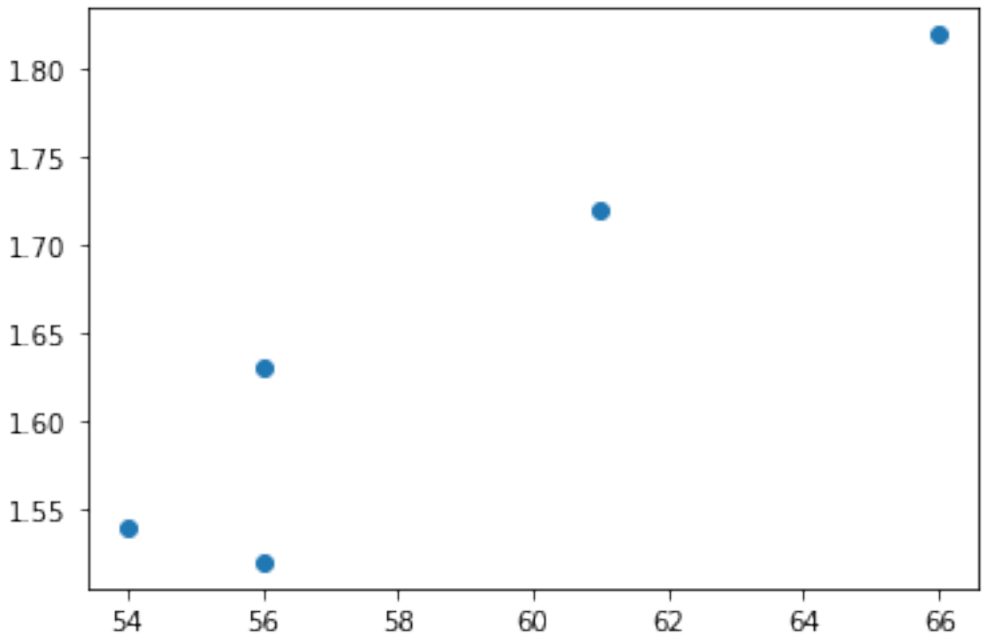
May 11, 2021

[1]:
```
import matplotlib.pyplot as plt
import numpy as np
```

[2]:
```
v = np.array([[  54,   56,   56,   61,   66],
              [1.54, 1.52, 1.63, 1.72, 1.82]])
```

[3]:
```
fig, ax = plt.subplots()
ax.plot(*v, 'o')
```

[3]:
```
[<matplotlib.lines.Line2D at 0x116fd3400>]
```



[4]:
```
v[0]
```

[4]:
```
array([54., 56., 56., 61., 66.])
```

[5]:
```
v[0].mean()
```

[5]: 58.6

[6]:
```
np.mean(v[0])
```

[6]: 58.6

[7]:
```
np.mean(v, axis=1)
```

[7]: array([58.6 , 1.646])

[8]:
```
v_bar = np.mean(v, axis=1, keepdims=True)
v_bar
```

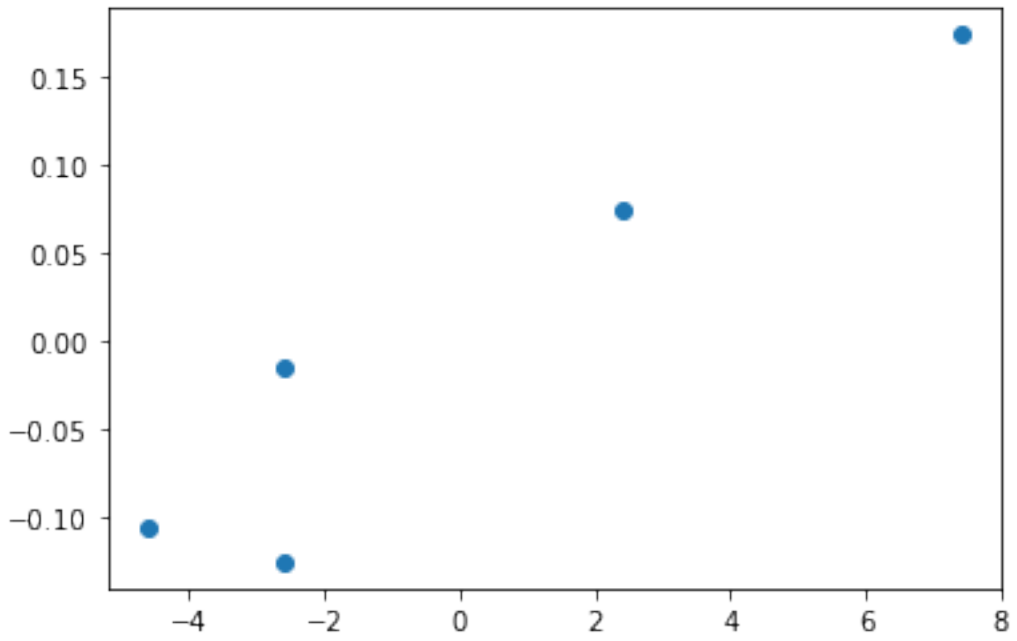
[8]:
```
array([[58.6  ],
       [ 1.646]])
```

[9]:
```
w = v - v_bar
w
```

[9]:
```
array([[-4.6  , -2.6  , -2.6  ,  2.4  ,  7.4  ],
       [-0.106, -0.126, -0.016,  0.074,  0.174]])
```

[10]:
```
fig, ax = plt.subplots()
ax.plot(*w, 'o')
```

[10]: [<matplotlib.lines.Line2D at 0x1170e7070>]



[11]:
```
m, n = v.shape
```

[12]:
```
c = (1 / (n - 1)) * w @ w.T
c
```

[12]:
```
array([[2.380e+01, 5.805e-01],
       [5.805e-01, 1.578e-02]])
```

[13]:
```
u, s, vt = np.linalg.svd(w)
s
```

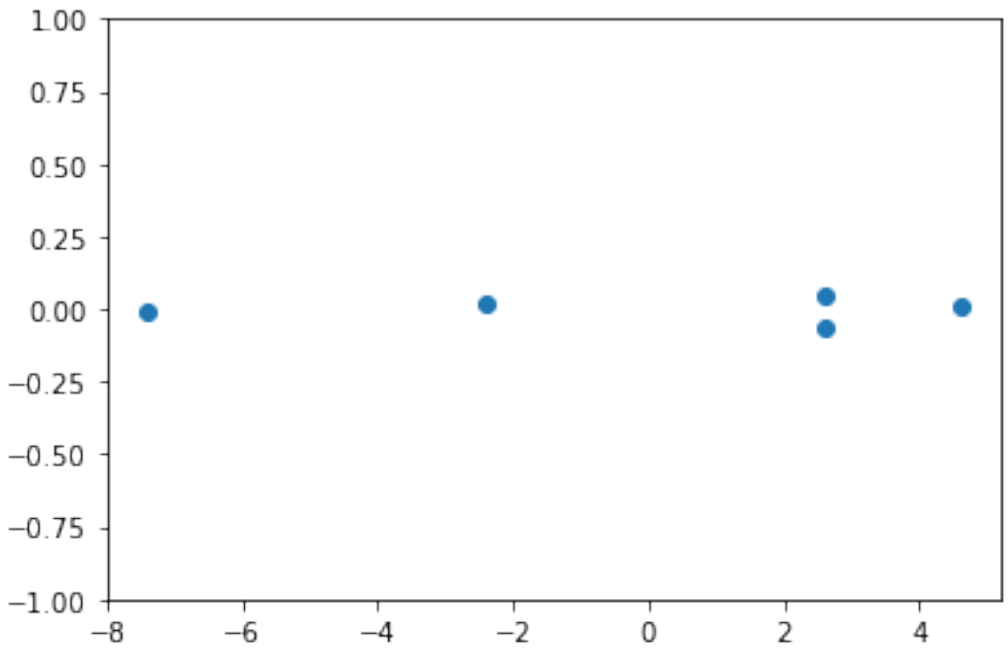
[13]:
```
array([9.75995078, 0.08050347])
```

[14]:
```
u.T @ w
```

[14]:
```
array([[ 4.60121696e+00,  2.60229939e+00,  2.59961702e+00,
        -2.40109083e+00, -7.40204254e+00],
       [ 6.20327227e-03, -6.25611074e-02,  4.74061828e-02,
         1.54536029e-02, -6.50195056e-03]])
```

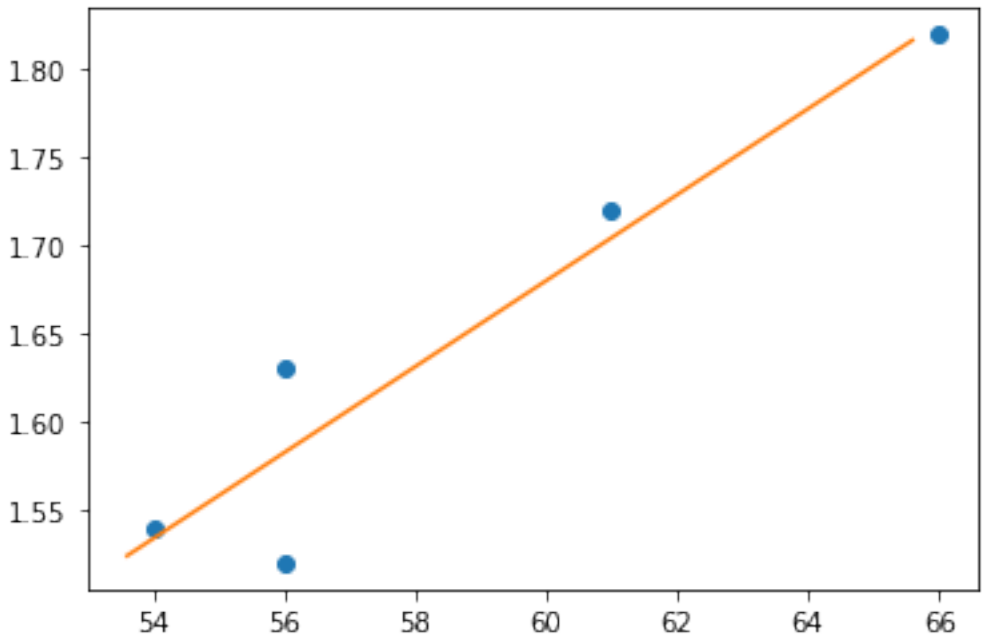
[15]:
```
fig, ax = plt.subplots()
ax.set_ylim(-1, 1)
ax.plot(*(u.T @ w), 'o')
```

[15]:
```
[<matplotlib.lines.Line2D at 0x1171552e0>]
```



[16]:
```
fig, ax = plt.subplots()
ax.plot(*v, 'o')
ax.plot(*(u[:, [0]]) * np.linspace(-7, 5, 2) + v_bar)
```

[16]:
```
[<matplotlib.lines.Line2D at 0x1171bea00>]
```



[17]:
```
(1 / (n - 1)) * (u.T @ w) @ (u.T @ w).T
```

[17]:
```
array([[2.38141598e+01, 2.16840434e-16],
       [2.16840434e-16, 1.62020203e-03]])
```

[18]:
```
skalæring = np.sqrt(np.diag(c))[:, np.newaxis]
```

[19]:
```
w_ny = w / skalæring
w_ny
```

[19]:
```
array([[-0.94290807, -0.53294804, -0.53294804,  0.49195204,  1.51685211],
       [-0.84382496, -1.00303721, -0.1273698 ,  0.58908535,  1.38514663]])
```

[20]:
```
c_ny = (1 / (n - 1)) * w_ny @ w_ny.T
c_ny
```

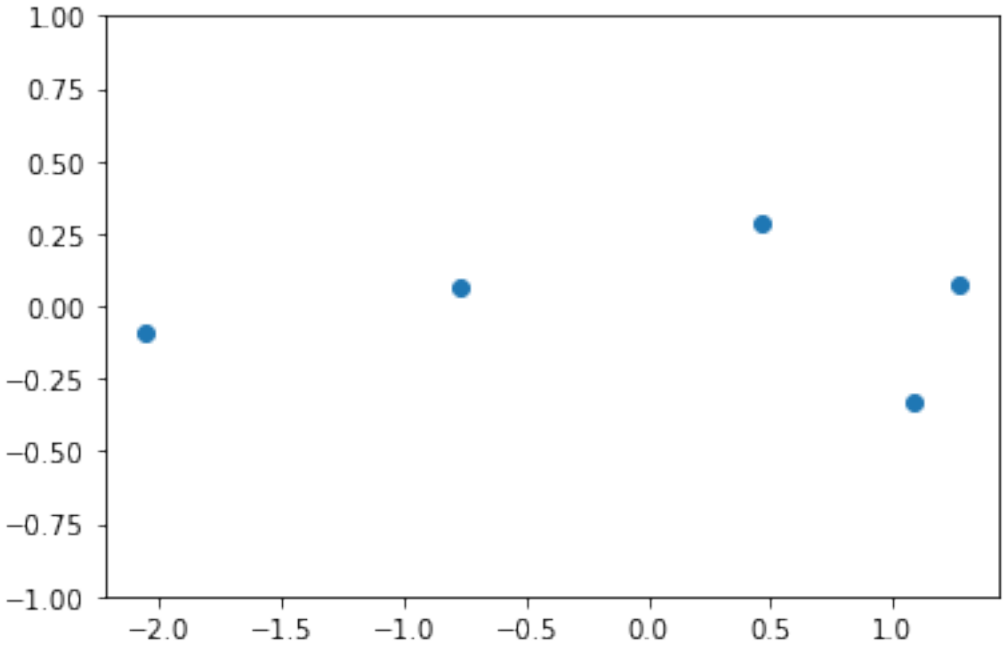
[20]:
```
array([[1.        , 0.94724047],
       [0.94724047, 1.        ]])
```

[21]:
```
u_ny, s_ny, _ = np.linalg.svd(w_ny)
s_ny
```

[21]:
```
array([2.79087117, 0.45938884])
```

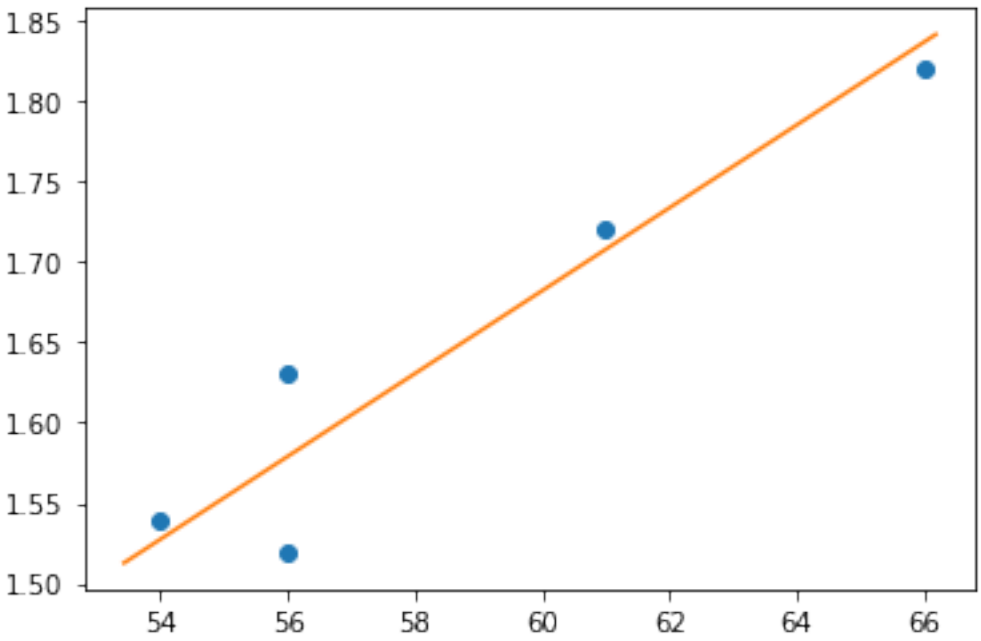
[22]:
```
fig, ax = plt.subplots()
ax.set_ylim(-1, 1)
ax.plot(*(u_ny.T @ w_ny), 'o')
```

[22]:
```
[<matplotlib.lines.Line2D at 0x11722f250>]
```



[23]:
```
fig, ax = plt.subplots()
ax.plot(*v, 'o')
ax.plot(*((u_ny * skalæring)[:, [0]] * np.linspace(-2.2, 1.5, 2) + v_bar))
```

[23]:
```
[<matplotlib.lines.Line2D at 0x11729b670>]
```


1.85
1.80
1.75
1.70
1.65
1.60
1.55
1.50
54
56
58
60
62
64
66

[ ]: