PCA

- step1. normalization
- step2. covariance matrix
- step3. eigen stuff (eigen vector, eigen - value)
- step4. principa component
- step5. reconstructing the original data

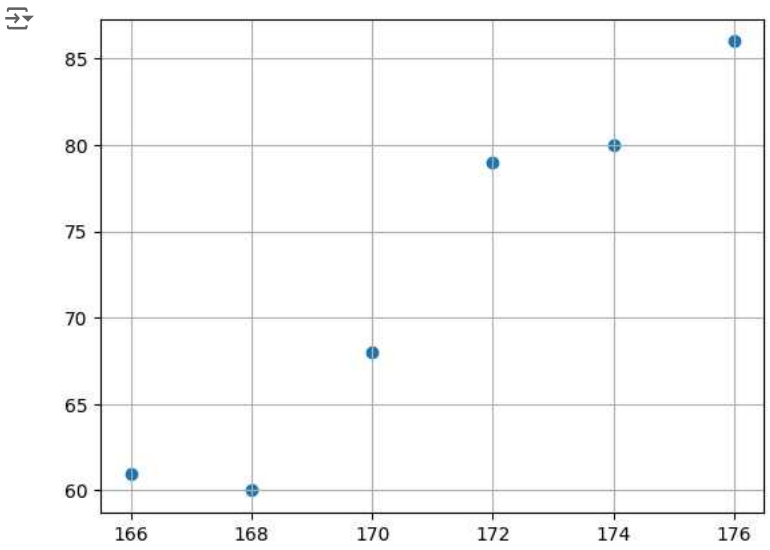
check eigen value and vector

```
1 코딩을 시작하거나 AI로 코드를 생성하세요.
```

Data Set

```
x = np.array([170, 174, 172, 176, 168, 166])
y = np.array([68, 80, 79, 86, 60, 61])
```

```
1 import numpy as np
2 import matplotlib.pyplot as plt
3
4 x = np.array([170, 174, 172, 176, 168, 166])
5 y = np.array([68, 80, 79, 86, 60, 61])
6
7 plt.scatter(x, y)
8 plt.grid(True)
9 plt.show()
```




```
1 data = np.column_stack((x, y))
2 print(data)
3 np.mean(data)
4 np.mean(data, axis=0)
```

```
[[170  68]
 [174  80]
 [172  79]
 [176  86]
 [168  60]
 [166  61]]
array([171.        ,  72.33333333])
```

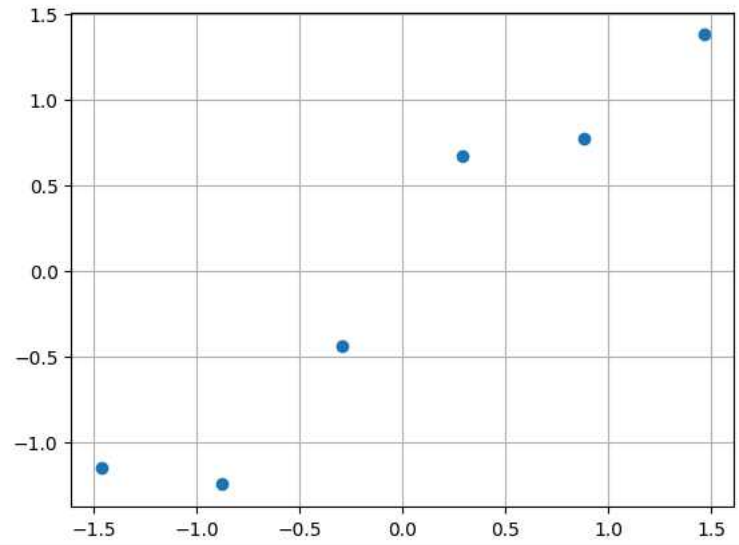
step1. Normalization

```
1 # Z-score
2 # Standardization
3 mean_data = np.mean(data, axis=0);
4 stddev_data = np.std(data, axis=0)
```

```
centered_data = (data - mean_data) / stddev_data
centered_data
```

```
array([[-0.29277002, -0.43723732],
       [ 0.87831007,  0.77357371],
       [ 0.29277002,  0.67267279],
       [ 1.46385011,  1.37897923],
       [-0.87831007, -1.24444467],
       [-1.46385011, -1.14354375]])
```

```
plt.scatter(centered_data[:, 0], centered_data[:, 1])
plt.grid(True)
plt.show()
```



step2. Covariance Matrix

```
cov_matrix = np.cov(centered_data, rowvar=False)
cov_matrix
```

```
array([[1.2       , 1.15799796],
       [1.15799796, 1.2       ]])
```

step 3. Eigen Value & Eigen Vector

```
eig_values, eig_vectors = np.linalg.eig(cov_matrix)
print(eig_values)
print(eig_vectors)
```

```
[2.35799796 0.04200204]
[[ 0.70710678 -0.70710678]
 [ 0.70710678  0.70710678]]
```

step 4. Pincipal Component

```
principal_component = eig_vectors[:, np.argmax(eig_values)]
print(principal_component)

print(centered_data)
#                  (6X2)행렬 * (2X1)행렬  = (6X1)행렬
projected_data = centered_data @ principal_component
print(projected_data)
```

```
[0.70710678 0.70710678]
[[-0.29277002 -0.43723732]
 [ 0.87831007  0.77357371]
 [ 0.29277002  0.67267279]
 [ 1.46385011  1.37897923]
 [-0.87831007 -1.24444467]
 [-1.46385011 -1.14354375]]
[-0.51619314  1.16805822  0.68267116  2.0101839  -1.50101427 -1.84370588]
```

step 5. reconstructing the original data

```
plt.scatter(x, y, label='original data')

pca_data_x = mean_data[0] + projected_data * principal_component[0] * stddev_data[0]
pca_data_y = mean_data[1] + projected_data * principal_component[1] * stddev_data[1]
plt.scatter(pca_data_x, pca_data_y, label='projected data using PCA')
plt.plot(pca_data_x, pca_data_y, 'r-')

plt.grid(True)
plt.legend()
plt.show()

```