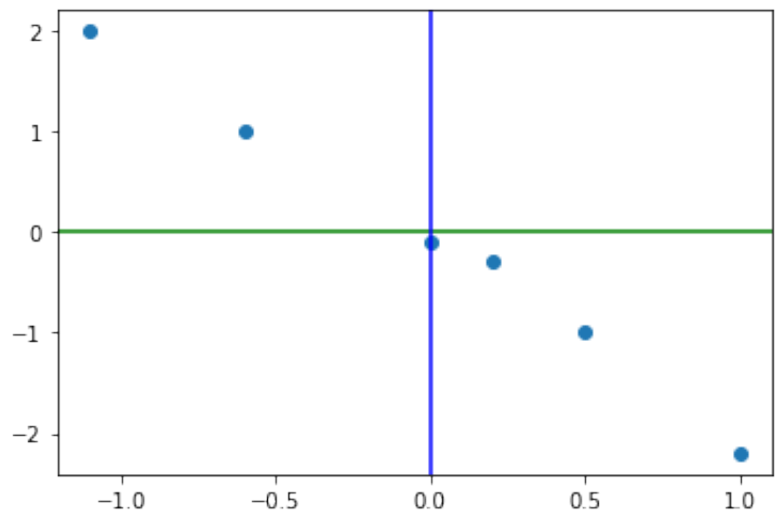
```
import numpy as np
import matplotlib.pyplot as plt


X = np.array(
    [
     [0.2, -1.1, 1, 0.5, -0.6, 0],
     [-0.3, 2, -2.2, -1, 1, -0.1]
    ]
)

plt.scatter(X[0], X[1])
plt.axhline(0, color="green")
plt.axvline(0, color="blue")
```

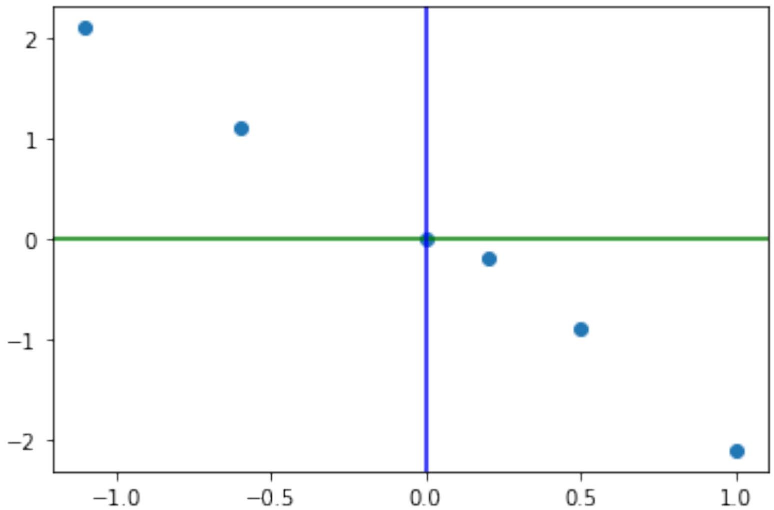
```
<matplotlib.lines.Line2D at 0x7fe7bc5c5668>
```



```
# Mean for the first feature is 0, so nothing needs to be done.
# Then the mean for the second feature is given as -0.1.
for i in range(6):
  X[1,i] += 0.1

plt.scatter(X[0], X[1])
plt.axhline(0, color="green")
plt.axvline(0, color="blue")
```

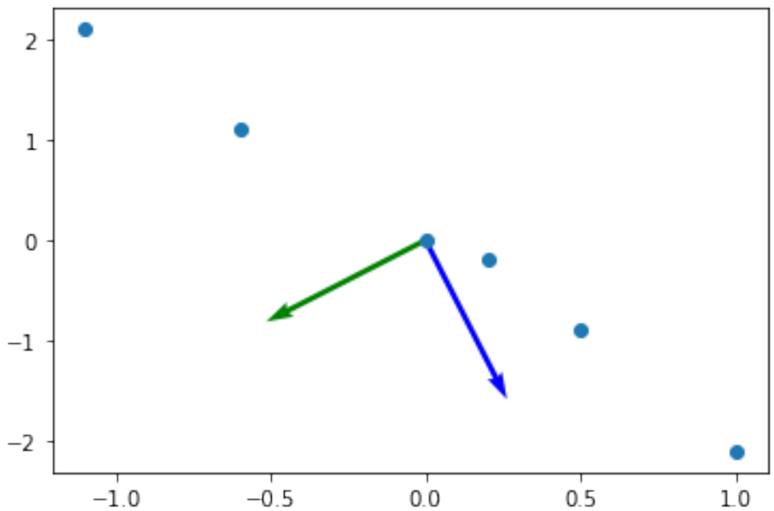
```
<matplotlib.lines.Line2D at 0x7fe7bc45c588>
```



```
# Create covariance matrix
covariance = np.cov(X)

# Get eigenvectors and eigenvalues
evals, temp = np.linalg.eig(covariance)
evects = temp.T

origin=[0,0]
plt.quiver(*origin, *evects[0], color=['g'], scale=4)
plt.quiver(*origin, *evects[1], color=['b'], scale=4)
plt.scatter(X[0], X[1])
plt.show()
```

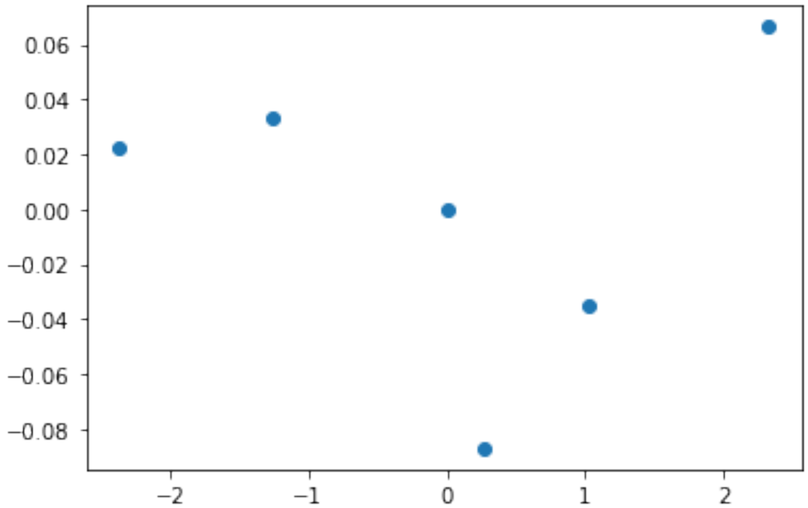



```
p = 2
sorted_stuff = sorted(list(zip(evals, evects)), reverse=True)
A = [x[1] for x in sorted_stuff[:p]]
A = np.array(A)
A
```

```
array([[ 0.45554483, -0.89021285],
       [-0.89021285, -0.45554483]])
```

```
B = X
T = np.matmul(A,B)
plt.scatter(T[0], T[1])
```

```
<matplotlib.collections.PathCollection at 0x7fe7bc06ceb8>
```



```
normalized_eig = [x/evals.sum() for x in evals]
normalized_eig.sort(reverse=True)
normalized_eig
```

```
[0.9989224971091342, 0.0010775028908658404]
```

As shown by the proportion of covariance, almost all of our information is coming from the first feature (99.89%). It was obvious from the above plot that one of the features was contributing almost nothing.

Let's repeat the above graph without that feature, making p = 1.

```
p2 = 1
sorted_stuff2 = sorted(list(zip(evals, evects)), reverse=True)
A2 = [x[1] for x in sorted_stuff2[:p2]]
A2 = np.array(A2)
A2
```

```
array([[ 0.45554483, -0.89021285]])
```

```
T2 = np.matmul(A2,B)
plt.scatter(T2[0], np.zeros_like(T2))
```

```
<matplotlib.collections.PathCollection at 0x7fe7bbfa3d30>
```