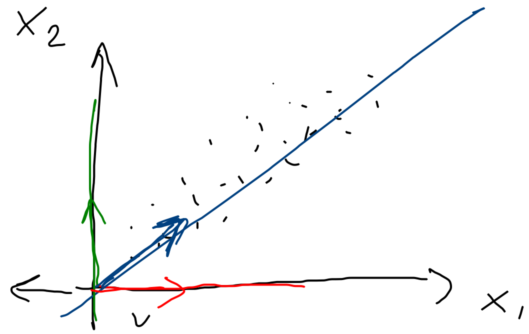
$$\frac{1}{m}(X-\mu)^T(X-\mu) = \Sigma \quad \text{(matrice di covarianza)}$$

baricentro

Se $\mu = 0$

$$\Rightarrow \quad \Sigma = \frac{1}{m} X^T X$$



$$\Sigma = \begin{pmatrix} 1 & 0.85 \\ 0.85 & 1 \end{pmatrix}$$

$$v = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

Varianza lungo v :

1 ×

$$v^T \Sigma v = \begin{pmatrix} 1 \\ 0 \end{pmatrix}^T \begin{pmatrix} 1 & 0.85 \\ 0.85 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

0 ×

$$= \begin{pmatrix} 1 \\ 0 \end{pmatrix}^T \begin{pmatrix} 1 \\ 0.85 \end{pmatrix} = 1.$$

$$v = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

Varianza lungo $v = v^T \Sigma v = 1$

$$v^T \Sigma v = \frac{1}{\sqrt{2}} \cdot \frac{1}{\sqrt{2}} \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix}^T \begin{pmatrix} 1 & 0.85 \\ 0.85 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$\left\| \begin{pmatrix} 1 \\ 1 \end{pmatrix} \right\| = \sqrt{1^2 + 1^2} = 2$$

$$v = \begin{pmatrix} 1/\sqrt{2} \\ 1/\sqrt{2} \end{pmatrix} = 1/\sqrt{2} \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$= \frac{1}{2} \begin{pmatrix} 1 \\ 1 \end{pmatrix}^T \begin{pmatrix} 1.85 \\ 1.85 \end{pmatrix} = \frac{2}{2} \, 1.85$$

$$= \underline{1.85} > 1$$