

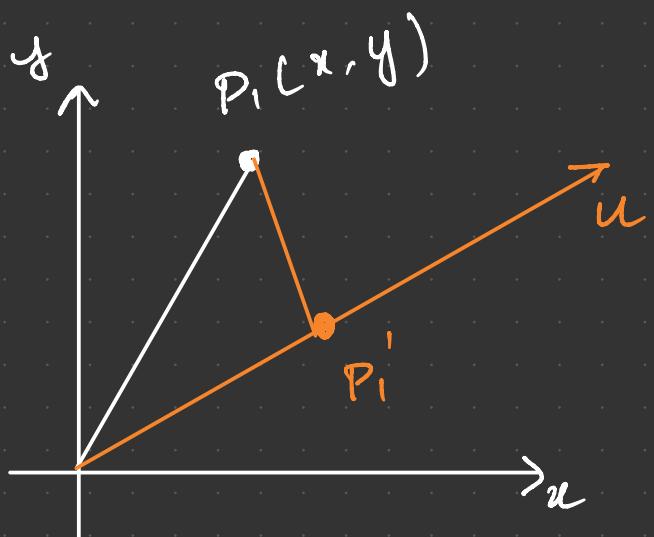
Math Intuition behind PCA Algorithm



2D \rightarrow 1 D

① Projection

② cost function \rightarrow
variance.



$$\text{Projection}_{P_i} u = \frac{P_i \cdot u}{\|u\|}$$

$\|u\| = 1 \rightarrow$ for centit
vector,

therefore,

$$\text{Projection}_{P_i} u = P_i \cdot u$$

$\|u\|$

Scalar value.

\Downarrow

Variance

Projection, $u = P_1 \cdot u$

↓↓

Scalar value of each projection

$P_0^{'}, P_1^{'}, P_2^{'}, P_3^{'}, \dots, P_n^{'}$

↓

$x_0^{'}, x_1^{'}, x_2^{'}, x_3^{'}, x_4^{'}, \dots, x_n^{'}$

$$\text{variance} = \frac{\sum_{i=1}^n (x_i^{'} - \bar{x})^2}{n} \Rightarrow \text{cost function}$$

↓↓

Goal is to find best unit vector which captures maximum variance.

Eigen Vectors and Eigen Values

- ① Identify covariance between features.
- ② Eigen vectors and Eigen values will be found out from this covariance matrix
- ③ Eigen vector where the Eigen value is high

→ Eigen values are the magnitude of the Eigen vector

→ this will capture the maximum variance

Eigen Vectors and Eigen values can be found by

$$A\mathbf{v} = \lambda \mathbf{v}$$

→ Linear transformation of matrix