Session: 39 ML

20 October 2024 05:43 PM

Principal Component analysis (PCA)

(Dimensionality Reduction)

① Curse of Dimensionality

3 features	f -> 6	f - 10	f - 100
M_1	M_2	M_3	M_3 -> model is over fitted
Acc 1 <	Acc 2	< Acc 3	Acc ↓↓

-> Two different ways to remove curse of dimensionality

① Feature Section

↓

In feature

② Dimensionality Reduction (PCA)

{ 500 f ↓ 20 f }

↓

Feature Extraction

↓

Principal Component Analysis

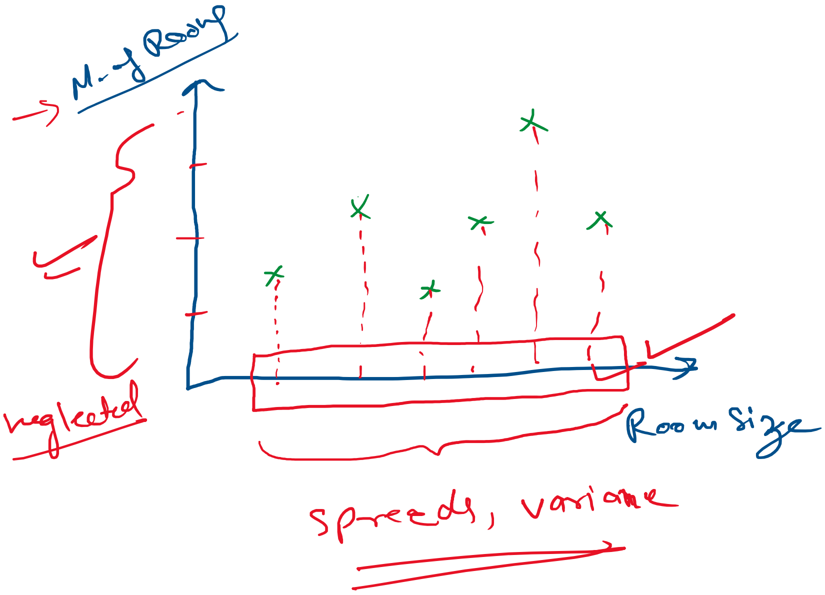
↓

Eigen value & vectors.

x_1 x_2 → O/P

size of room | No. of rooms | Price

Aim → 2d → 1d



① Feature selection

2D ⇒ 1D

② PCA

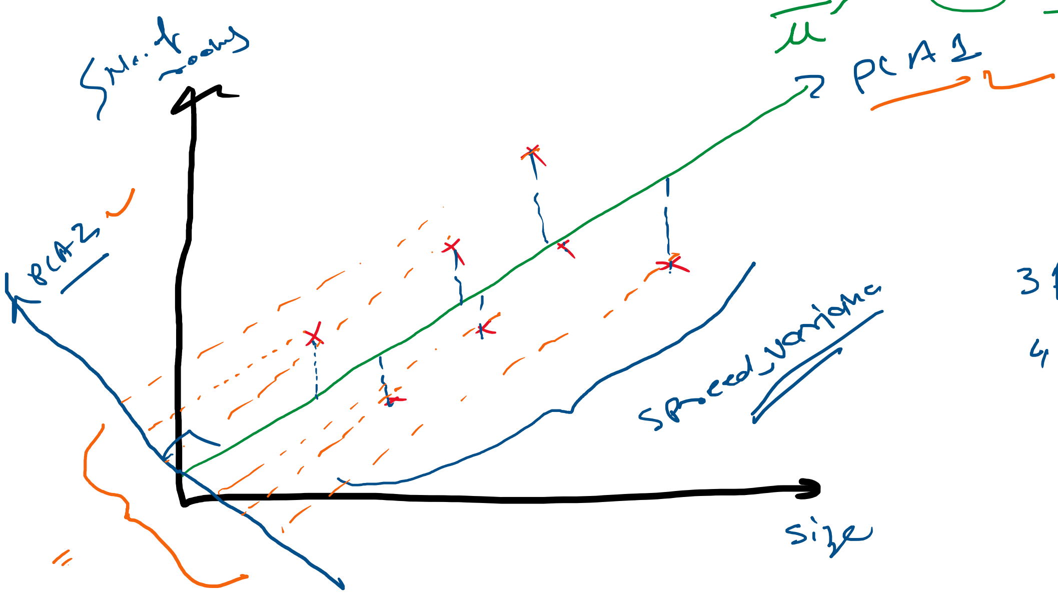
2D - 1D

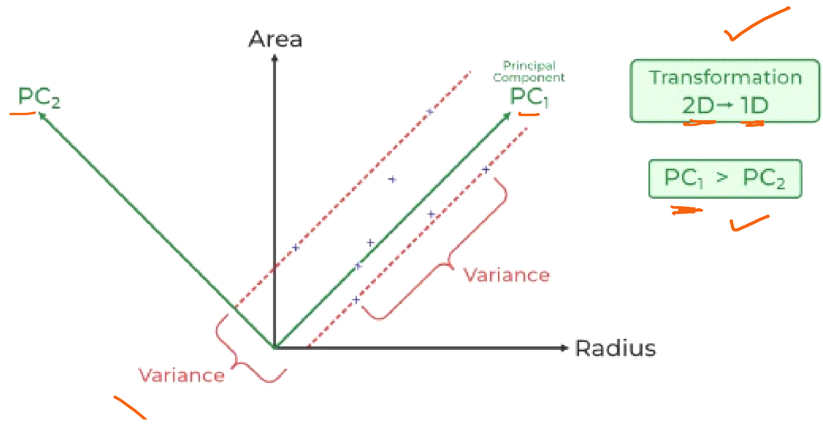
2D

→ 2 vectors (PCA)

3 feature → 3 PCA

4





Area | Ready

Principal Component Analysis

Step by - step

① Standardization

→ We need to standardize our dataset to ensure that each variable has a mean of 0 & a standard deviation of 1.

$$\boxed{Z = \frac{X - \mu}{\sigma}}$$

→ μ → is the mean of independent feature
$\mu = \{\mu_1, \mu_2 \ldots \mu_m\}$

→ σ is the standard deviation of independent feature $\sigma = \{\sigma_1, \sigma_2, \ldots \sigma_m\}$

② Covariance matrix Computation

→ Covariance measures the strength of joint variability

→ covariance measures the strength of joint
b/w two or more variables, indicating,
how much they change in relation to each
other.

$$Cov(x1, x1) = \frac{\sum_{i=1}^{n} (x1_i - x1)(x2_i - x2)}{n-1}$$

Step 3 Compute Eigenvalues & Eigenvectors

of covariance matrix to identify
Principle components

Let A be a square nXn matrix and X be a non-zero vector for which

$$AX = \lambda X$$

for some scalar values λ. then λ is known as the eigenvalue of matrix A and X is known as the eigenvector of matrix A for the corresponding eigenvalue.

It can also be written as :

$$AX - \lambda X = 0$$
$$(A - \lambda I)X = 0$$

where I am the identity matrix of the same shape as matrix A. And the above conditions will be true only if $(A–\lambda I)$ will be non-invertible (i.e. singular matrix). That means,

$$|A–\lambda I| = 0$$

From the above equation, we can find the eigenvalues \lambda, and therefore corresponding eigenvector can be found using the equation $AX = \lambda X$.

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