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1. Introduction

Wednesday, May 5, 2021 1:02 PM

feature extraction → CoD ↓

↳ PCA → fl ↓

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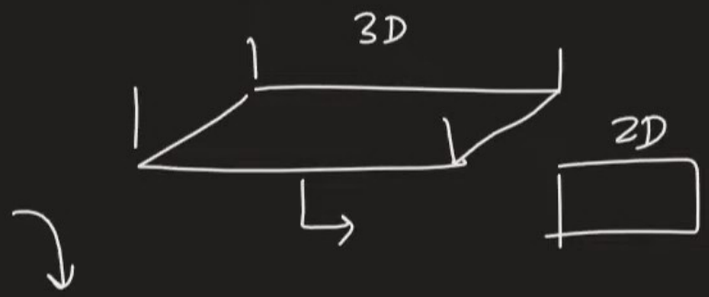

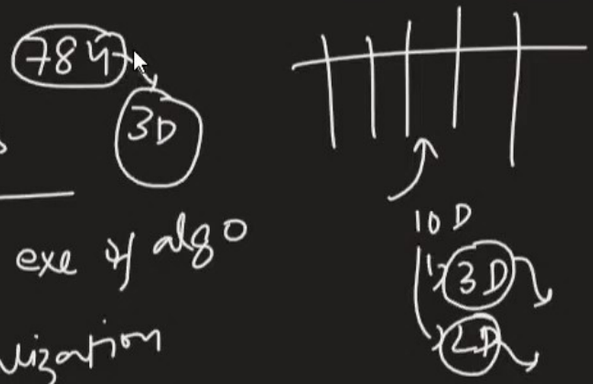

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2. Geometric Intuition

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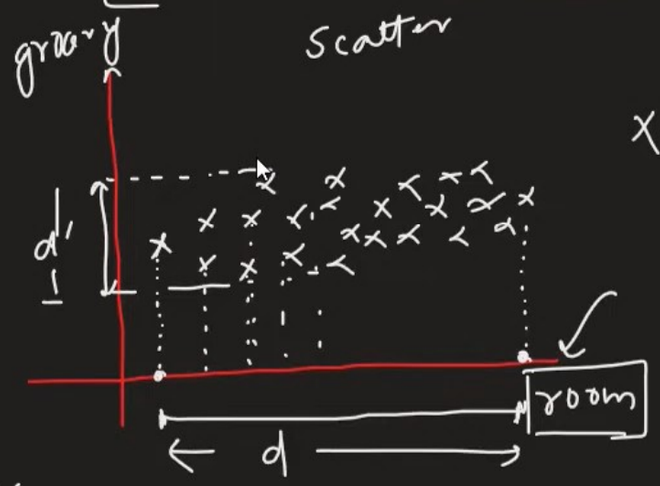
PCA

feature selection

No. of rooms	No. of grocery shops	price (L)
3	2	60
4	0	130
5	6	170
2	10	90



X → rooms

Variance

d > d'

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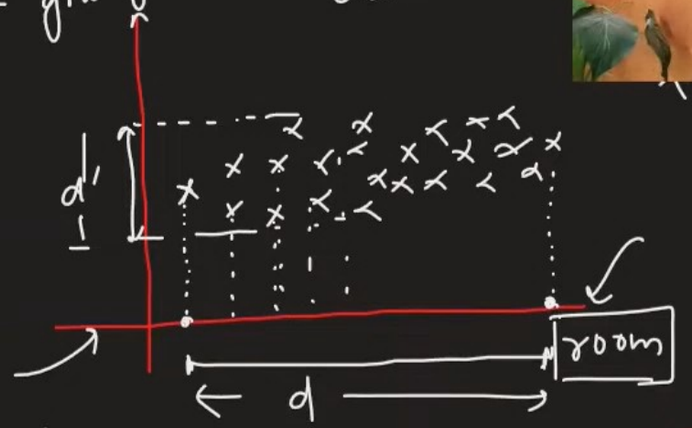
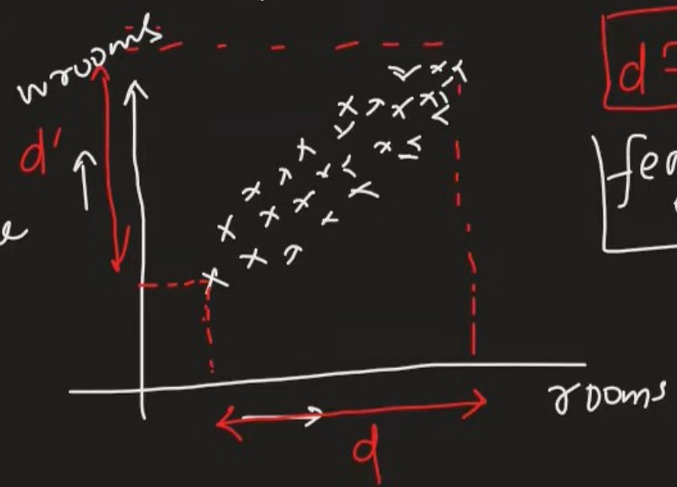
rooms	grocery shops	(L)
3	2	60
4	0	130
5	6	170
2	10	90

Scatter

Variance



$d > d'$



$d = d'$

feature extraction

No. of rooms	No. of Washrooms	Price

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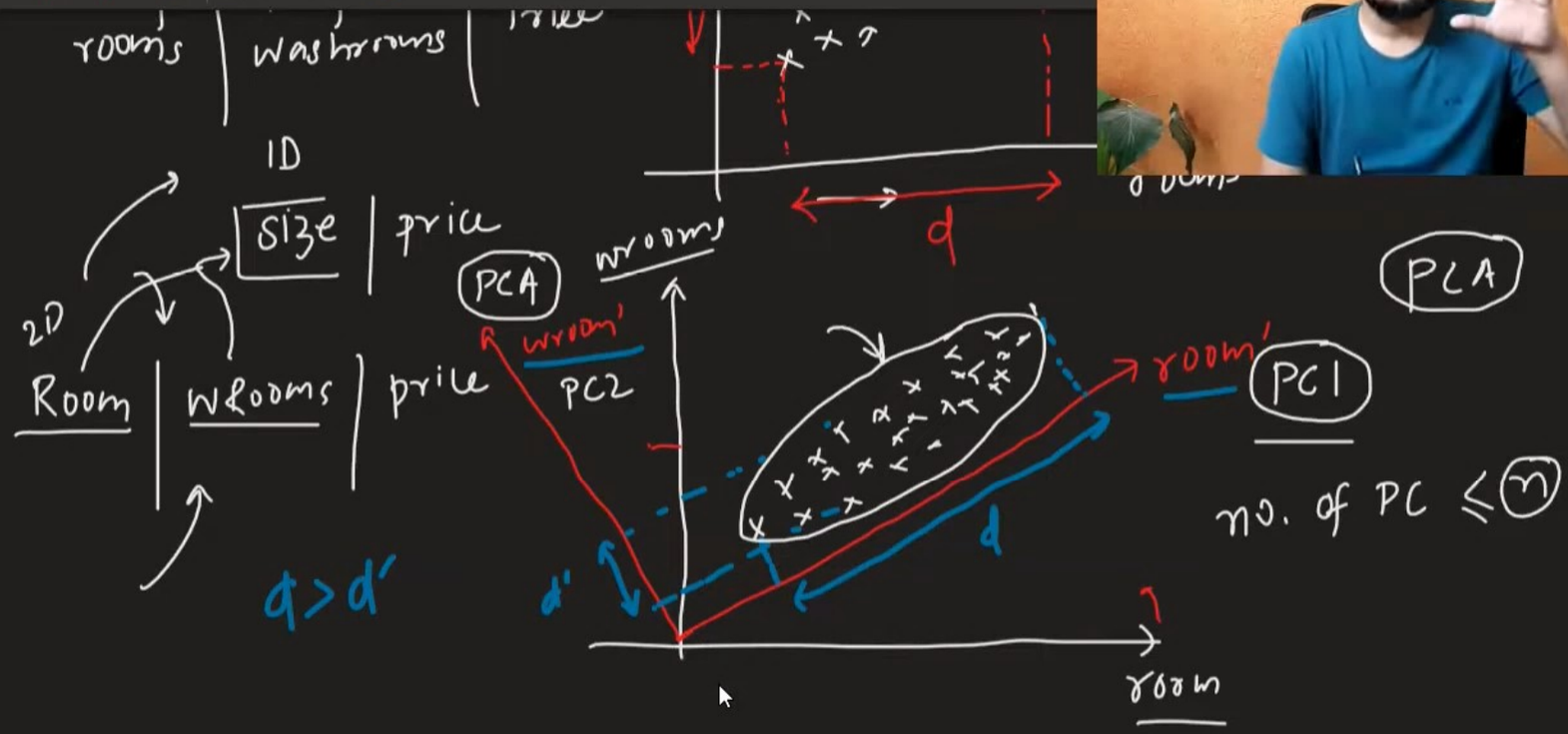

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3. Why Variance is Important?

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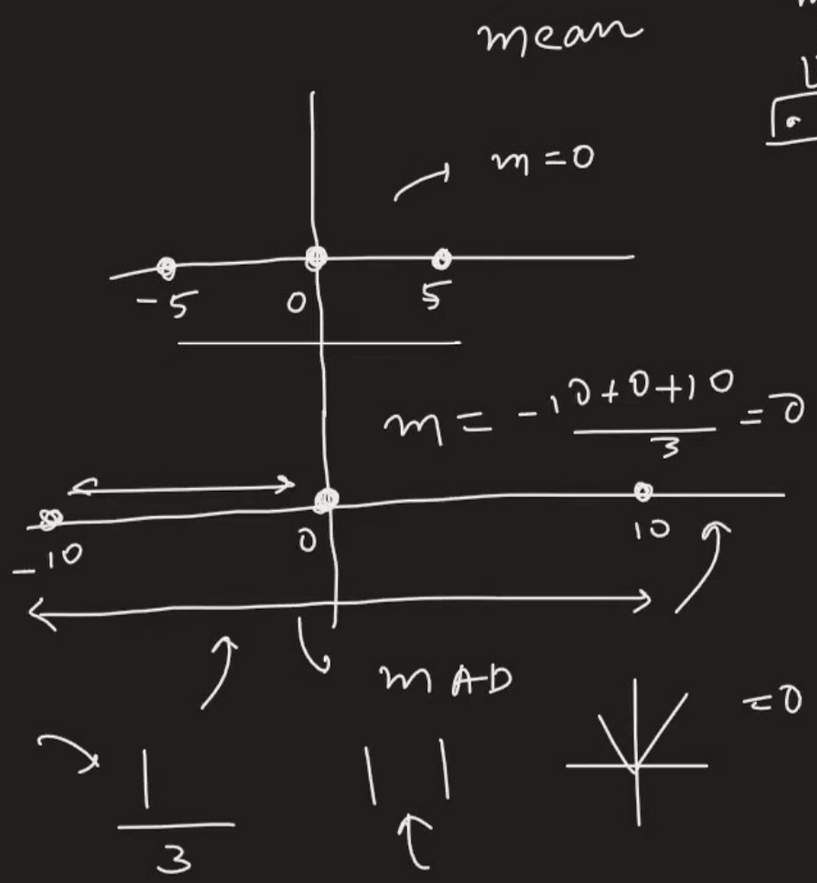

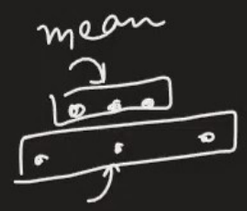

Variance

$$\sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n} =$$ variance

$$v = \frac{25+0+25}{3} = \frac{50}{3}$$

$$V = \frac{100+0+100}{3} = \sqrt{\frac{200}{3}} = sd$$

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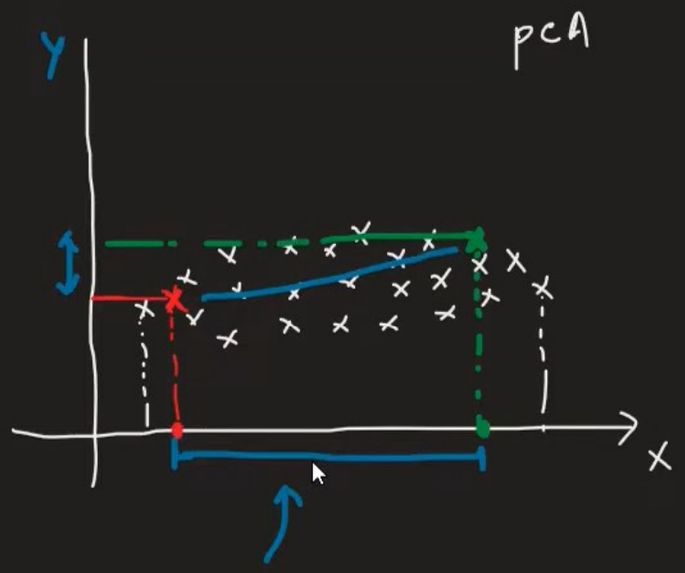

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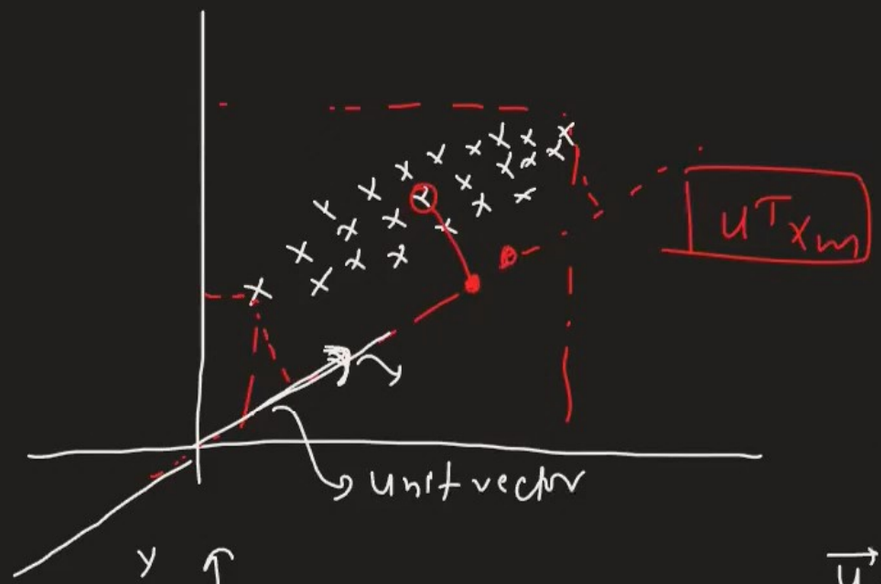

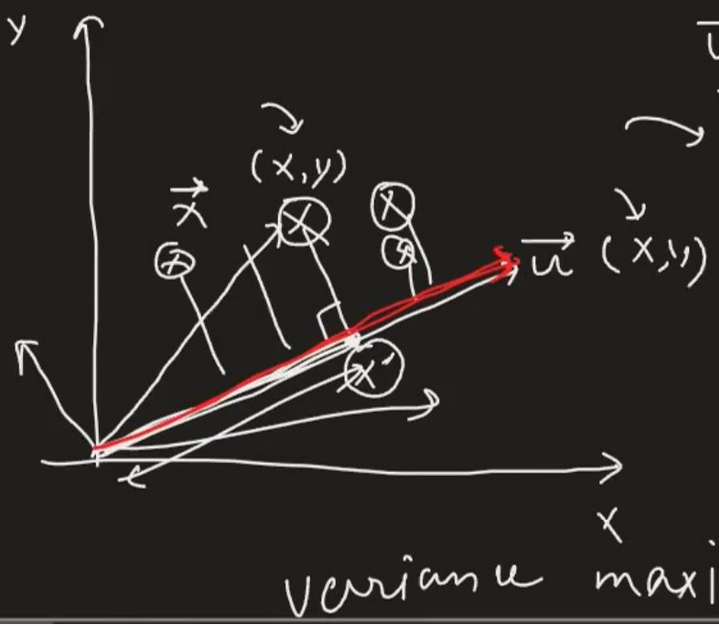

$$\frac{\vec{u}\cdot\vec{x}}{|u|=1} = \vec{u}\cdot\vec{x} = u^T x$$

$$[x\ y]\ [x\ y]$$

$$x \quad u$$

$$[x_1\ x_2]\ \begin{bmatrix} x_2 \\ y_2 \end{bmatrix}$$

$$= x_1 x_2 + y_1 y_2$$ — scal

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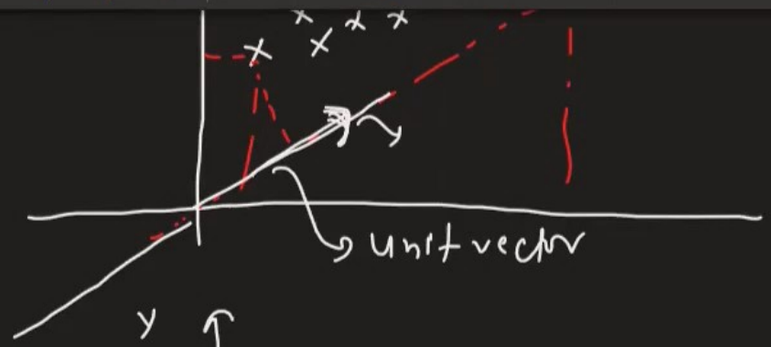

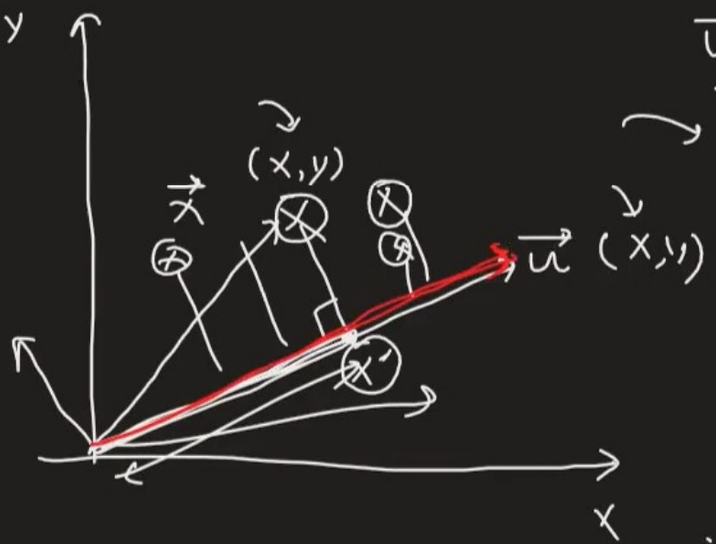

variance maxi

$$\frac{\vec{u}\cdot\vec{x}}{\|u\|=1} = \vec{u}\cdot\vec{x} = \boxed{u^T x}$$

$$[x\ y]\ [x\ y]$$

$$\boxed{= x_1 x_2 + y_1 y_2} \text{ — scalar}$$

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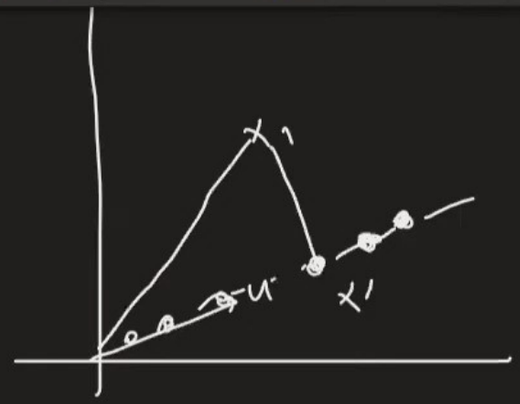

$$[u^T x_1]$$

$$\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$$

$$\frac{\sum_{i=1}^{n}(u^T x_i - u^T \bar{x})^2}{n} = \text{variance}$$

u

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Covariance and Covariance Matrix

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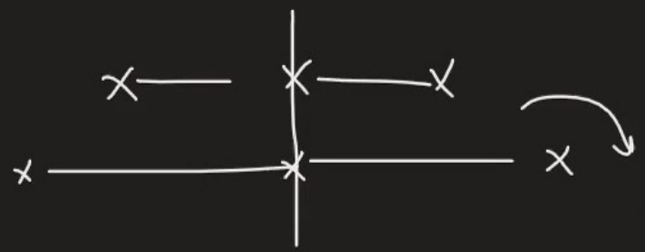
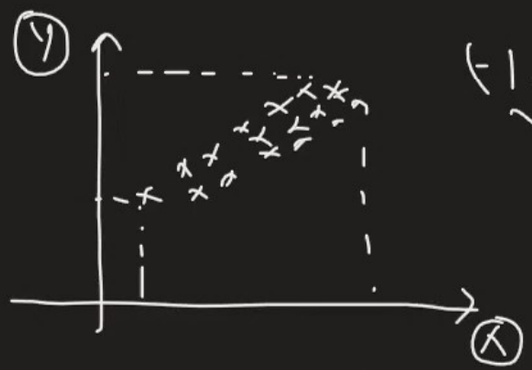
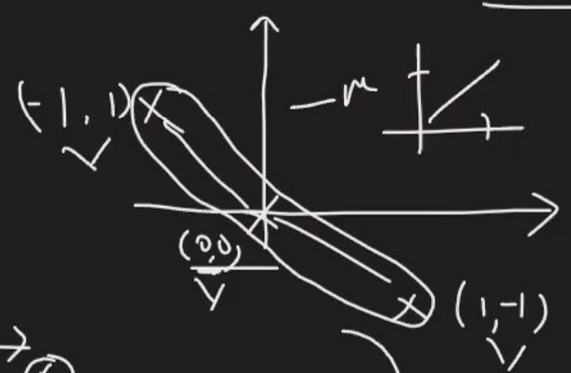


Variance



Correlation

-1 to 1

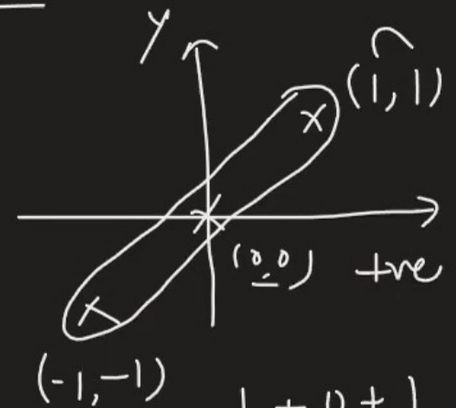


$$\frac{1+0+1}{3}$$

$$\frac{-1+0-1}{3}$$

$$\left(-\frac{2}{3}\right)$$

Covariance



$$\frac{1+0+1}{3}$$

$$= \frac{2}{3}$$

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$\begin{vmatrix} -1 & 10 & 1 \end{vmatrix}$

$-\frac{2}{3}$

x_1	x_2

cov mat

x_2 | x_1

$[\ 2 \times 2\ ]$

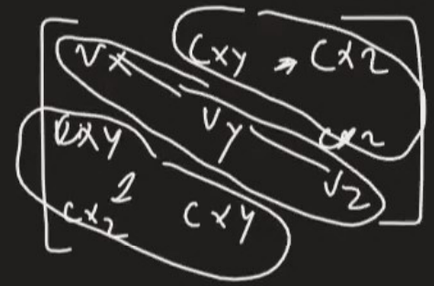
$$\begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{bmatrix} cov(x_1,x_1) & cov(x_2,x_1) \\ cov(x_1,x_2) & cov(x_2,x_2) \end{bmatrix}$$

x_1 x_2

$cov(x_1,x_1) \rightarrow var(x_1)$

$$\begin{bmatrix} var\,x_1 & cov(x_2,x_1) \\ cov(x_1,x_1) & var\,x_2 \end{bmatrix}$$ → square symmetric

$cov(a,b) = cov(b,a)$



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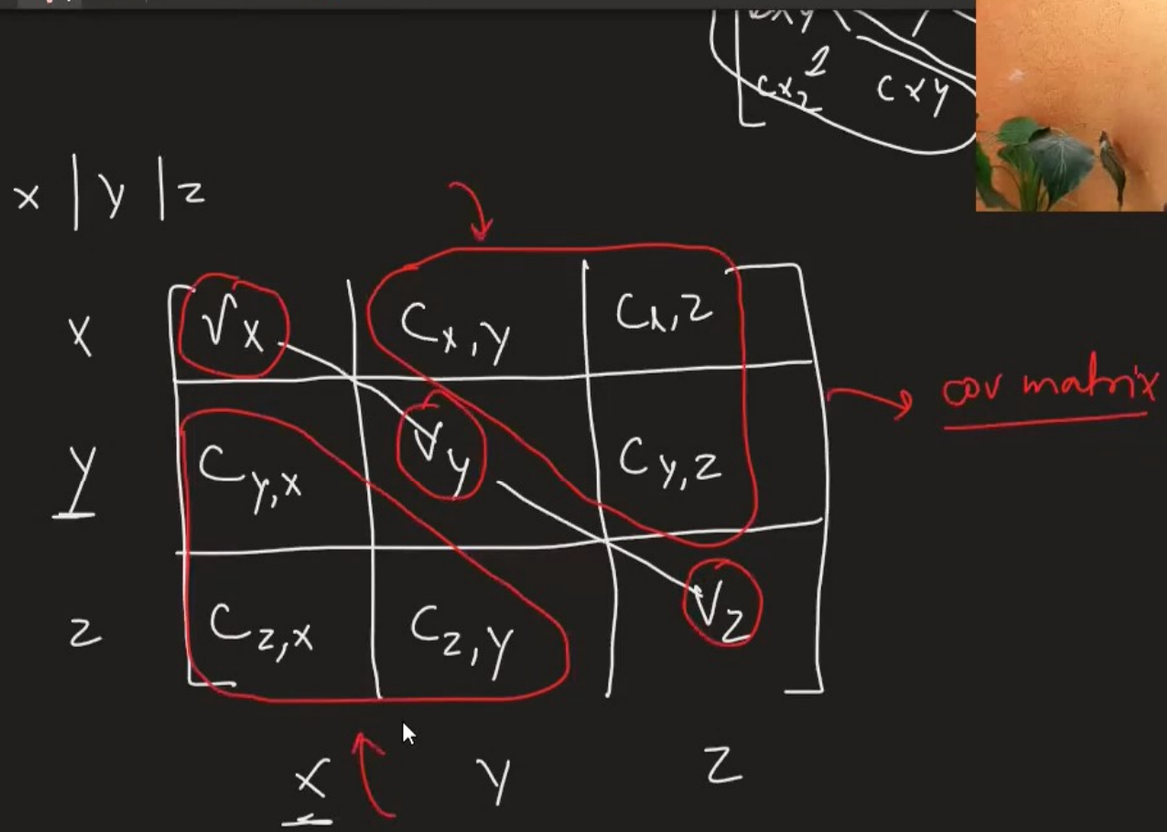

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Linear Transformation, Eigen Vectors and Eigen Values

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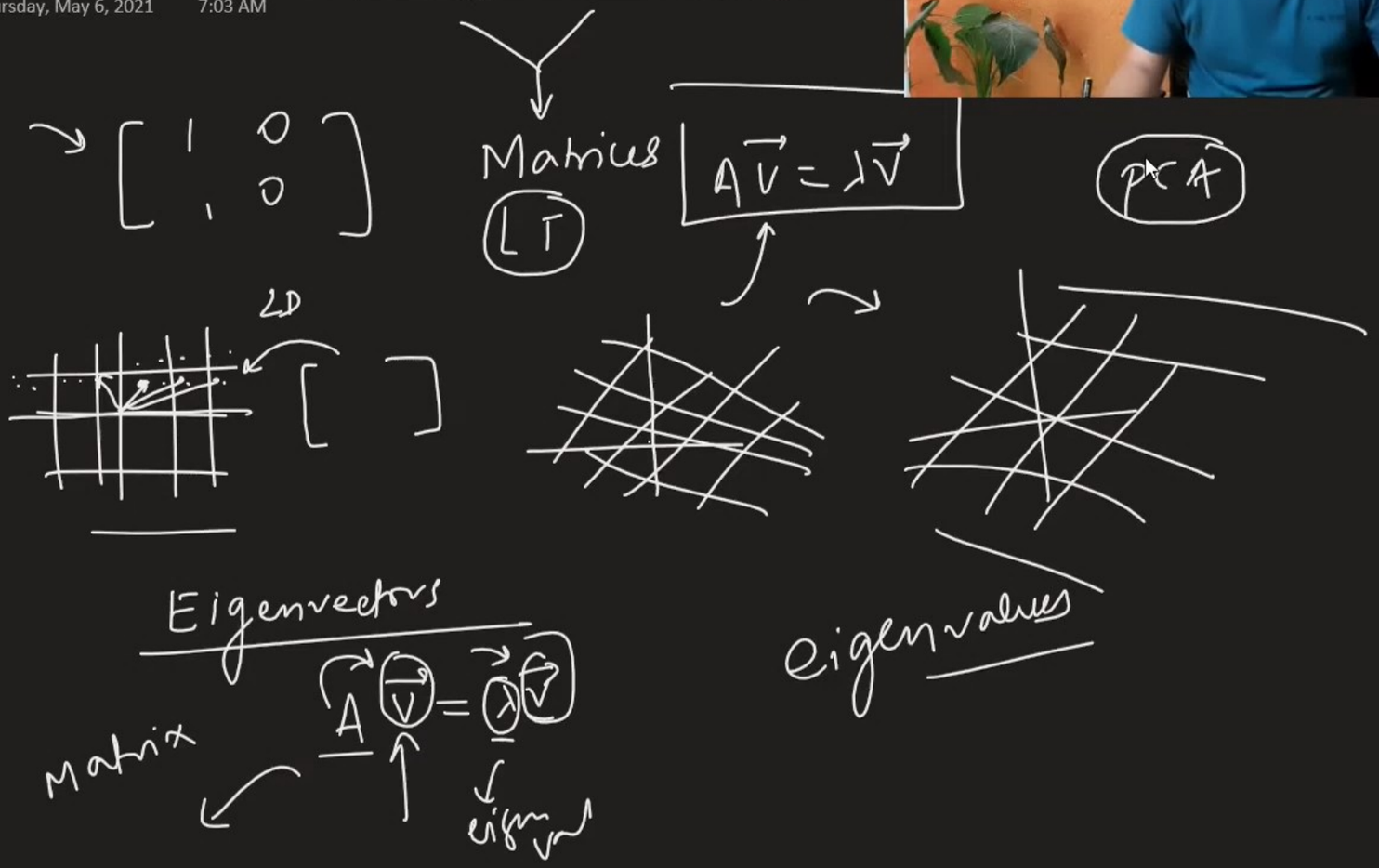

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100 Days of ML

- Day 29 - Pipelines
- Day 30 - Function T...
- Day 31 - Power Tra...
- Day 32 - Discrtizati...
- Day 33 - Working-...
- Day 34 - Working...
- Day 35 - Complete...
- Day 36 - Handling...
- Day 37 - Handling...
- Day38-Missing Indi...
- Day39 - KNN Impu...
- Day40 - Iterative I...
- Day 41 - Outliers in...
- Day 42 - Outlier De...
- Day 43 - Outlier de...
- Day44 - Outlier De...
- Day 45 - Feature C...
- Day 46 - Curse of...
- Day 47 - PCA

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4. Problem Formulation

Covariance and Covariance Matrix

Linear Transformation, Eigen Vecto...

5. Step By Step Solution

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8. Visualization of MNIST Dataset
9. Explained Variance
10. Finding optimum number of Pr...
11. When PCA does not work

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5. Step By Step Solution

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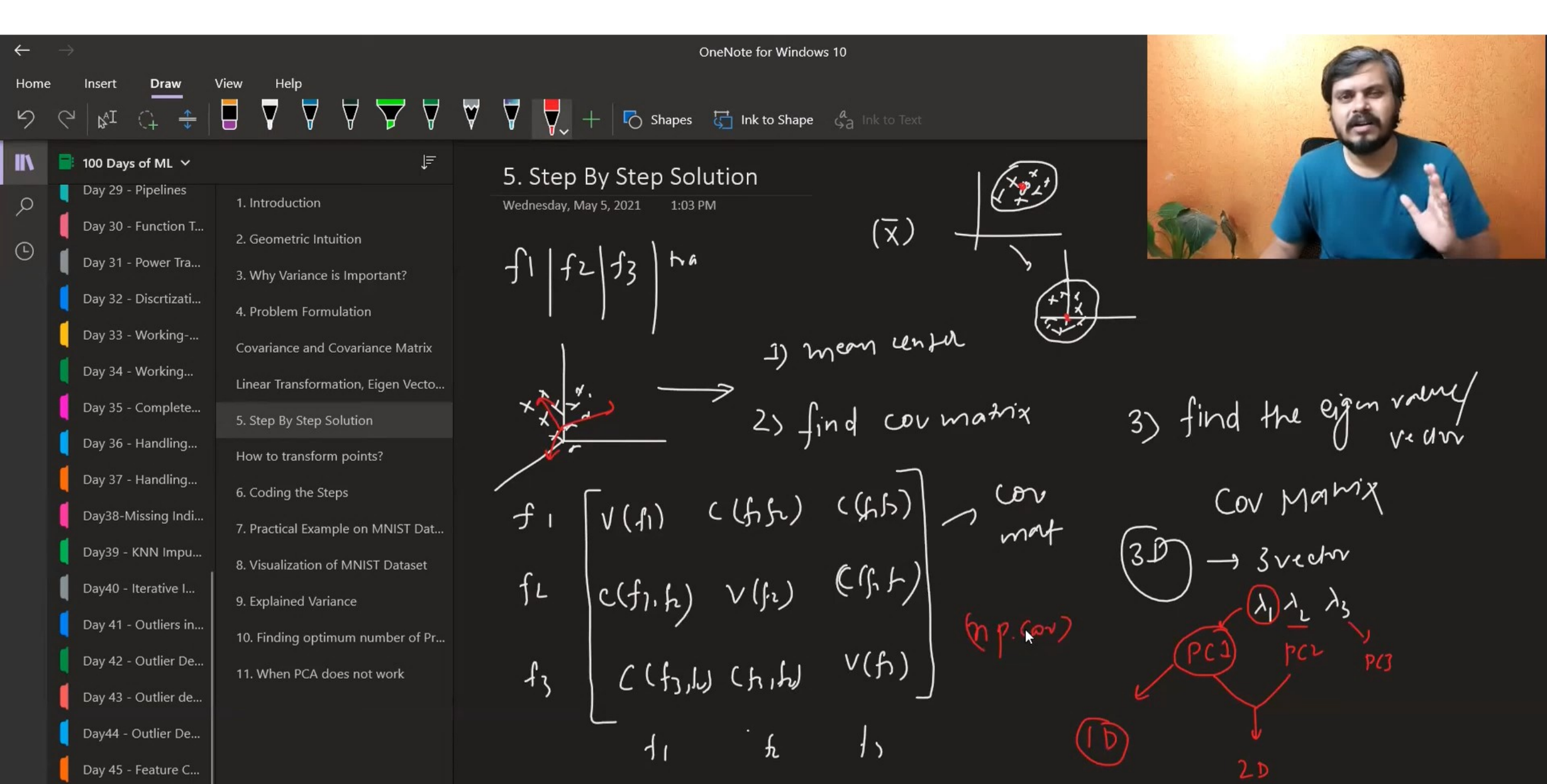

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How to transform points?

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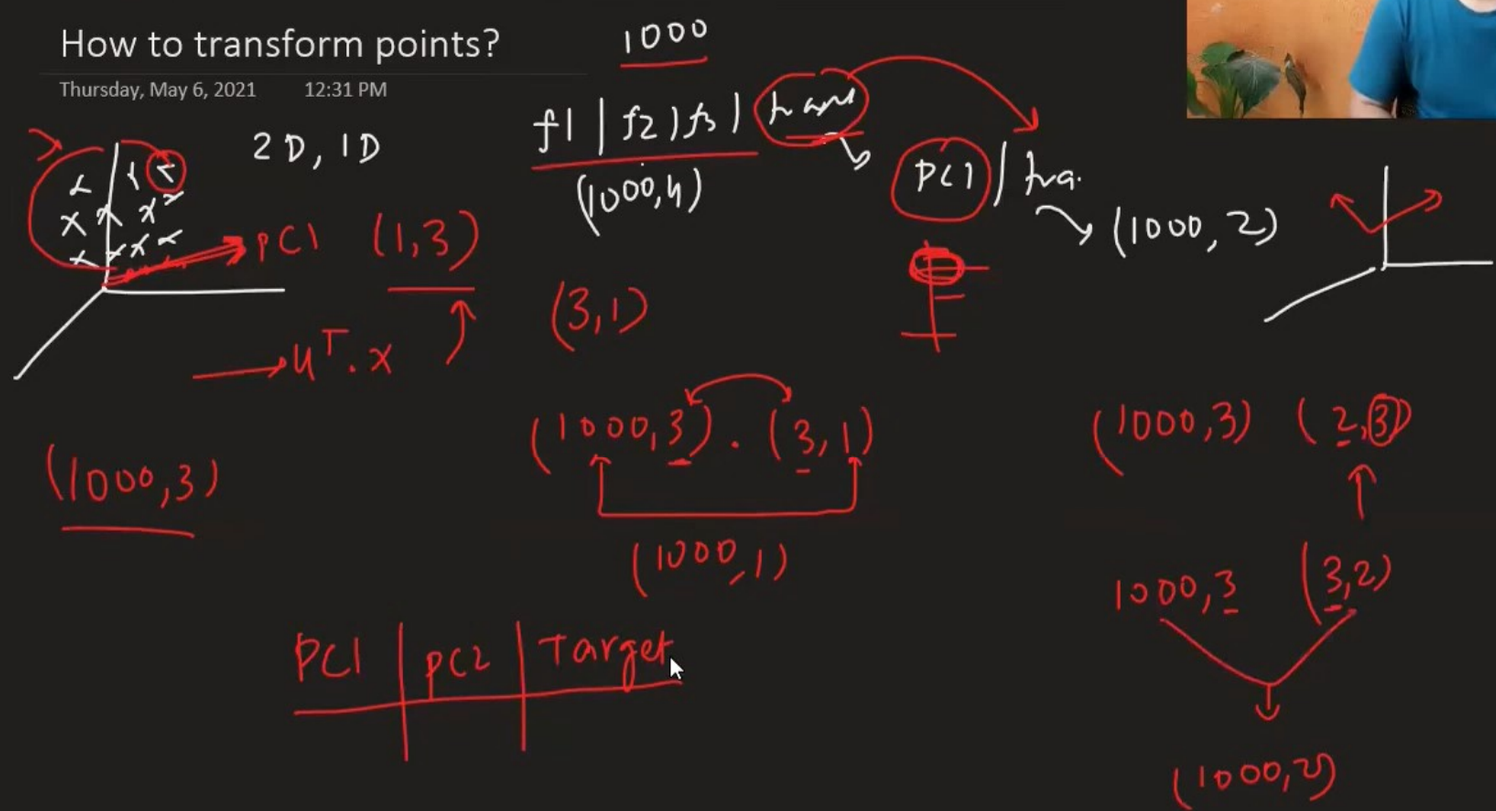

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10. Finding optimum number of Principle Components

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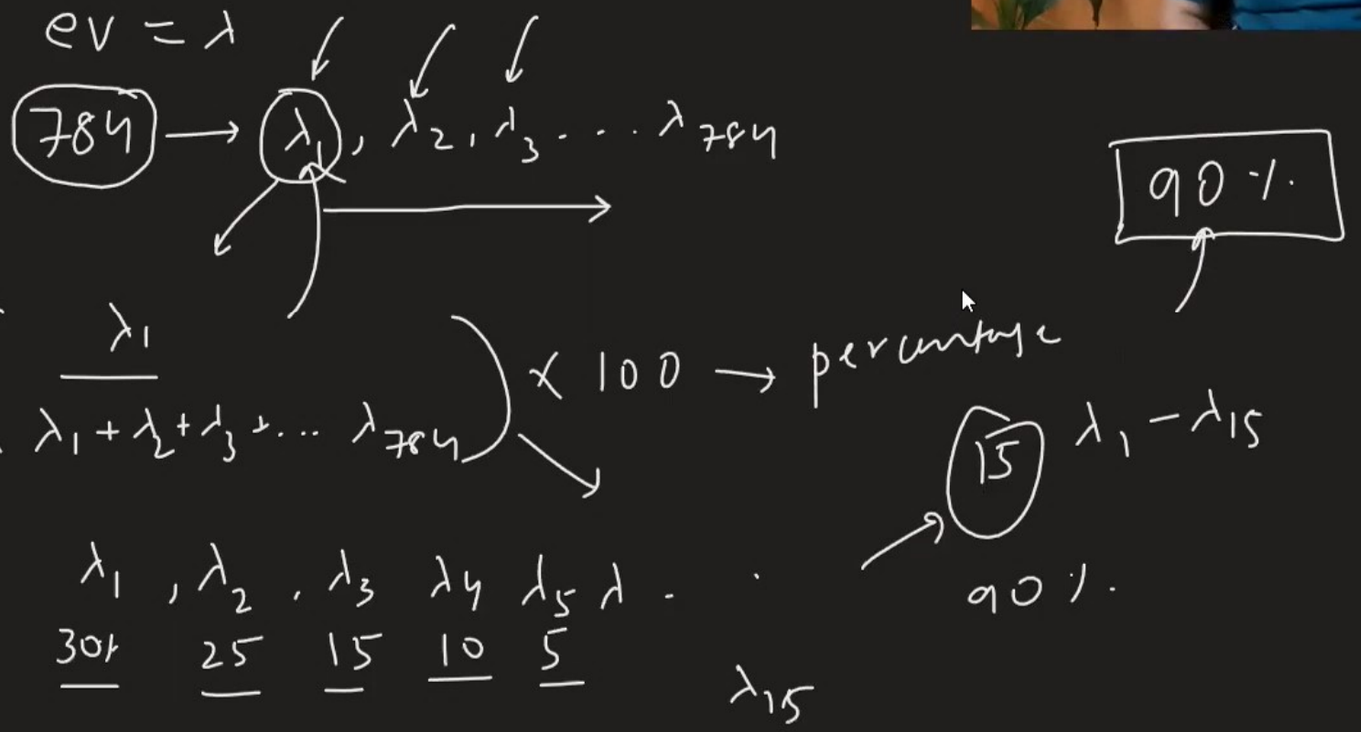

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11. When PCA does not work

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