(3) FIRST P.C.

$$S\vec{\varphi}_1 = \lambda_1 \vec{\varphi}_1 \longrightarrow \vec{\varphi}_1 = \begin{bmatrix} \varphi_{11} \\ \varphi_{21} \\ \vdots \\ \varphi_{p1} \end{bmatrix}$$

$$\vec{z}_1 = \varphi_{11} \begin{bmatrix} \vec{x}_1 \\ \\ \\ \\ \\ \end{bmatrix} + \varphi_{21} \begin{bmatrix} \vec{x}_2 \\ \\ \\ \\ \\ \end{bmatrix} + \cdots + \varphi_{p1} \begin{bmatrix} \vec{x}_p \\ \\ \\ \\ \\ \end{bmatrix}$$

$$= \begin{bmatrix} \vec{x}_1 & \vec{x}_2 & \cdots & \vec{x}_p \\ \downarrow & \downarrow & & \downarrow \end{bmatrix} \begin{bmatrix} \varphi_{11} \\ \varphi_{21} \\ \vdots \\ \varphi_{p1} \end{bmatrix} = X\vec{\varphi}_1$$

(line 164 of code)

④ reconstituting the image (1 PC)

$\vec{\phi}_1, \vec{\phi}_2, \dots, \vec{\phi}_p$

$\vec{z}_1, \vec{z}_2, \dots, \vec{z}_p$

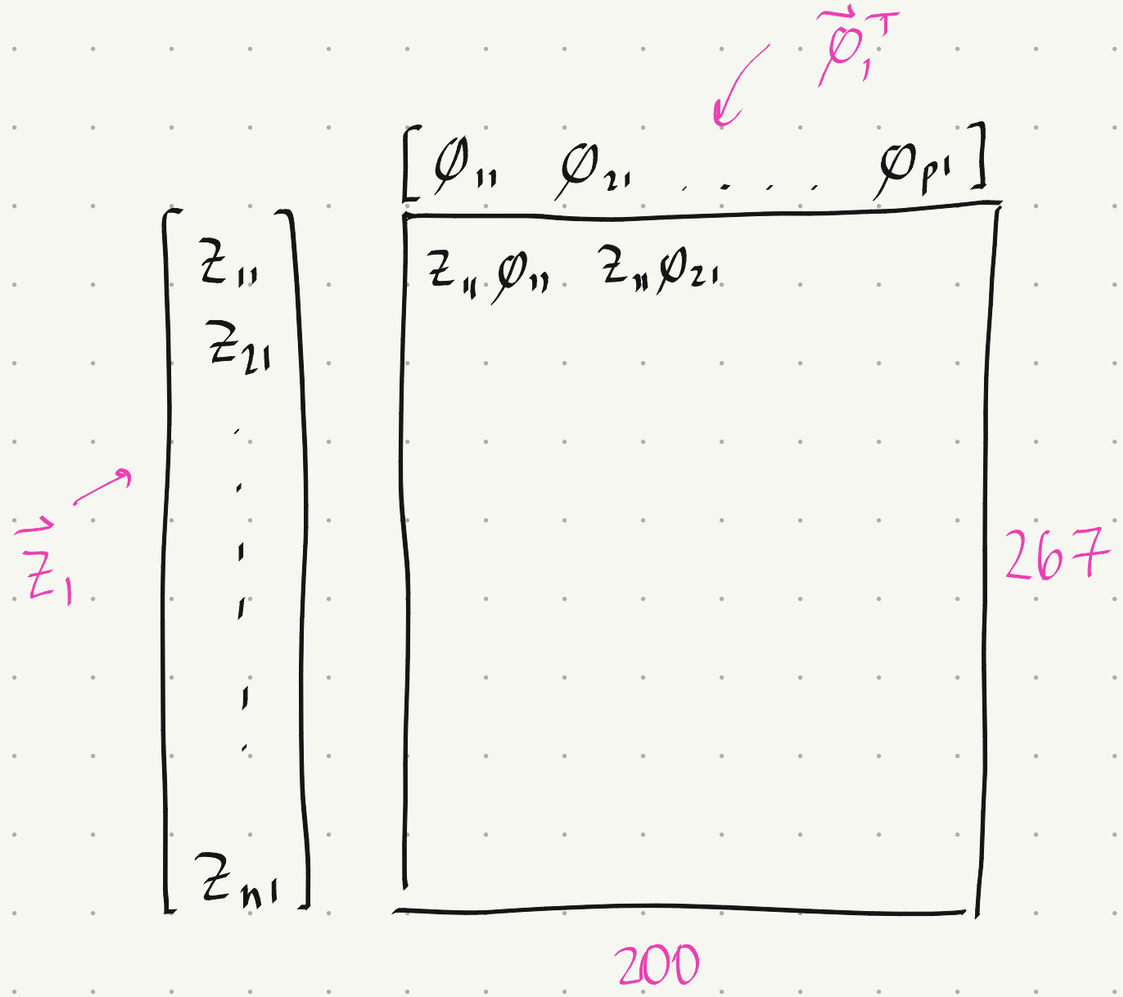
$\vec{\phi}_1$: 200×1

$\vec{z}_1$: 267×1

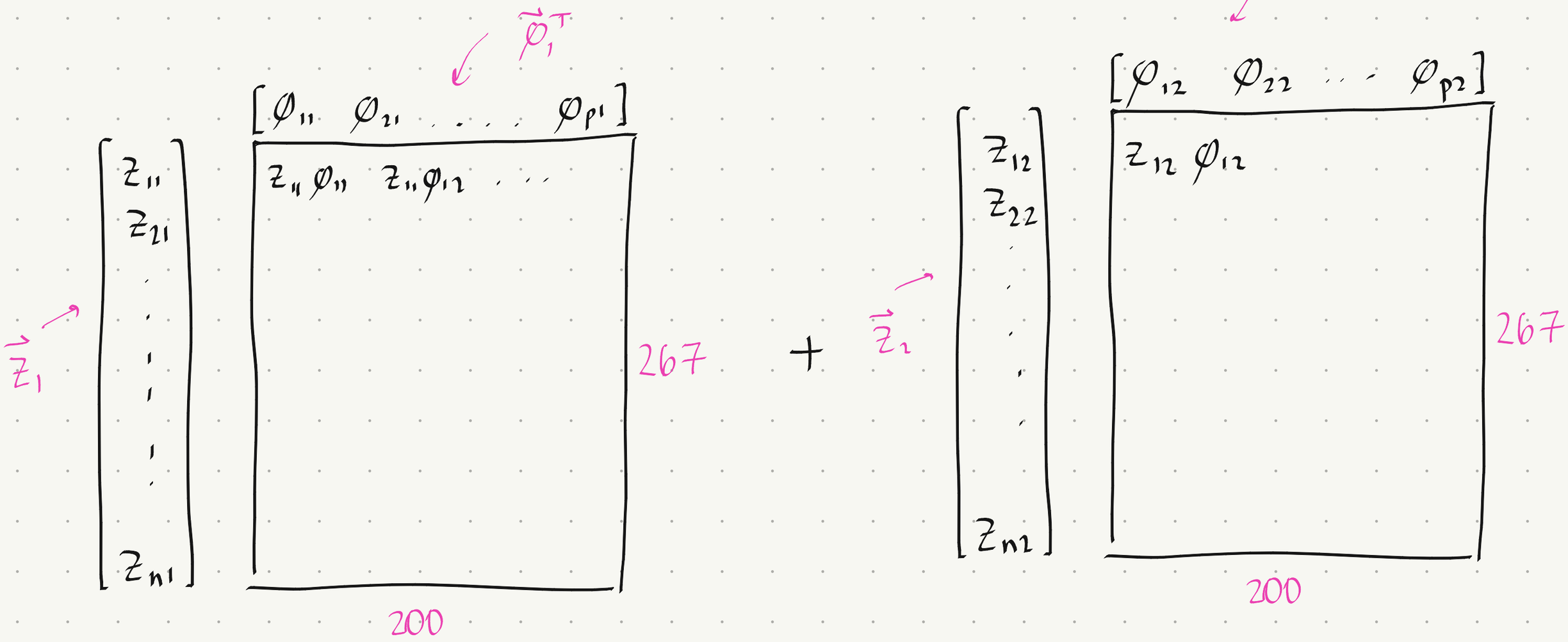
new image : $\vec{z}_1 \, \vec{\phi}_1^{\,T}$

$267 \times 1 \quad 1 \times 200$

267×200



(5) reconstituting (2 PC)



new image : $\vec{z}_1 \vec{\varphi}_1^T + \vec{z}_2 \vec{\varphi}_2^T$

3PC

$$\begin{matrix} \vec{z}_1 & \vec{z}_2 & \vec{z}_3 \end{matrix}$$

$$\begin{bmatrix} z_{11} & z_{12} & z_{13} \\ z_{21} & z_{22} & z_{23} \\ \vdots & \vdots & \vdots \\ z_{n1} & z_{n2} & z_{n3} \end{bmatrix} \quad \begin{matrix} \vec{\varphi}_1^T \\ \vec{\varphi}_2^T \\ \vec{\varphi}_3^T \end{matrix} \quad \begin{bmatrix} \varphi_{11} & \varphi_{21} & \dots & \varphi_{p1} \\ \varphi_{12} & \varphi_{22} & \dots & \varphi_{p2} \\ \varphi_{13} & \varphi_{23} & \dots & \varphi_{p3} \end{bmatrix}$$

$n \times 3$ $\qquad$ $3 \times p$

$n \times p$

first pixel

$$= \begin{bmatrix} z_{11}\varphi_{11} + z_{12}\varphi_{12} + z_{13}\varphi_{13} & \dots & \dots & \dots & \dots & - \\ z_{21}\varphi_{11} + z_{22}\varphi_{12} + z_{23}\varphi_{13} & & & & & \\ \vdots & & & & & \\ & & & & & \end{bmatrix}$$