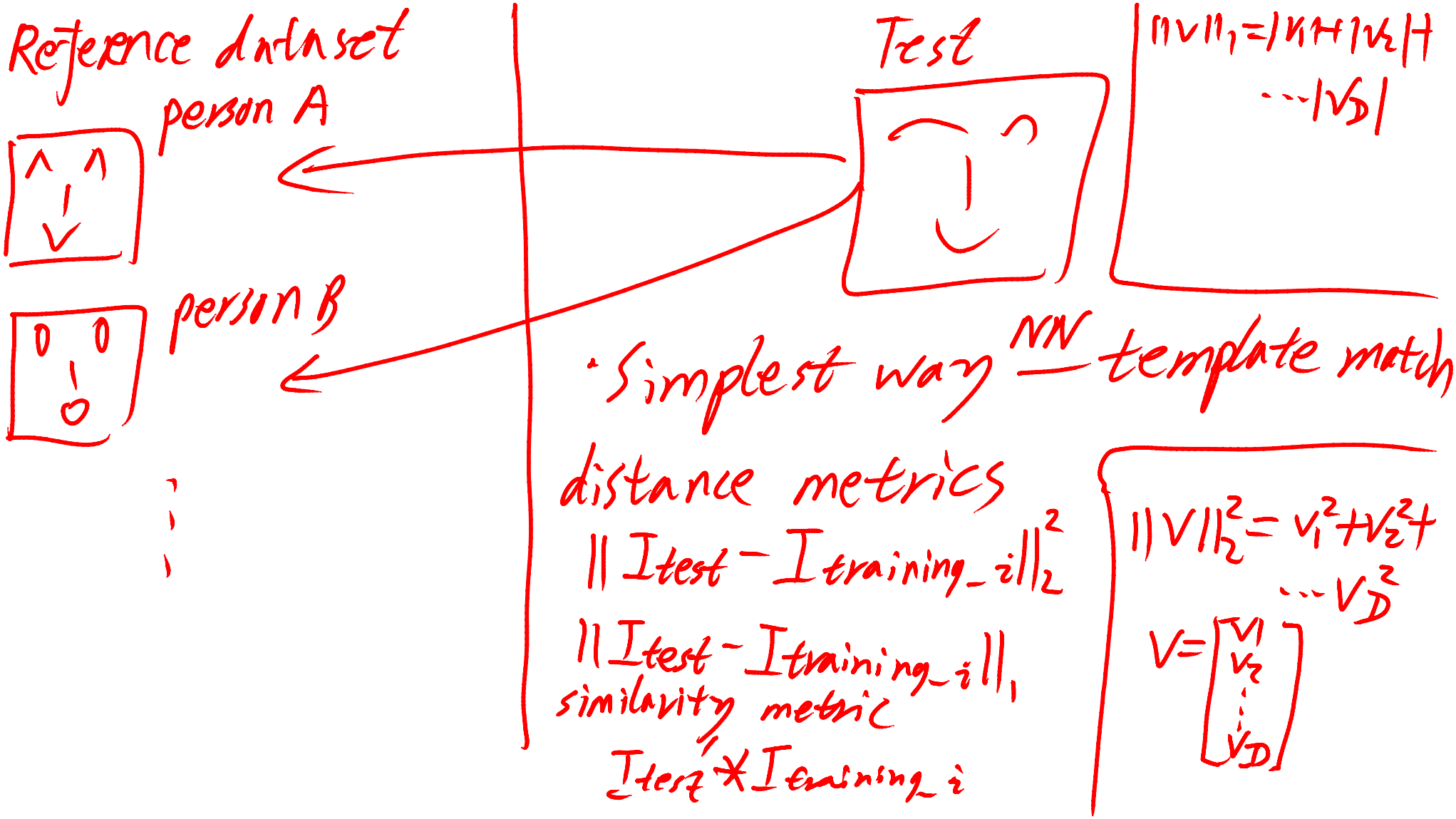
Some instructions on assignment 4


Reference dataset
person A
person B
Test
$\|v\|_1 = |v_1| + |v_2| + \cdots |v_D|$
· Simplest way NN template match
distance metrics
$\|I_{test} - I_{training\_i}\|_2^2$
$\|I_{test} - I_{training\_i}\|_1$
similarity metric
$I_{test} * I_{training\_i}$
$\|v\|_2^2 = v_1^2 + v_2^2 + \cdots v_D^2$
$v = \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_D \end{bmatrix}$

$$\{I_m\}_{m=1\cdots M}$$

$$\bar{I} = \frac{\sum_{m=1}^{M} I_m}{M}$$

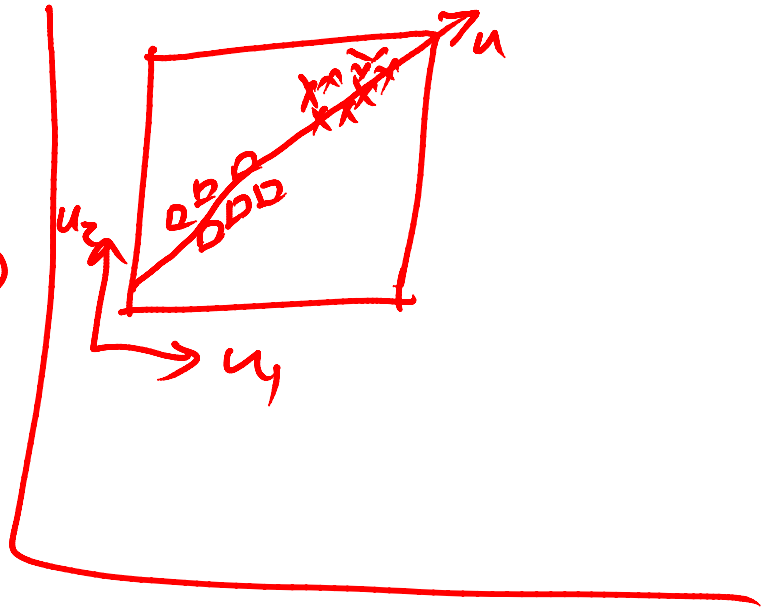
$$I_m \leftarrow I_m - \bar{I}$$

$I_{30\times40\times3}$ $D=3600$

$$I = \alpha_1 \cdot u_1 + \alpha_2 u_2 + \cdots \alpha_K \cdot u_K \qquad K << D$$

$$\begin{bmatrix} \\ \\ \\ I \end{bmatrix} = \underset{\uparrow}{\alpha_1} \cdot \begin{bmatrix} \\ \\ \\ u_1 \end{bmatrix} + \underset{\uparrow}{\alpha_2} \cdot \begin{bmatrix} \\ \\ \\ u_2 \end{bmatrix} + \cdots \underset{\uparrow}{\alpha_K} \cdot \begin{bmatrix} \\ \\ \\ u_K \end{bmatrix} \qquad \text{eg } K=30$$

$I \leftarrow [\alpha_1, \alpha_2, \cdots, \alpha_K]^T$



$\{I_i\}_{i=1\cdots M}$ training images.

$A = \underbrace{\begin{bmatrix} | & | & \cdots & | \\ I_1 & I_2 & & I_M \end{bmatrix}}_{D \times M}$ e.g. $D=3600$, $M=184$

$C_V = \underbrace{A}_{D\times M}\underbrace{A^T}_{M\times D}$ $D\times D$

$\underbrace{A^T}_{M\times D}\underbrace{A}_{D\times M}$ $M\times M$

$Bu = \lambda u$ (u: eigenvector, λ: eigen value)

$[V, D] = eig(AA^T)$

V: $D\times M$, D: $M\times M$

$(AA^T)u = \lambda u$?

① $(A^TA)v = \lambda' v$ ($M\times M$) ✓

② $u = Av$ ($D\times M$ $M\times 1$)

$\begin{bmatrix} u_1 \\ \vdots \\ u_D \end{bmatrix}_{D\times 1} = \begin{bmatrix} | & | & \cdots & | \\ I_1 & I_2 & & I_M \end{bmatrix} \begin{bmatrix} v_1 \\ \vdots \\ v_M \end{bmatrix}$

$(AA^T)Av = \lambda' Av$

$$I = \alpha_1 u_1 + \alpha_2 u_2 + \cdots + \alpha_k u_k + o(\cdot)$$

$$u_1^T I = \alpha_1 \underbrace{u_1^T u_1}_{\|} + \alpha_2 \underbrace{u_1^T u_2}_{\|} + \cdots + \alpha_k \underbrace{u_1^T u_k}_{\|} = \alpha_1$$

$$\boxed{u_k^T I = \alpha_k}$$

$$I \leftarrow [\alpha_1, \alpha_2, \cdots \alpha_k]^T$$

$u_1^T u_1 = 1$

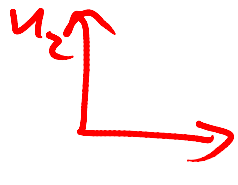
$u_1^T u_2 = 0$

$\vdots$

- $u_i^T u_j = \begin{cases} 1 & \text{if } i = j \\ 0 & \text{otherwise} \end{cases}$

$u_1 = (1, 0)$

$u_2 = (0, 1)$



$u_1^T u_1$

nSubject = 33 in training data

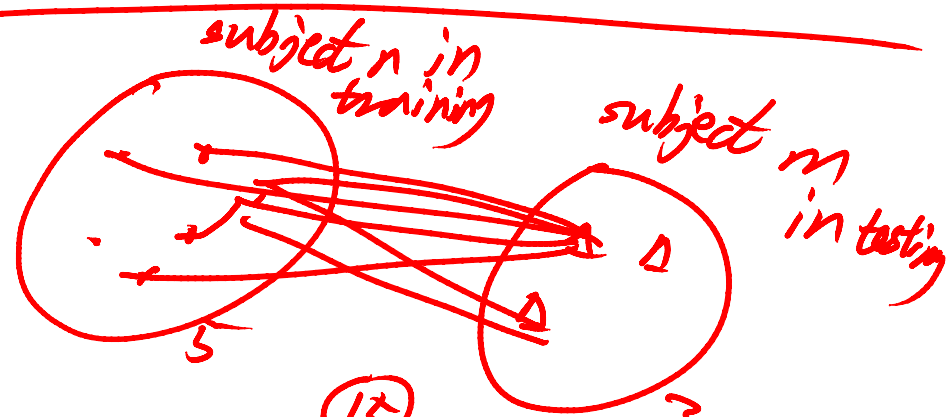
nImage = 184

nSubject = 27 in testing data

nImage = 249

- $$\text{Accuracy} = \frac{\#\text{matched image}}{\#\text{test image}}$$

- $$\text{Accuracy} = \frac{\#\text{matched subjects}}{\#\text{test subject}}$$



(15)

$$dist(m,n) = \min_{i \in I_m, j \in I_n} dist(i,j)$$