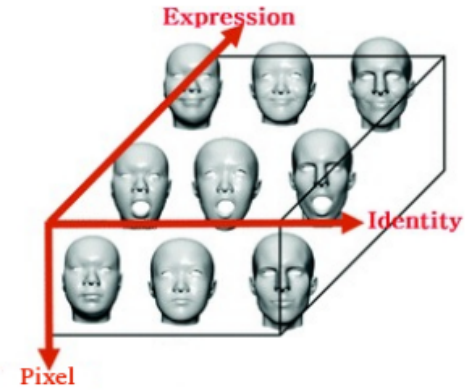
Project of Group 2

Description

Suppose you have a databse of n_p person photographed in n_e different expressions was represented by p matrices $\boldsymbol{A}_p \in \mathbb{R}^{n_i \times n_e}$, where n_i is the number of pixels of each image. The same databse can be considered as $\boldsymbol{\mathcal{A}} \in \mathbb{R}^{n_i \times n_e \times n_p}$.



Face Recognition using HOSVD

Consider $\boldsymbol{\mathcal{A}}$ is a databse. Using the HOSVD method, we have

$$\boldsymbol{\mathcal{A}} = \boldsymbol{S} \times_i F \times_e G \times_p H,$$

where $\times_i, \times_e, \times_p$ are the $1, 2, 3$-mode production,respectively. For face recognition porpuse, let

$$\boldsymbol{\mathcal{A}} = \mathcal{C} \times_p H, \text{where } \mathcal{C} := \mathcal{S} \times_i F \times_e G.$$

If we fix the expression e and we identify the tensors $\mathcal{A}(:, e, :)$ and $\mathcal{C}(:, e, :)$ with matrices A_e and C_e has relation as

$$A_e = C_e H^T, \quad e = 1, 2, \cdots, n_e.$$

Each column of A_e contains the image of the person p in the expression e.

Let $z \in \mathbb{R}^{n_i}$ be the image of an unknown person in an unknown expression that we want to classify. The identification problem is

$$\min_{\alpha_e} \|C_e \alpha_e - z\|_2, \ e = 1, 2, \cdots, n_e,$$

obviously if z is an image of a person p in expression e, then the α_e are equal to $h_p = H(p, :)$.

The second approach is using the transposed version of z as $\hat{z} = F^T z$, and the taking QR-decomposition of $\mathcal{C}$, then solving $R\alpha_e = Q^T \hat{z}$ for achieving faster.

Use extended Yale Database for apply the face recognition task using described method. Please report the performance metrics of both methods on the dataset. Compare and interpret the results. For the basics of tensors and *HOSVD* or *HOOI* please read GeneralIntro.pdf.