

CP decomposition with rotation and decomposed vector

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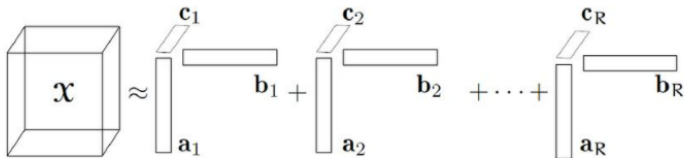
2022 2/24

List

CP decomposition

- Calculate the distance using the decomposed vector → **Check**
- Find rotation effect in CP decomposition → **Check**

CP decomposition



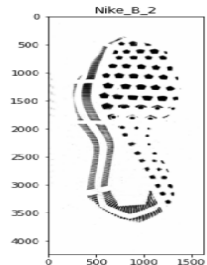
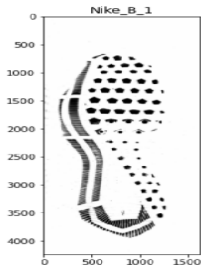
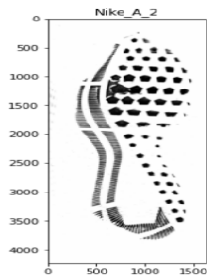
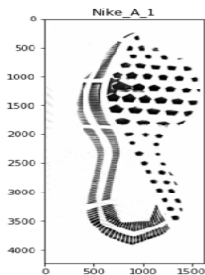
$$x_{ijk} \approx \sum_{r=1}^R a_{ir} b_{jr} c_{kr}$$

Data

- Left side
- Two brands; Nike, Adidas
- Four sample; $A(\text{Nike})$, $B(\text{Nike})$, $C(\text{Adidas})$, $D(\text{Adidas})$
- Two images for one sample; A_1 , A_2 , B_1 , \dots , D_1 , D_2
- Rank 1 CP-decomposition

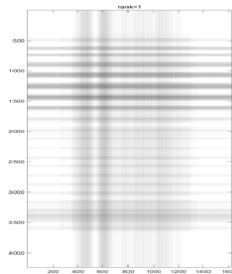
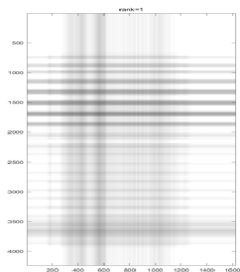
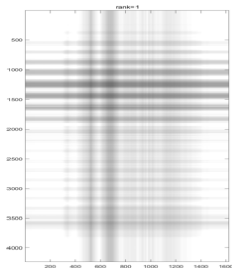
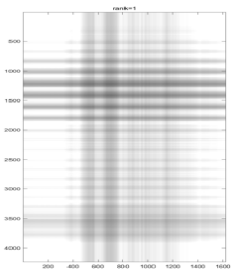
Decomposition

Nike



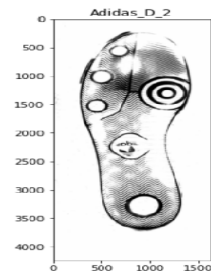
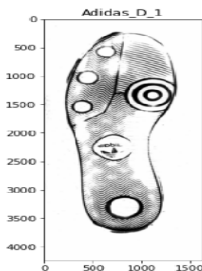
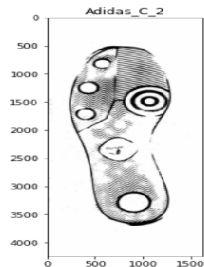
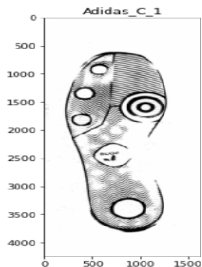
Decomposition

Nike rank 1



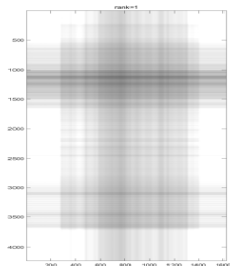
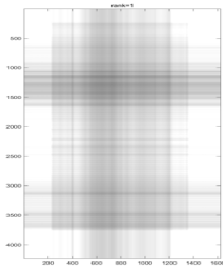
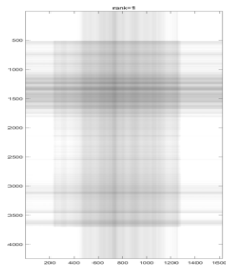
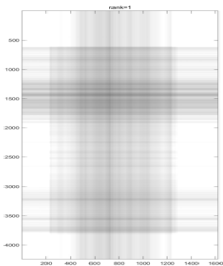
Decomposition

Adidas



Decomposition

Adidas rank 1



Decomposed vector

Euclidean distance

$$d(a_j, b_j) = \sqrt{\sum_{i=1}^n (a_{ji} - b_{ji})^2}$$

- a, b : one part of decomposed vectors in image a and b
- n : the length of the vector(the size of the row/column/3rd-axis)
- j : the number of image axes

Total weight

$$TW(image_a, image_b) = \sum_{j=1}^3 d(a_j, b_j)$$

Decomposed vector

Result table

	$mean(d_1)$	$mean(d_2)$	$mean(d_3)$	$mean(TW)$
Matching	0.0669	0.0395	0	0.1064
Non-matching (same brand)	0.0793	0.0544	0	0.1189
Non-matching (different brand)	0.0668	0.0468	0	0.1135

- height-axis(d_1): weird result
 - ▶ **alignment problem**
- width-axis(d_2): ideal result
 - ▶ coincidence case
- color-axis(d_3): all the same elements
 - ▶ low dimension(just 3-dim)

Rotation effect

Check list

- Is there a rotation effect in CP-decomposition?
- 45 degree rotation
- Without alignment
- Rank: 1, 2, 3, 5 and 10

Summaries

Decomposed vector

- Alignment problem
 - ▶ simple alignment using large scale points
- Resize image to lower dimension
 - ▶ rebuild CP-decomposition
- Check the difference of outer products
 - ▶ after alignment

Rotation effect

- CP-decomposition is sensitive to rotation
- Vertical or horizontal info \rightarrow good
- Diagonal info \rightarrow bad