

1. Problem Description

- Why does action recognition accuracy drop when training and testing on distinct datasets?

Training	Testing	Accuracy
UCF 50	UCF 50	70.00 %
UCF 50	HMDB 51	55.70 %
Olympic Sports	Olympic Sports	71.80 %
Olympic Sports	UCF 50	16.67 %

- Discriminative background in datasets may be responsible
- Backgrounds should be diverse but not discriminative
- Reducing the influence of background features may improve cross dataset action recognition

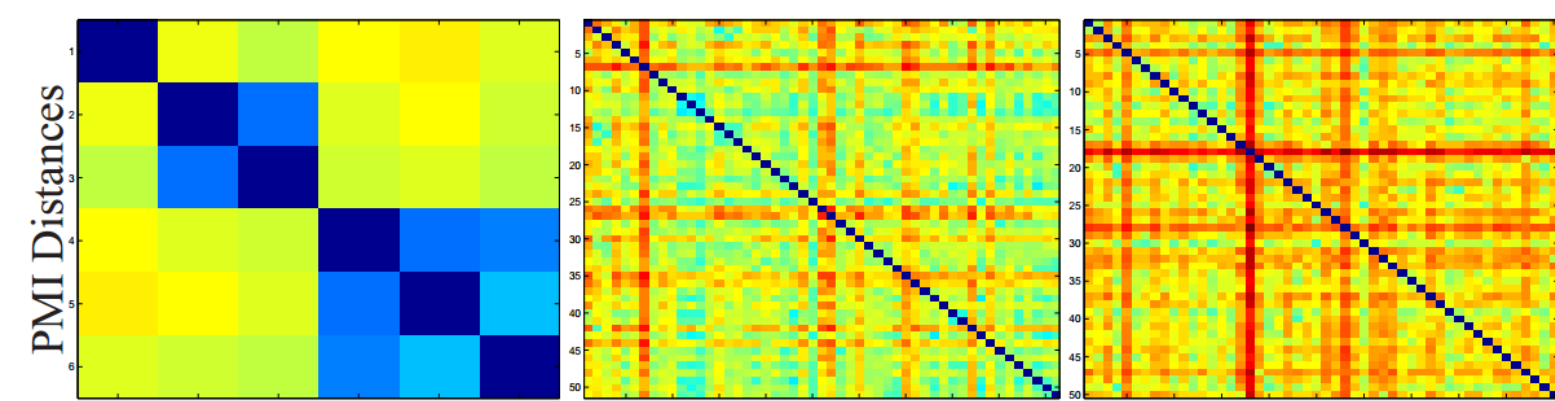
2. Background Discriminativity in Action Datasets

- Comparable accuracy can be achieved using only background features, without even observing the actors

STIP sampling	UCF YouTube	UCF Sports
Foreground only	59.80 %	71.92 %
Background only	55.27 %	73.97 %
Both	60.60 %	75.34 %

- How to quantify background scene discriminativity?

- Compute GIST feature clusters for each dataset
- Estimate the point-wise mutual information between each cluster and action class

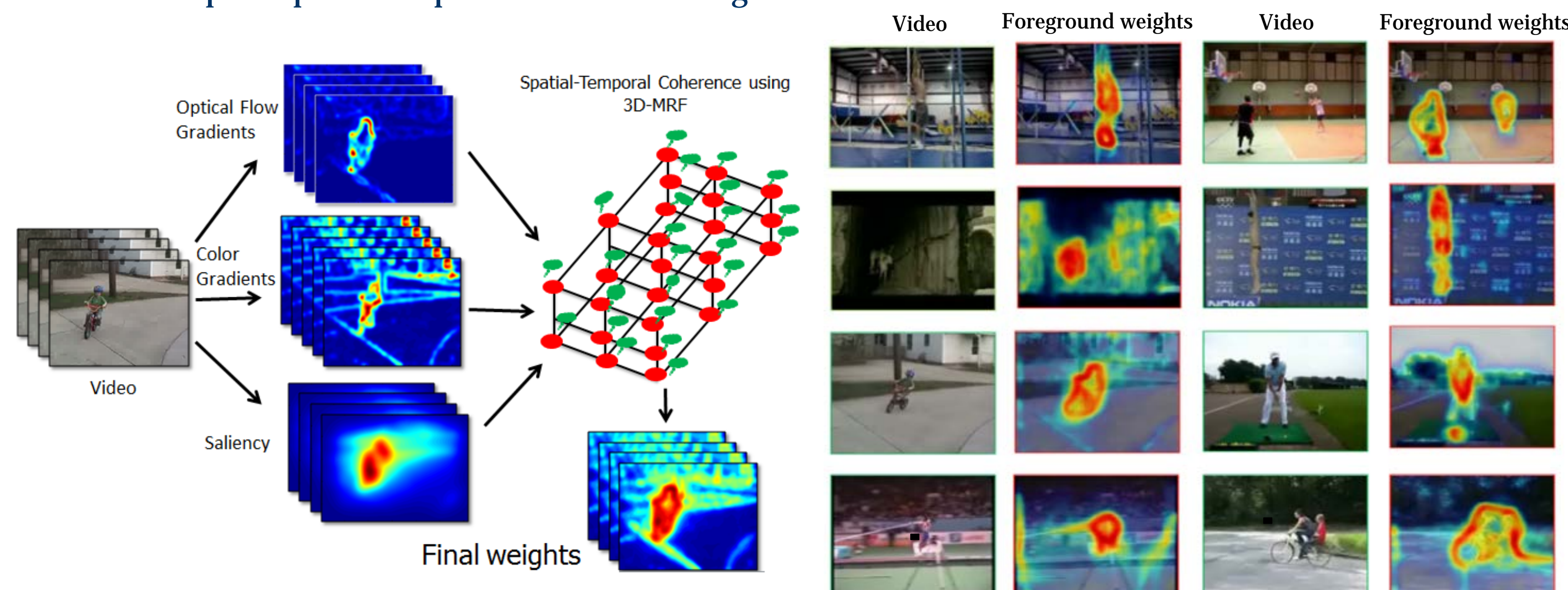


Clusters	100	200	300
KTH	5.12	8.25	10.40
HMDB 51	7.15	11.07	14.06
UCF 50	7.97	11.79	14.38

- Based on scene information alone, KTH is harder to classify than HMDB51 and UCF50

3. Our Approach

- Actor localization or binary segmentation are difficult to achieve in realistic videos
- Instead, obtain the confidence of each pixel, in being part of foreground
- Use foreground to obtain weighted video representation
- Foreground confidence estimated using: motion gradients, color gradients, visual saliency
- Impose spatio-temporal coherence using 3-D MRF



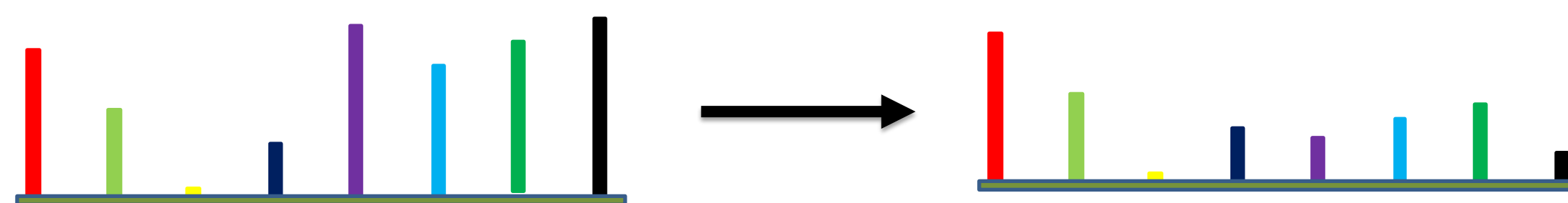
- Use weights to create foreground focused codebook and histograms

- Weighted K-means

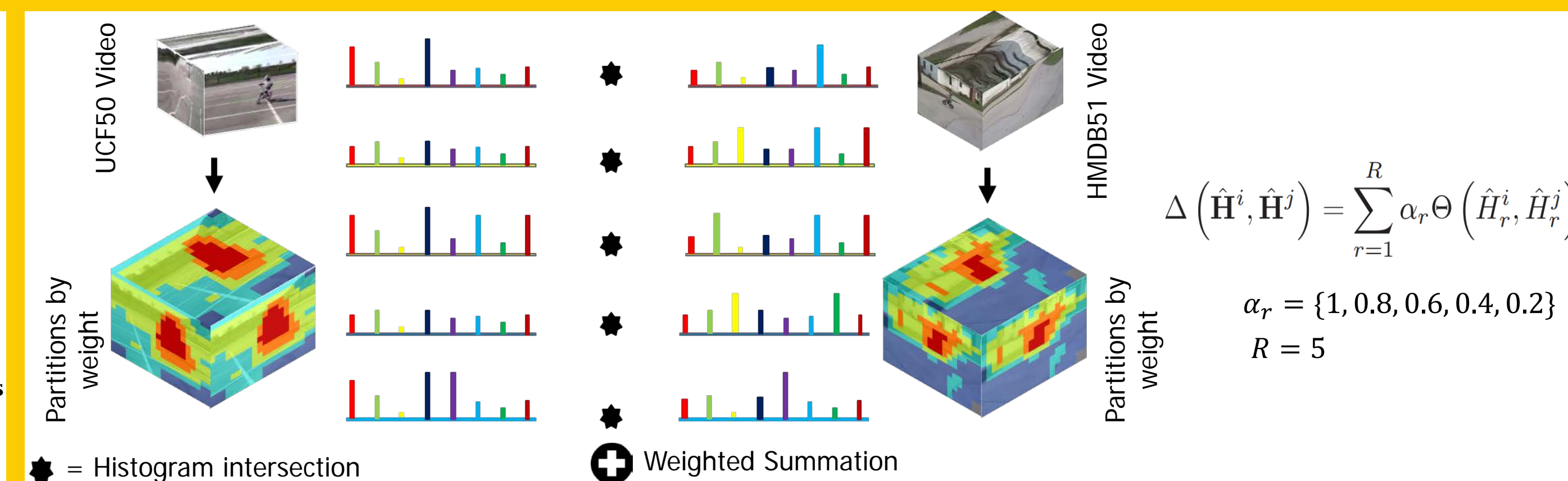
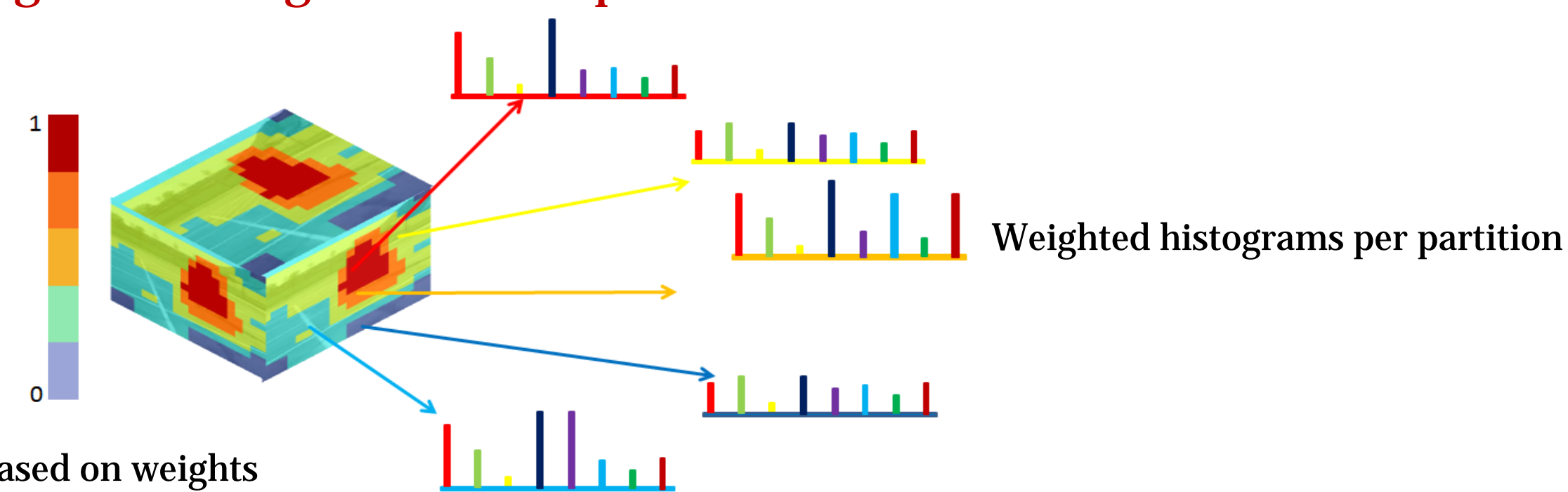
$$\underset{C}{\operatorname{argmin}} \sum_{j=1}^K C(i, j) w_i \|x_i - z_j\|^2$$

where w_i is the average weight of all pixels in a cuboid

- Weighted Histogram

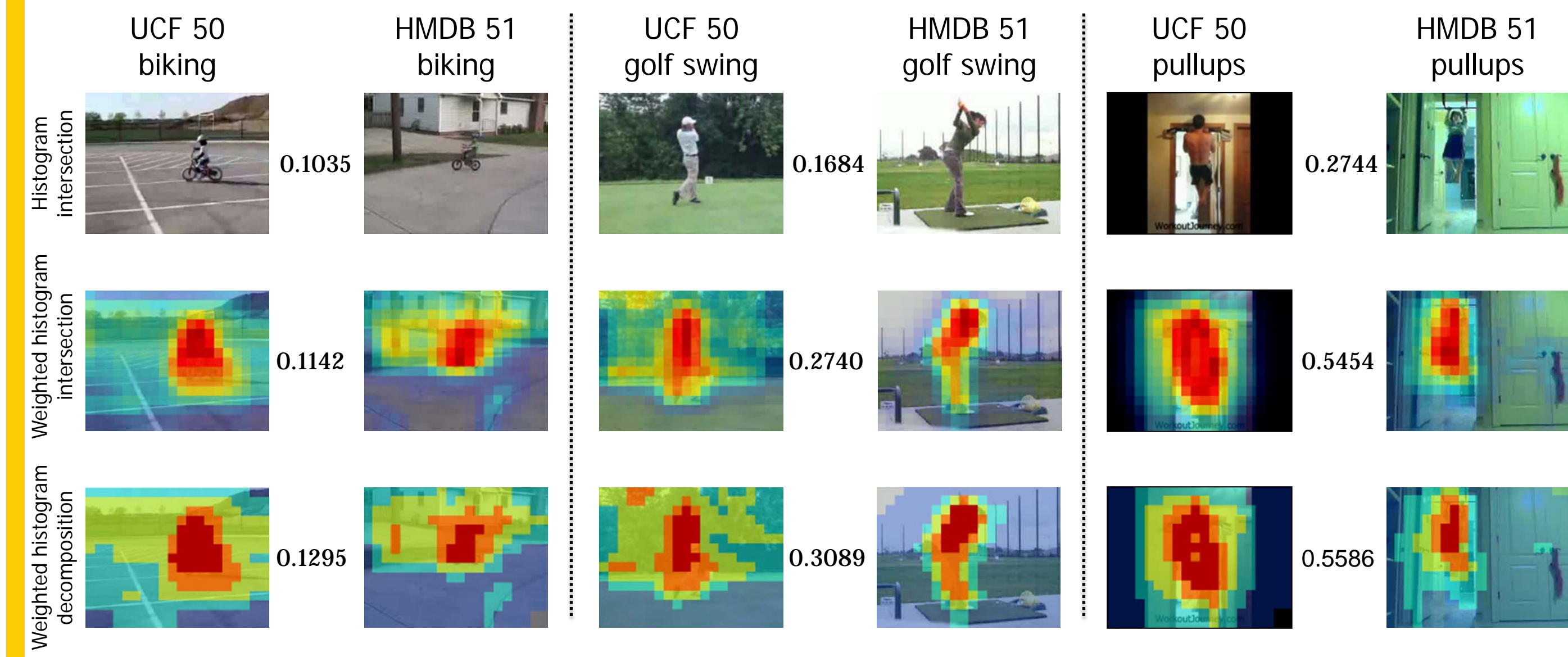


- Foreground weighted Histogram Decomposition



4. Experimental Results:

- Datasets used: Visually similar actions across UCF50, HMDB51, Olympic Sports



Training	Testing	Unweighted	Weighted	Histogram Decomposition
UCF 50	UCF 50	70.00	74.20	77.85
UCF 50	HMDB 51	55.70	60.00	68.70
HMDB 51	HMDB 51	65.30	69.30	68.00
HMDB 51	UCF 50	63.3	64.00	68.67
Olympic Sports	Olympic Sports	71.80	73.95	69.79
UCF 50	Olympic Sports	31.25	31.25	33.33
Olympic Sports	UCF 50	16.67	32.29	47.91