Predicting the Memorability of Natural-scene Images
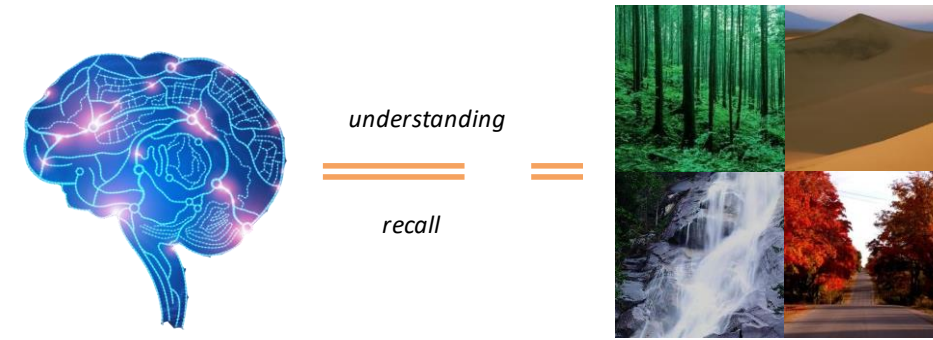
Jiaxin Lu*, Mai Xu*, and Zulin Wang*†

*School of Electronic and Information Engineering, Beihang University
† Collaborative Innovation Center of Geospatial Technology, Wuhan, China

Motivations

What is memorability?

Image memorability as an intrinsic feature of an image demonstrates whether an image is easy to be recalled or not.


Which picture is easier to be recalled?

Observation: the low level features of color are highly correlated with memorability of natural-scene images.

Score = 0.27

Score = 0.82

Why to predict the memorability of natural-scene images?

- *It is hard for machine to understand what contents in a natural-scene image make it memorable.*
- *The future applications vary.*

Video/Image Category
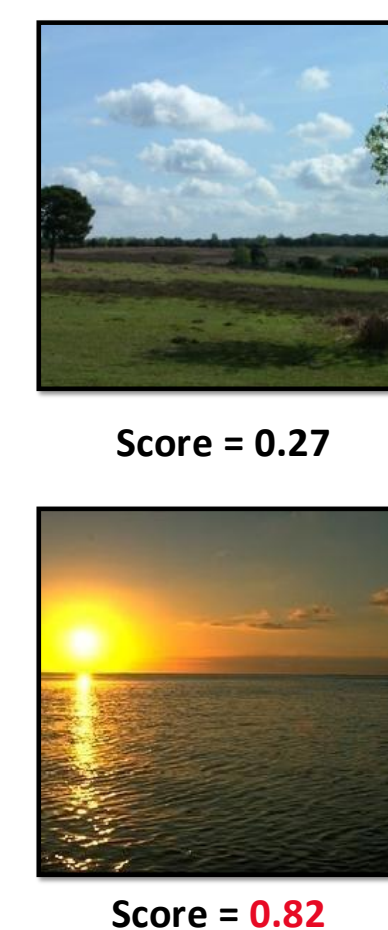
Basic Idea

For predicting the memorability of natural-scene images, we propose a memorability prediction approach for natural-scene images, which is based on the HSV-based feature.

Contributions:

- We establish a dataset, which includes the ground-truth memorability of 258 non-object images.

- We find that some of HSV colors have high correlation with human memorability.
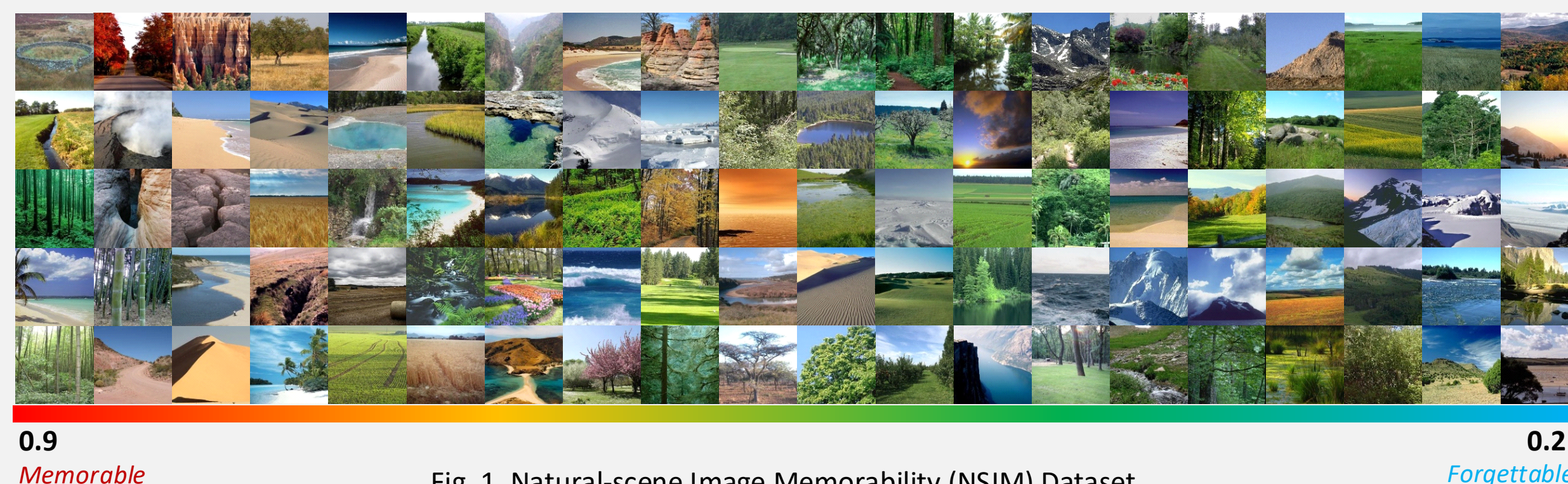

0.9 Memorable   0.2 Forgettable

Fig. 1. Natural-scene Image Memorability (NSIM) Dataset

Dataset contains 258 natural-scene images selected from the existing memorability dataset.
(Isola *et al.* 2011)

Natural-scene images: natural calibrated images
- Belong to outdoor natural scenes
- Not include any salient object, which refers to human, animals and man-made object

HSV-based Feature

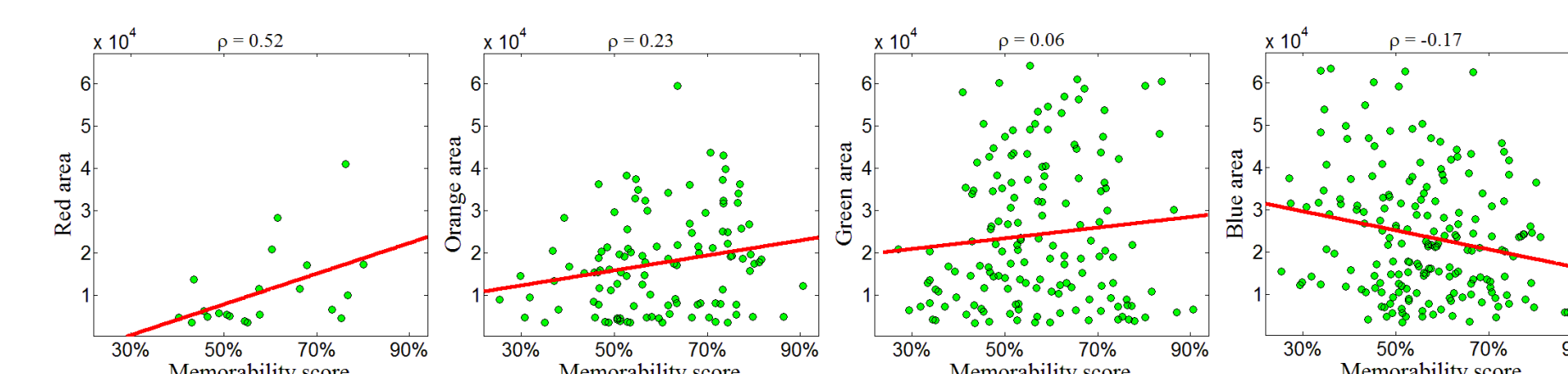### Correlation between memorability and color

Fig. 3. Color Area Versus Image Memorability Score
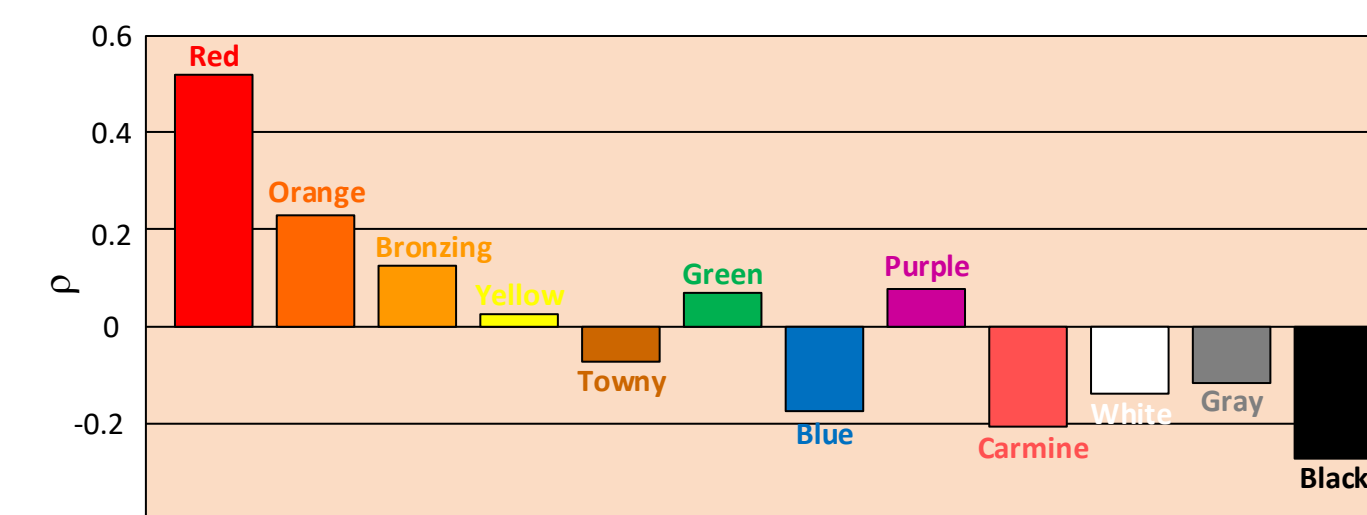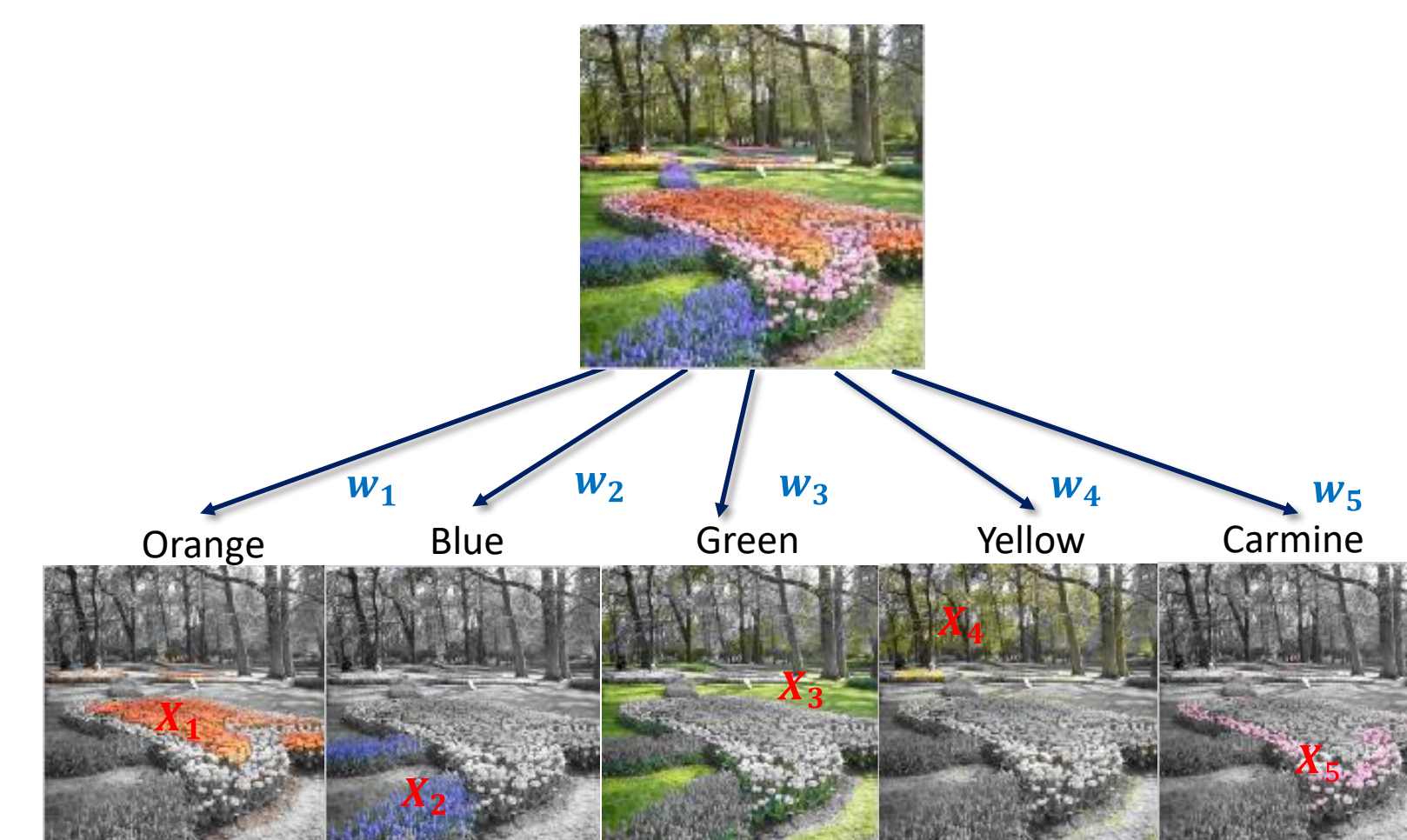(Include all images with featured color occupying over 5% of total pixels.)

Fig. 4. Spearman's Rank Correlation Between Color and Memorability

HSV-color segmentation

Feature vector: $(w_1 X_1, w_2 X_2, w_3 X_3, w_4 X_4, w_5 X_5, \cdots)$

We trained the weights $W = (w_1, w_2, w_3, w_4, w_5)$ by Support Vector Machine (SVM).

Observation

Observation 1:
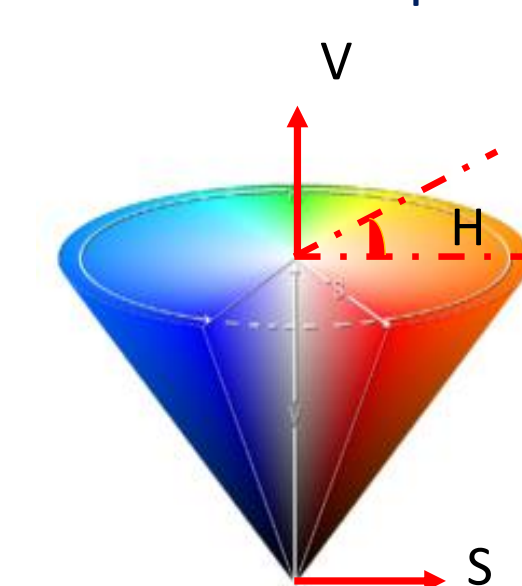Different color has different correlation with the memorability of natural-scene images.

Observation 2:
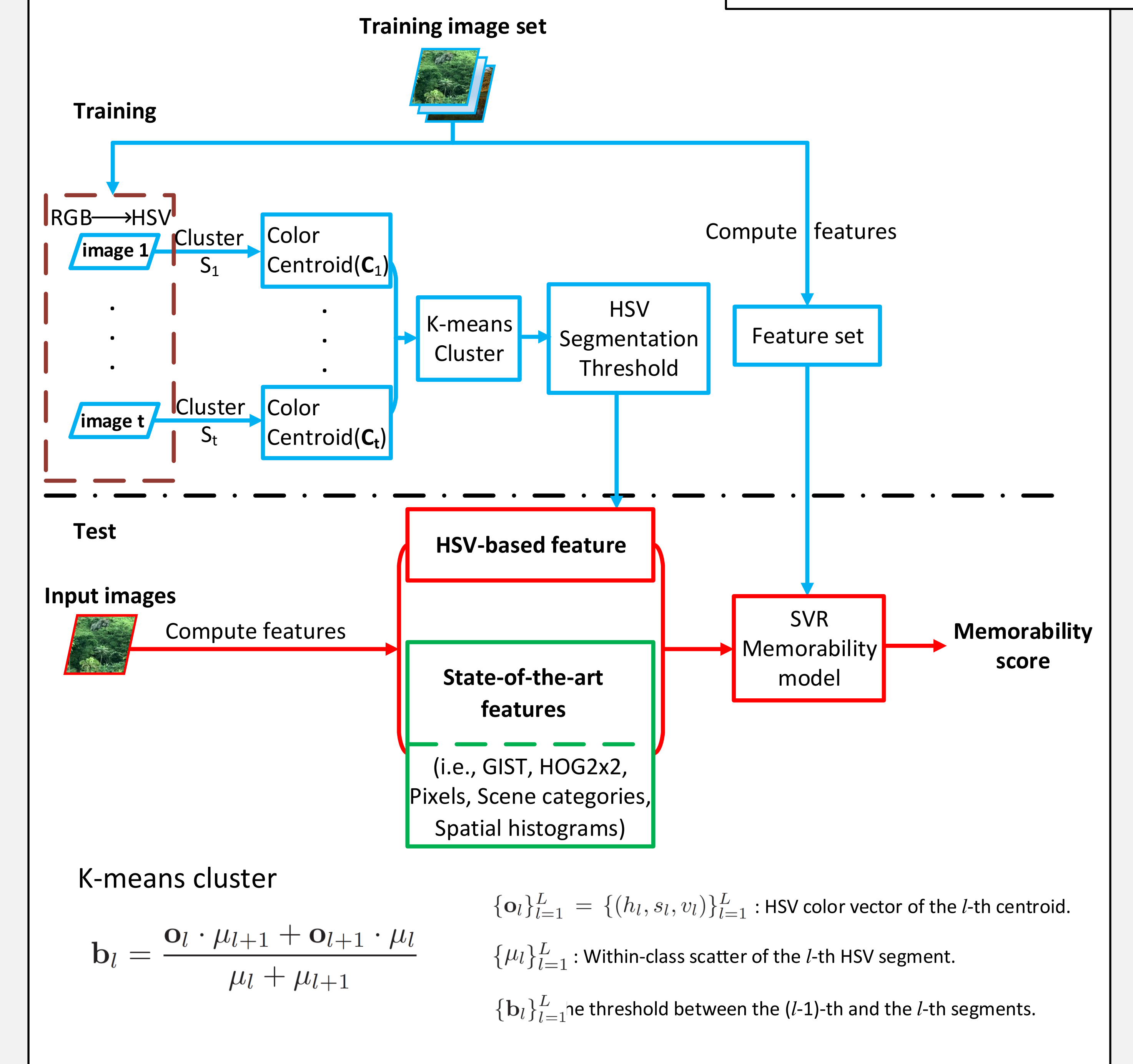Red component has higher correlation with memorability than blue component.
(The analysis is based on NSIM dataset.)

HSV-color model for our new feature?

HSV model is superior to RGB model in segmenting the whole color space.

Framework

Training image set

Training

RGB→HSV

Compute features

Feature set

Test

Input images

Compute features

HSV-based feature

State-of-the-art features

(i.e., GIST, HOG2x2, Pixels, Scene categories, Spatial histograms)

SVR Memorability model

Memorability score

K-means cluster

$$\mathbf{b}_l = \frac{\mathbf{o}_l \cdot \mu_{l+1} + \mathbf{o}_{l+1} \cdot \mu_l}{\mu_l + \mu_{l+1}}$$

$\{\mathbf{o}_l\}_{l=1}^{L} = \{(h_l, s_l, v_l)\}_{l=1}^{L}$: HSV color vector of the l-th centroid.

$\{\mu_l\}_{l=1}^{L}$: Within-class scatter of the l-th HSV segment.

$\{\mathbf{b}_l\}_{l=1}^{L}$: The threshold between the $(l-1)$-th and the l-th segments.

Experimental Results

Baseline prediction model: Isola *et al.* [1] and Khosla *et al.* [2]

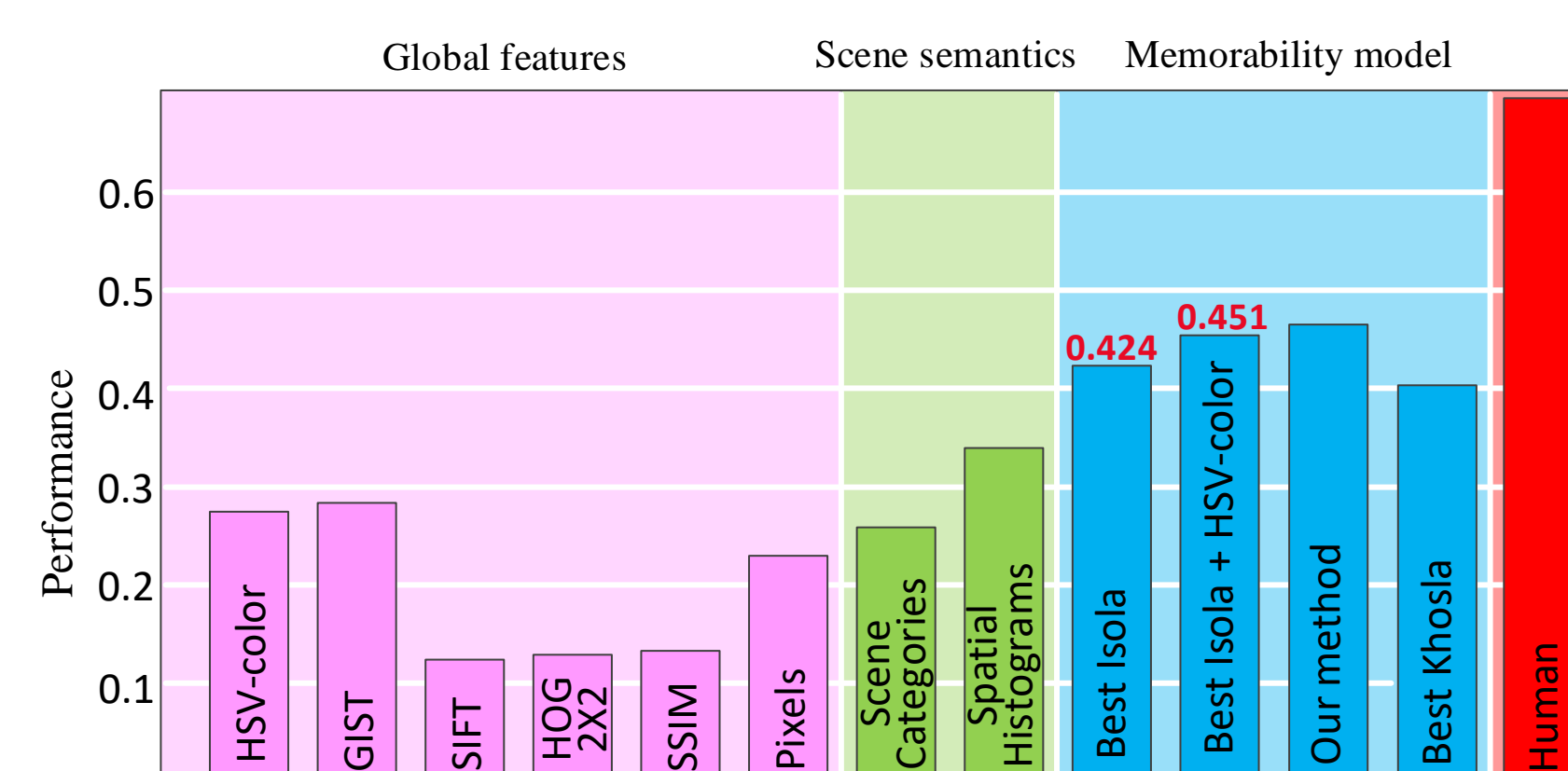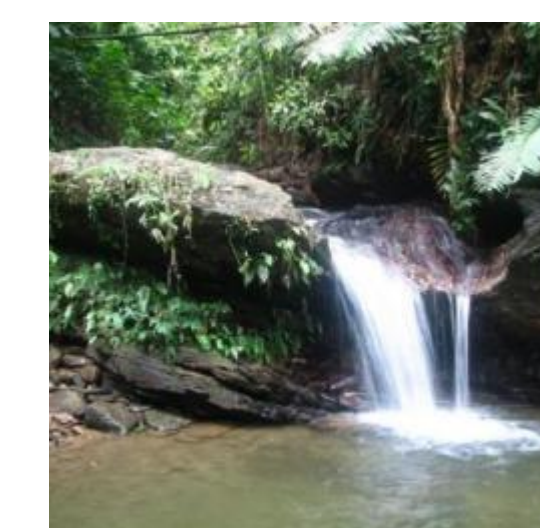|	Our method	[1]	[2]
ρ	**0.466±0.068**	0.424±0.070	0.404±0.069

Fig. 6 Rank correlation of predicted natural-scene image memorability.
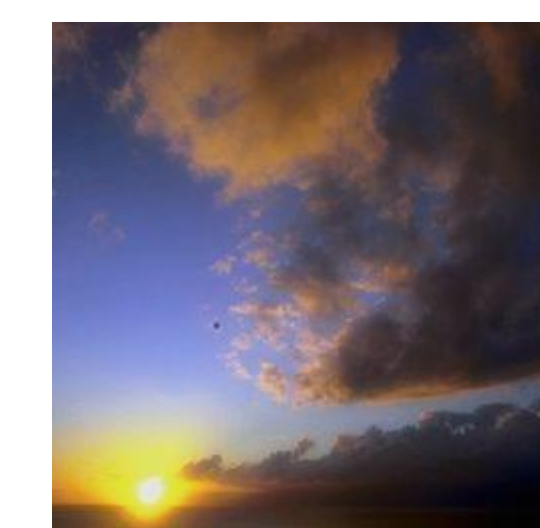
Adding HSV-based feature can increase ρ by 7.3%.

Comparison to ground-truth

Most Memorable   Memorable   Least Memorable

	Most Memorable	Memorable	Least Memorable
Groundtruth	0.7221	0.5793	0.2709
Prediction	0.7221	0.5797	0.2714

References

[1] Isola, Phillip, *et al.* "What makes an image memorable?." Computer Vision and Pattern Recognition (CVPR), 2011 IEEE Conference on. IEEE, 2011.
[2] Khosla, Aditya, *et al.* "Understanding and predicting image memorability at a large scale." Proceedings of the IEEE International Conference on Computer Vision. 2015.

Contact Information

- Email: lu-jia-xin@163.com
  MaiXu@buaa.edu.cn

- Phone: +86 13260126681