

Learning Color Names from Real-World Images

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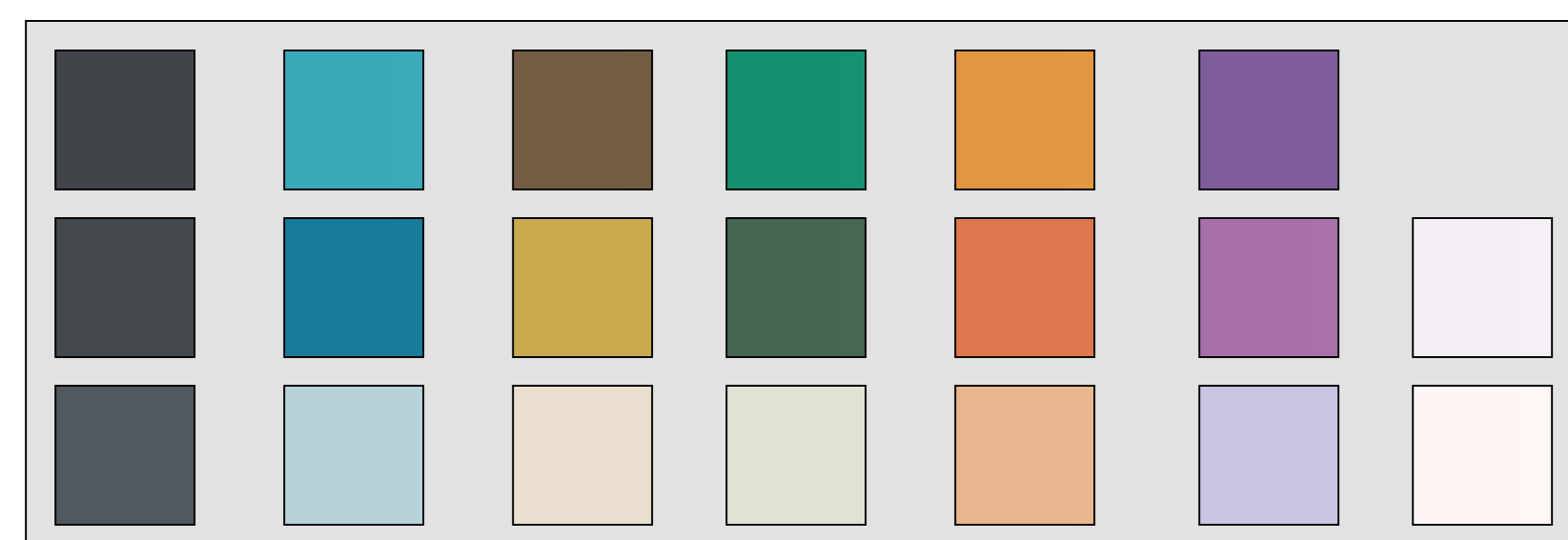
ABSTRACT Within a computer vision context color naming is the action of assigning linguistic color labels to image pixels. In general, research on color naming applies the following paradigm: a collection of color chips is labeled with color names within a well-defined experimental setup by multiple test subjects. The collected data set is subsequently used to label RGB values in real-world images with a color name. In this research we propose to learn color names from real-world images. We avoid test subjects by using Google Image to collect a data set. Due to limitations of Google Image this data set contains a substantial quantity of wrongly labeled data. The color names are learned using a PLSA model adapted to this task. Experimental results show that color names learned from real-world images significantly outperform color names learned from labeled color chips on retrieval and classification.

Research Problem

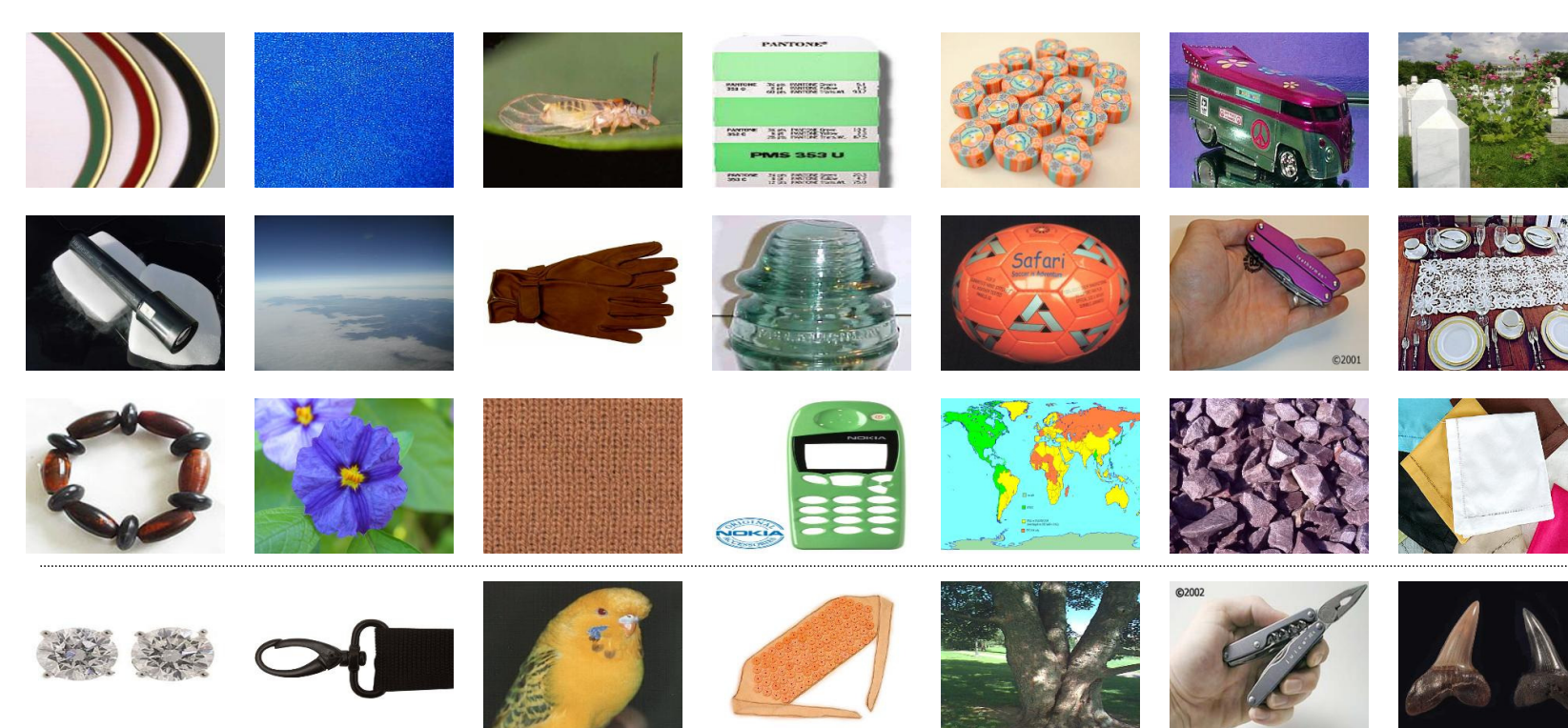
- Is it possible to learn color names from weakly labeled images retrieved from Google Image on the query of 'color name+ "color" ', e.g. "red+color" ?
- How do learned color names compare to chip-based color names, i.e. the traditional way to compute color names from color chips which are labeled by multiple test subjects in a well-defined experimental setup ?

Chip-Based vs. Real-World

Color Chips named by human test subjects



black blue brown green orange purple white



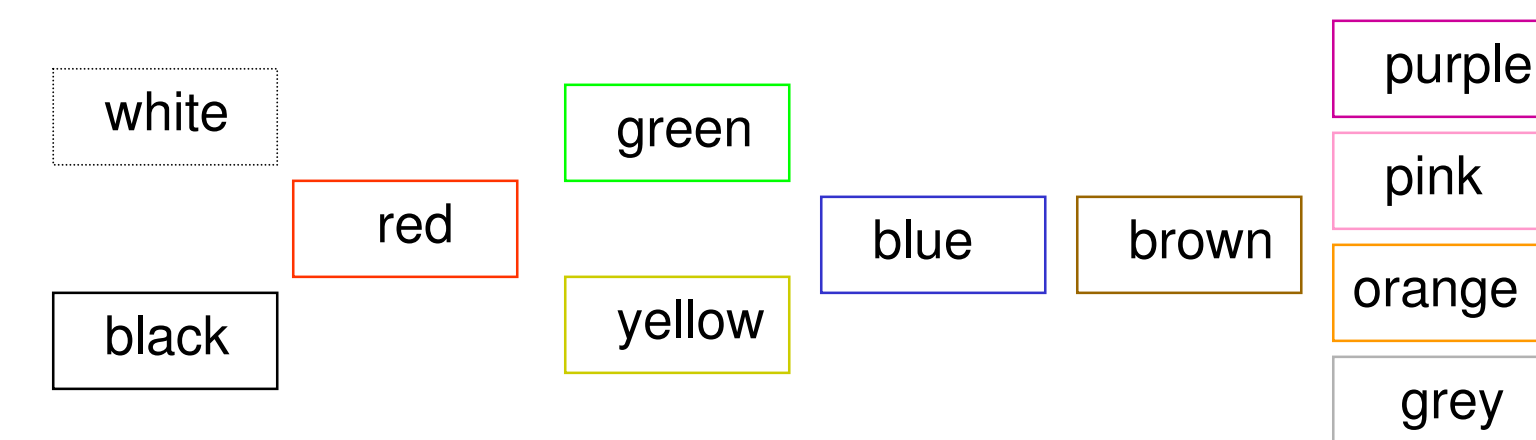
Images retrieved with Google image

Basic Color Terms

The English language consists of 11 basic color terms. These basic color terms are defined by the linguistics Berlin and Kay as those color names:

- which are applied to diverse classes of objects.
- whose meaning is not subsumable under one of the other basic color terms.
- which are used consistently and with consensus by most speakers of the language.

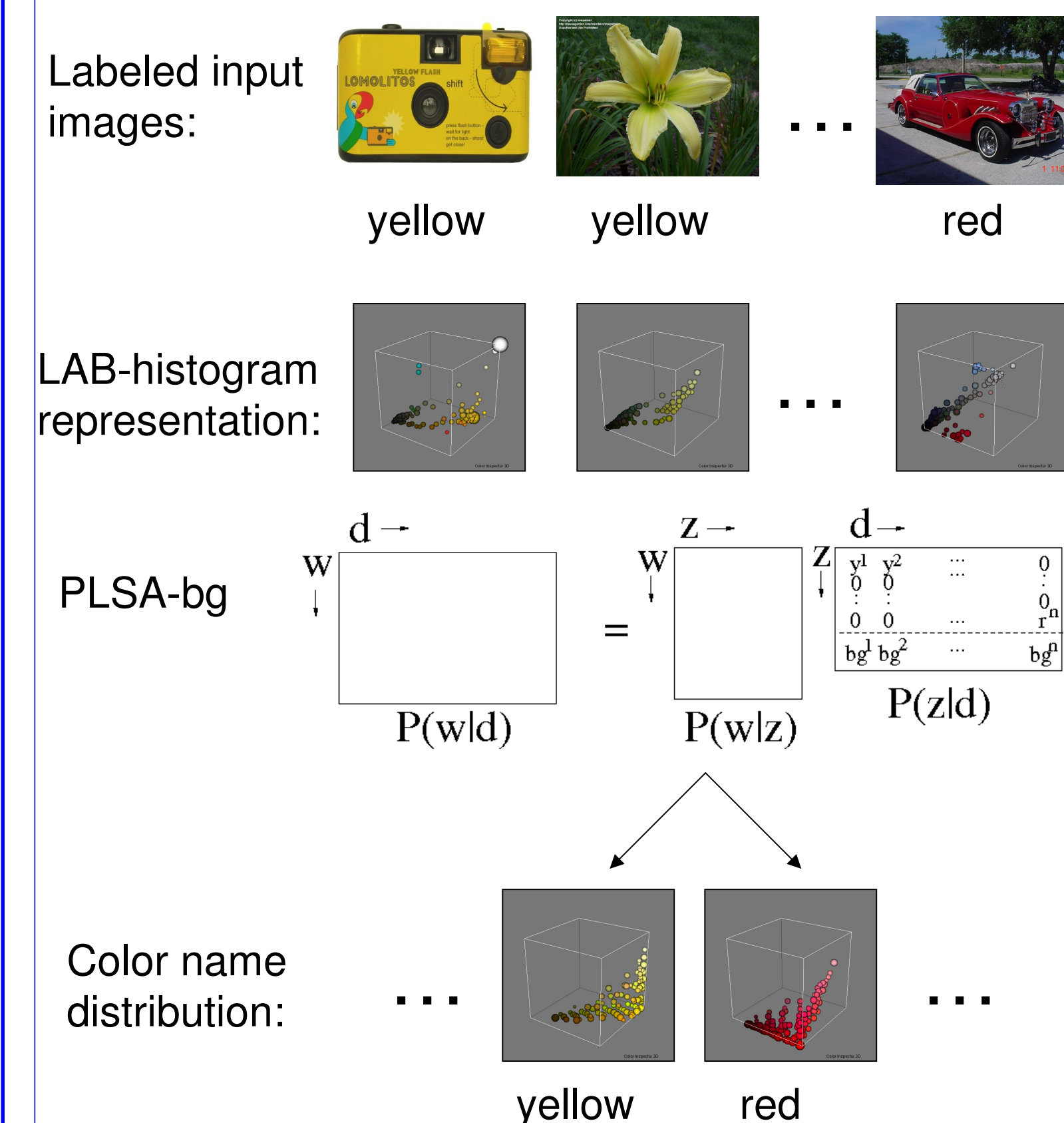
Development color names in languages:



Learning Color Names

Color names are learned with an adapted *Probabilistic Latent Semantic Analysis* (PLSA-bg).

Overview learning approach:



Data Sets

Google set: 1100 images queried with Google image, containing 100 images per color name.

Color Chip set: 387 labeled color patches (CVC lab)

Ebay set: 440 images of four categories labeled with color names collected from the Ebay auction site.

<http://lear.inrialpes.fr/data>

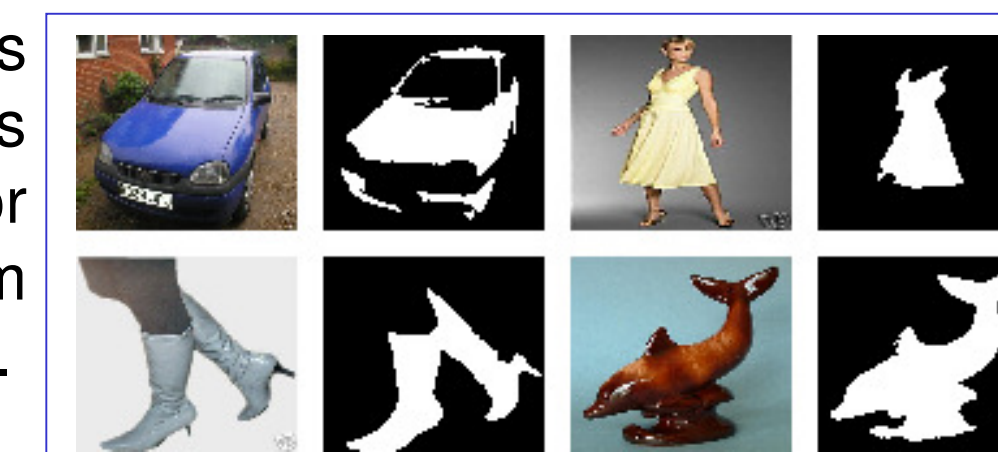


Image Retrieval

Image are retrieved (e.g. retrieve 'brown shoes') based on the percentage of pixels which has been assigned to the color name. EER are given.

method	train-set	cars	shoes	dresses	pottery	overall
chip-based	CVC	88	93	94	91	92
SVM	Google	91	96	96	91	94
PLSA	Google	89	95	94	92	93
PLSA-bg	Google	92	97	99	95	96
PLSA-bg	Google+Ebay	92	97	100	94	96

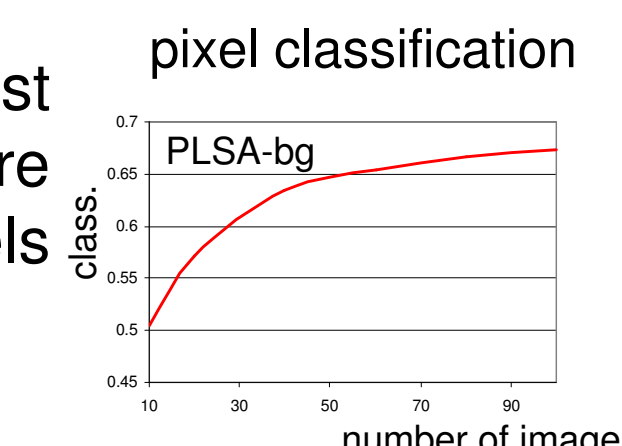
retrieval results for 'orange dresses'



Results

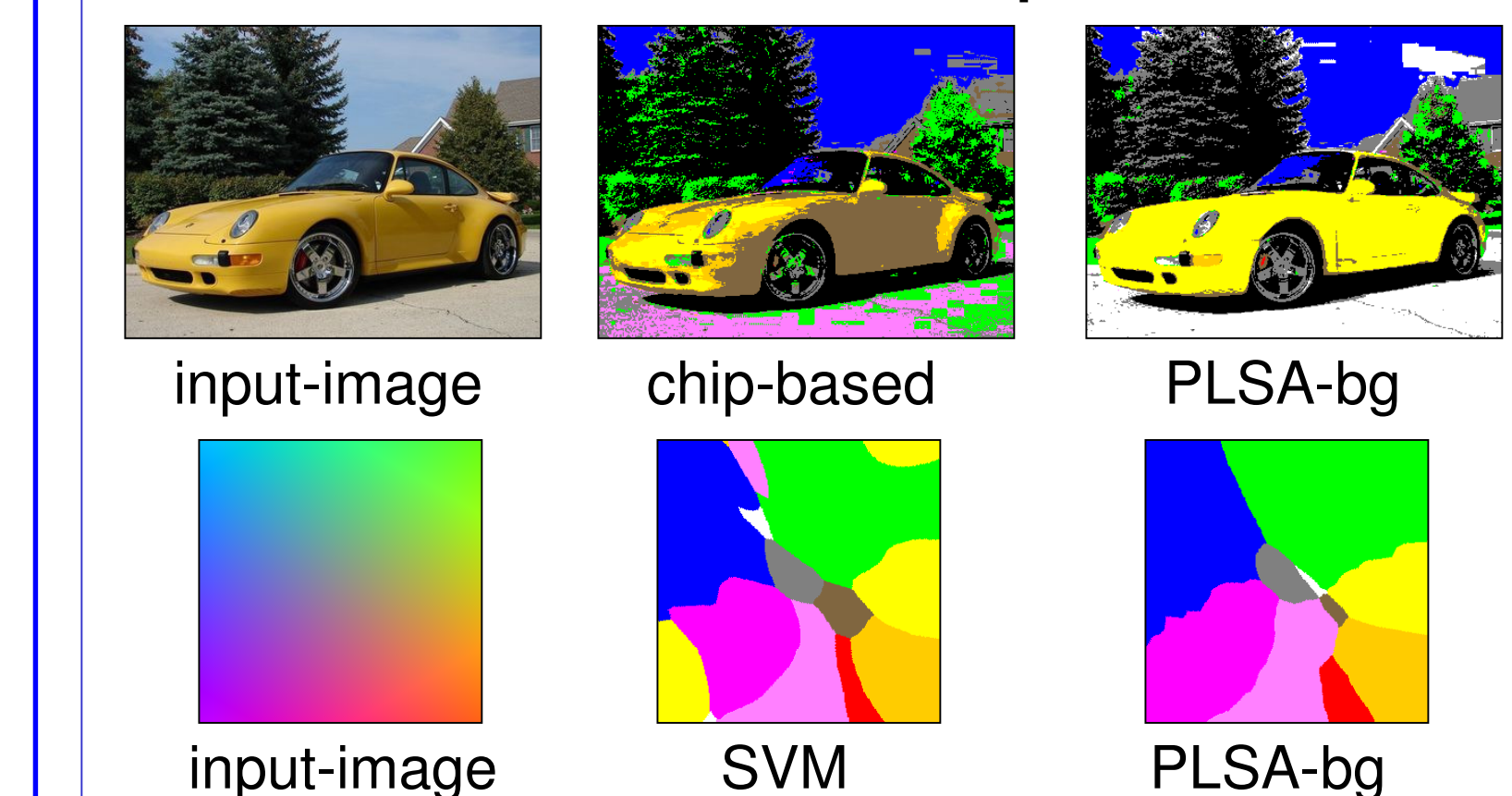
Pixel Classification

Pixels are assigned to their most probable color name. Results are given in percentage of pixels correctly classified.



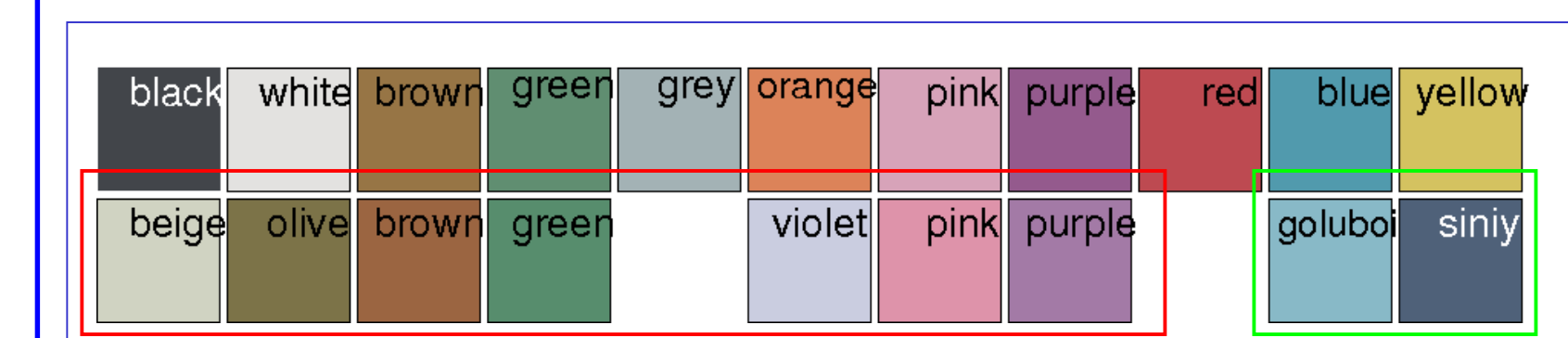
method	train-set	cars	shoes	dresses	pottery	overall
chip-based	CVC	39	60	62	50	53
SVM	Google	45	61	68	56	62
PLSA	Google	48	69	71	62	63
PLSA-bg	Google	51	71	81	66	67
PLSA-bg	Google+Ebay	53	73	84	71	70

pixel classification



Flexibility

Learning color names from Google has the advantage that the set of basic color terms can easily be varied.



- Added the color names beige, olive and violet.
- Replaced blue by the Russian blues goluboi and sinii.

Conclusions

- Results indicate that color names can be learned from weakly labeled images returned from Google Image search.
- Results show that color names returned from Google image outperform color names derived from human-named color chips. Pixel classification results improve by 17 % compared to chip-based color naming.
- We illustrate that color naming based on Google images is flexible in the set of basic color terms.