CLASSIFICATION-BASED COLOR CONSTANCY

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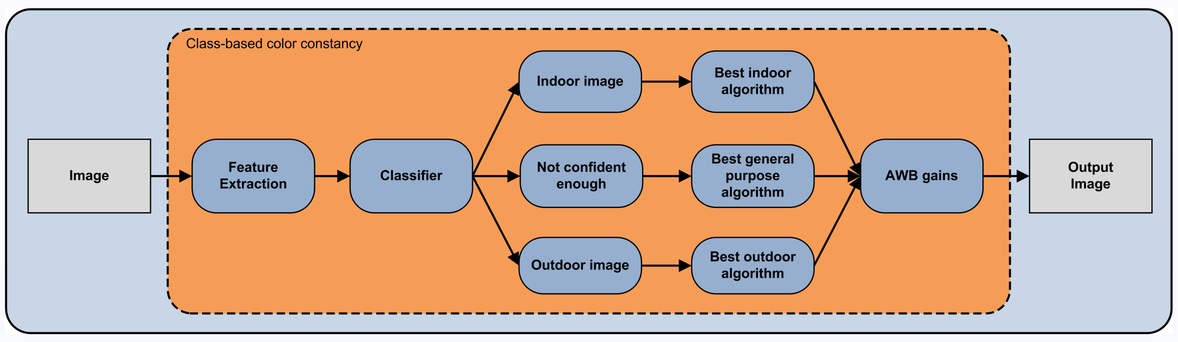
Abstract

We present two different classification-based approaches for color constancy which are part of a PhD thesis [6] founded by ST Microelectronics: the former exploits automatically extracted information about the content of the images [1]; the latter exploits intrinsic, low level properties of the images [2]. We have tested the proposed strategies on a suitable subset of the widely used Funt and Ciurea dataset [4]. Experimental results clearly demonstrate that classification based strategies outperform recently proposed general purpose algorithms [3].

Proposed approaches

Two different strategies for color constancy algorithm selection are proposed: a class-based (CB) [1] and a feature-based (FB) [2] approach.

In the class-based [1], the images are classified as indoor/outdoor/uncertain. The best algorithm for each class is identified among a set of state-of-the-art ones. To each image is applied the best algorithm for the predicted class.



In the feature-based [2] there are two different instantiations: in the former (FBs) the classifier predicts with which state-of-the-art algorithm, among the set considered, it is best to process the current image; in the latter (FBc) the classifier also gives as output the weights to combine the output of the different state-of-the-art algorithms considered.

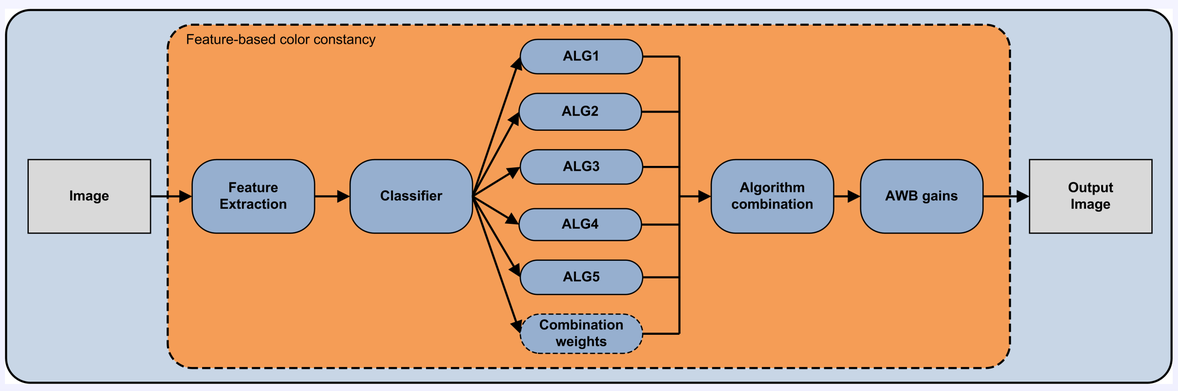


Image representation and classification

Two groups of low level features have been considered for image representation: general purpose and specifically designed features.

General purpose features used in [1, 2]			Specifically designed features used in [2]		
Name	Length	Category	Name	Length	Category
YCbCr color moments	42	Color	Number of colors	1	Color
RGB color histogram	27	Color	Cast indexes	2	Color
Edge direction histogram	18	Edges	Color clipping	8	Color
Wavelet statistics	20	Texture	Edge magnitude histogram	5	Edges

The classification is made by a decision forest composed of trees built according to the CART methodology. The decision forest is trained on feature vectors composed by the general purpose features for the CB approach, on feature vectors composed by both the general purpose and the specifically designed features for the FB approach.

Dataset

The dataset used is a subset of a widely used dataset with ground truth illuminant measurements [4]. The images which showed redundancy in terms of visual content were removed using an automatic tool [1] and only the most representative were retained.

Results

Results are reported on the test set in terms of angular error between the measured and estimated illuminant RGB color. The Wilcoxon sign test is used to generate a score (WST) representative of the algorithm performances (higher is better). The proposed strategies outperform the state-of-the-art algorithms considered.

Algorithm Type	Algorithm Name	Median	Mean	WSTs
Simple [3]	Do Nothing (DN)	6.05	8.07	0
	Gray World (GW)	5.95	7.27	0
	White Point (WP)	5.48	7.45	4
	1st order Gray Edge (GE1)	4.47	5.84	8
	2nd order Gray Edge (GE2)	4.65	6.23	7
	Shades of Gray (SoG)	5.80	7.03	2
	general Gray World (gGW)	5.80	7.01	2
Combining [5]	Average (AVG)	4.66	5.99	5
	Least Mean Squares (LMS)	4.12	5.29	9
	No 2 Max (N2M)	4.79	5.82	5
Class-based [1]	Class Based (CB)	3.54	4.89	10
Feature-based [2]	Feature Based select. (FBs)	3.21	4.76	11
	Feature Based comb. (FBc)	**3.04**	**4.46**	**12**

References

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