Modeling Relationship between Visual Impression of Commodities and Their Graphical Features

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Abstract: Consumers feel heavy burden to find Commodities suited individual preferences owing to large quantity of them on the Web. Therefore, it is necessary to classify Commodities based on subjective preferences. This paper describes the method to model the relationship between subjective visual impressions and objective graphical features through machine learning for each user. The way to describe the visual impression is to use adjectives used by the professional photographers. As graphical feature vectors, we compute Lab color histogram and SURF from Commodity photos. We estimate the subjective visual impression of Commodities and classify them by constructing classifiers for the impression groups using Random Forests. As a result of the experiment, the proposed method achieved 80.1% accuracy on average.

Key words: Modeling, Subjective Visual Impression, Machine Learning, Graphical Features

1. Introduction

Recently, consumers have the opportunity to look at Commodities on the Web frequently. However, consumers feel heavy burden to find Commodities suited individual preferences owing to large quantity of them on the Web. Therefore, it is necessary to classify Commodities based on subjective preferences.

This paper describes the method to model the relationship between subjective visual impressions and objective graphical features through machine learning for each user [1][2]. Thus, our method can estimate the visual impression of Commodity photos and classify them based on individual subjectivity by the model.

2. Representation of Visual Impression

The way to describe the visual impression of Commodities is to use four adjectives (which we call impression words) used by the professional photographers. Impression words we use are “Wild”, “Sharp”, “Fresh”, and “Natural”. According to the subjective visual impression, a user classifies training examples into groups labeled by impression words.

3. Graphical Features

Commodity photos giving us similar visual impression would have similar graphical features. To quantitatively represent Commodity characteristics, we compute graphical feature vectors of Commodity photos.

Visual perception system of human beings has photoreceptors, which extract features of colors and brightness. Then, by integrating and selecting features extracted by photoreceptors, human beings perceive shapes [3]. Colors and shapes greatly affect the impression of objects. Therefore, we compute their graphical feature vectors from Commodity photos.

3.1 Color Features

As the color graphical features, we calculated values of the color histogram in Lab color space. Unlike the RGB and CMYK color models, Lab color space (with ranges [0,100], [0,255], [0,255], respectively) is designed to approximate the visual perception system of human beings. Although many colors can be defined in computer system, the colors that can be recognized by human beings are limited. Thus, we calculated the 64 bins color histogram.

3.2 Shape Features

As the shape graphical features, we calculated SURF (Speeded Up Robust Features) [4]. SURF is a robust local feature detector that is used in computer vision tasks such as object recognition. We can describe the shape and structure of parts using SURF feature vectors. We construct the bag of features by K-means clustering algorithm (K = 500), quantize the SURF descriptors according to the bag of words. Thus, Commodity photos can be represented as the histograms of the visual words that are the features vectors of them.

4. Estimation of Subjective Visual Impression

To estimate the subjective visual impression of Commodities and classify them, by constructing classifiers for the impression groups using Random Forests [5], we model the relationship between impression words given by each user and their graphical feature vectors. Random Forests gives estimations of what variables are important in the classification. The variable importance is based on the Gini gain.

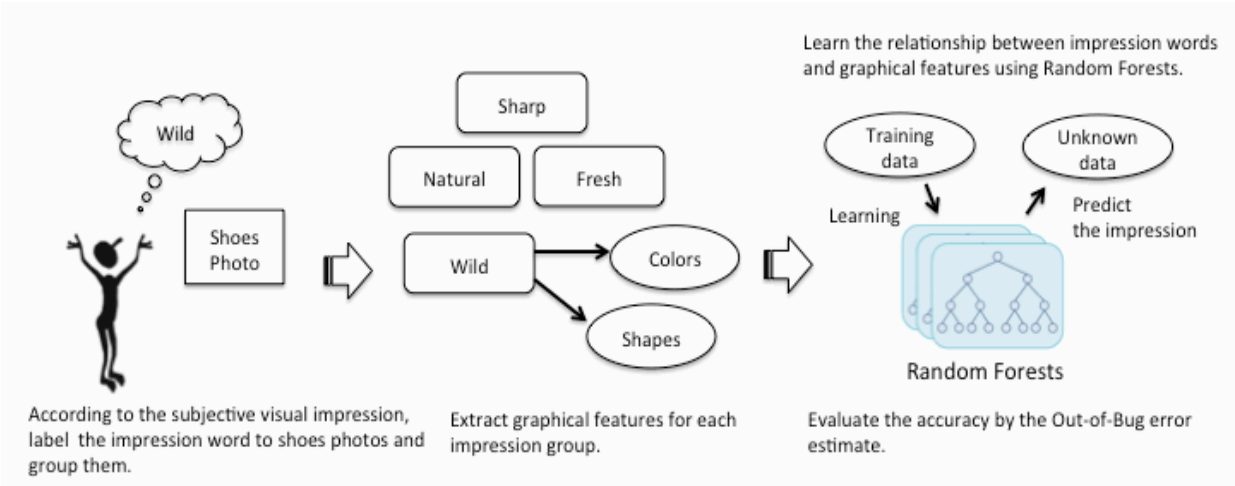

Figure.1 Experiment flow chart

5. Experimental Result

We evaluated the proposed method on the database of 300 shoes photos with 8 subjects. Figure 1 shows the experiment flow. As a result, the proposed method achieved 80.1% accuracy on average. Table 1 shows the

accuracy of the experiment. Thus, it can be said that simple graphical features can model the subjective preference. Table2 shows the Average variable importance based on Gini gain. The estimations given by Random Forests suggest that color variables are more important than shape in the classification.

Table.1 Experiment accuracy

Subject	Impression words				
	Wild	Sharp	Fresh	Natural	All
1	85.1%	89.1%	85.9%	80.2%	84.7%
2	83.5%	76.4%	38.5%	91.3%	78.7%
3	82.5%	91.5%	49.0%	85.7%	80.0%
4	86.7%	76.8%	85.7%	79.1%	82.7%
5	78.8%	64.0%	81.8%	78.8%	77.0%
6	66.7%	79.8%	69.5%	65.1%	70.7%
7	85.1%	84.6%	85.3%	75.6%	82.7%
8	83.3%	92.6%	88.9%	68.9%	84.3%
Average	81.5%	81.9%	73.1%	78.1%	80.1%

Table.2 Average Variable Importance (Gini gain)

Subject	1	2	3	4	5	6	7	8
Color Importance	2.42	2.49	2.86	2.26	2.39	2.69	2.29	2.38
Shape Importance	0.32	0.32	0.31	0.33	0.32	0.32	0.34	0.33

6. Conclusion

To classify Commodity photos on the Web based on subjective preferences, this paper describes the method to model the relationship between subjective visual impressions using impression words and objective graphical features through Random Forests for each user. The experimental result suggested that simple graphical features could model the subjective preference. In addition, it is found that color variables are more important than shape in the classification. In our future work, we intend to design low dimensional graphical features to describe the features more clearly.

6. References

[1] Tada, M., Kato, T. (2006) *Visual Impression Modeling Using SVM for Automatic Image Classification*. 2006 IEEE International Conference on Systems, Man and Cybernetics. pp. 872–877. IEEE.

[2] Uesaka, S., Yasukawa, K., Kato, T. (2011) *Kansei Modeling on Visual Impression from Small Datasets*. HCI International 2011, HCI International 2011-Posters' Extended Abstracts. pp.605–609.

[3] Spillman, L., Werner, J.S. (1990) *Visual Perception: The Neurophysiological Foundations. Academic Press*.

[4] Bay, H., Tuytelaars, T., Gool, L. Van. (2006) *Surf: Speeded up robust features*. Computer Vision ECCV 2006.

[5] Breiman, L. (2001) *Random Forests. Machine Learning*. 45, 5–32.