A Review of Aesthetic Evaluation of Images

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***Abstract*— Aesthetic image quality assessment (or aesthetic assessment) is the use of computers to automatically evaluate the "beauty" of images by simulating human perceptions and cognition of beauty [1]. Aesthetic image quality assessment is a new direction of intersection between computational aesthetics and computer vision, psychology, virtual reality, etc. Its core is to use computers to simulate human preferences for image content and composition, including the aesthetic stimuli formed under the influence of aesthetic factors such as images, so as to simulate human perception and cognition of beauty, automatically evaluate the "beauty" of images "The main purpose of this paper is to introduce the most recent work on the "aesthetics" of images. The main purpose of this paper is to present the recent developments in the evaluation of the aesthetic quality of images over the years.**

***Index Terms*— Image aesthetic quality evaluation, computational aesthetics**

INTRODUCTION

With the development of cell phones, computers, communication networks and other science and technology, pictures, videos and other information exist in our lives in large quantities. How to better manage and use these pictures and other information has become a new technical problem, such as whether the photos taken can be automatically modified, and whether some beautiful images in the cell phone camera video can be automatically captured? The core of this question is actually the question of how to evaluate the aesthetic quality of an image.

Aesthetic image quality evaluation investigates how to predict human emotional responses to visual stimuli using computable techniques that allow computers to mimic human aesthetic processes, i.e., to predict people's evaluation of the aesthetic quality of images using computable methods. The evaluation of the aesthetic quality of images is a very subjective task, which makes it more difficult to study because individuals may have different evaluations of the same image depending on their cultural background and habits. However, we all have the same perception of beautiful things, and there are only some small differences, so it is feasible to study the method of evaluating the aesthetic quality of images. The purpose of image aesthetic quality evaluation is to predict the results of popular evaluation of images, rather than individualized, niche evaluation. We are more interested in the relative ranking among the evaluated images than in the accuracy of the specific data of the evaluation results, and as long as the relative ranking is correct, the evaluation score can be transformed by mathematical transformation to any desired value range.

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Image Quality Assessment (IQA) is classified according to the amount of information provided in the reference image. No Reference-IQA, NR-IQA), and those with only partial information of the reference image or partial features extracted from the reference image are called Semi-Reference-IQA (Reduced Reference-IQA, RR-IQA), i.e., the purpose of the previous image quality is to distinguish the good and bad images for dichotomous classification, so the training is also based on the reference image and The image evaluation results in recent years have developed toward a more refined direction, and all selected datasets composed of images from daily life for training, instead of selecting deliberately created distorted images for training. Of course, there are many other applications of image aesthetic quality evaluation technology, but the above introduction shows that the use of image aesthetic quality evaluation technology can provide better services to people, free up hands, improve work efficiency, etc. Therefore, it is necessary and meaningful to further study the image aesthetic quality evaluation method. So the intention of this paper is to want to introduce the development of image aesthetic quality in recent years.

The method of image aesthetic quality evaluation is mainly divided into two major stages, the first stage does not use deep learning methods, and the second stage uses deep learning methods, which is equivalent to using deep learning methods to act as bounds for the description. Before the first stage mainly used the manual method to evaluate the aesthetic quality of the image, which is equivalent to the extracted features are known to themselves. And later the deep learning approach is to use convolutional neural networks and so on to extract aesthetic features for image aesthetic quality evaluation, but this method evaluation is black box, and the extracted features are not as good interpretable as the manual features.

The pioneering work in image aesthetic quality evaluation was a solution proposed in 2004 by the Department of Automation at Tsinghua University in conjunction with Microsoft Research Asia, where we solved a specific image classification task, that is, grouping photos according to whether they were taken by a photographer or a home user. First, a set of explicitly relevant low-level features is explored for such high-level semantic concepts of generic low-level functionality. Next are two different schemes proposed to identify those most distinguishing features and train them on a suitable classifier: one using boosting for both feature selection and classifier training; the other using feature inverse extraction and feature de-correlation using principal component analysis on label information; followed by maximum marginal feature selection for diversity and Bayesian classifier or support vector machine classification. In addition, we demonstrate an application of reference-free overall quality assessment as a natural extension of this

assessment for image classification. That is, the experimental results demonstrate the validity of the method [2], and this work is one of the earliest papers considered for the aesthetic quality evaluation of images.

Then came the time in 2006 when the visual content of images will be used as machine learning to automatically infer the aesthetic quality of images in this paper, with peer-rated online photo sharing sites as data sources. We distinguish between aesthetically pleasing and unpleasant images based on intuition to extract certain visual features. Automatic classifiers are constructed using support vector machines and classification trees. Linear regression on features of polynomial terms is used to infer numerical aesthetic ratings. The work attempts to explore the relationship between the emotions evoked by images in people's minds and the low-level content [3]. Potential applications include content-based applications in image retrieval and digital photography. This is the second article on the aesthetic quality of images.

By the time of 2014, the evaluation phase of the aesthetic quality of images proceeded to the era of deep learning, in which a lot of deep learning methods were born to solve the previous problems. The main purpose of using deep learning methods is to automatically extract the aesthetic features. As deep learning became more and more mature, researchers started to use deep learning for feature extraction. In general, AADB is considered a complement to the AVA dataset. The way the annotation was done, 5 people were asked and the final score was taken as the average of 5 people, with a total of 10,000 images. In addition to the labeled scores, 11 attributes were also labeled. The main difference with the AVA data set is that AVA contains many non-real photographic images and post-processed images, so the majority of the scores in AVA are over 5 (out of 10). Because of the small number of annotators, AADB specifically analyzes the consistency of annotators. This indirectly reflects the quality of the annotators, which proves that the annotators are of high annotation standard. The results have high consistency and are reliable; regarding the image properties, i.e., the style of annotation, AADB has added to AVA. The AADB has added to the AVA a binary classification evaluation (good and bad on individual aesthetic factors) of eight aesthetic factors (balance, color harmony, interest, depth of field, illumination, subject, thirds, color richness), however, the evaluation of aesthetic factors is too simple [4]. [NIMA [5] is based on a state-of-the-art deep object detection neural network that is able to predict the distribution of human evaluations of images from direct perception and attractiveness. The scoring of the neural network proposed in the paper has the advantage of being very similar to the subjective human scoring and thus can be used in image quality assessment work. In the training dataset, each image is linked to a human histogram, but traditional aesthetic scoring systems can still only classify image quality as good or bad. instead of using this classification and regression averaging, the NIMA algorithm generates scoring histograms for any image - that is, it scores images on a scale of 1 to 10 and directly comparing images of the same subject. This design is formally compatible with the histograms generated by human scoring systems, and the evaluation results are closer to those of human evaluation. The main objective is to predict the distribution of image quality scores as a histogram by using CNNs. At the same time, the EMD-based loss,which is based on the probability distribution of human evaluation of the image, is calculated and back propagated. The reason why this is done is that EMD has good performance in ordered classification, so it is used as loss. The reason for using classification instead of regression is that, according to the literature, the classification-based approach works better, and this classification is not purely independent of each other, because there is also a comparative relationship between classes, and EMD-based loss can do this.

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