Aesthetic Assessment of Photographic Images

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1 Abstract

We are going to propose software for automatic aesthetic assessment of photographic images.In this assessment, we will use computational approach and compare it with actual human assessment.Our software will sort images according to their aesthetic scores and can also remove poor quality images automatically. We are trying to identify important features or parameters that distinguish high and low quality images.
To understand high level semantic features, we identified calculable features for automatic assessment of photography aesthetics using machine learning methods. The calculation of features depends heavily on the identication of the subject in photographs. With the subject identied, we dened and implemented various features to analyze various aspects of a photograph.

2 Problem Statement

- Assessing the quality of images from their features using computational approach and comparing it with actual human assessment.
- Ordering of images in areas like websites by software.

3 Introduction

There is no unanimously agreed standard for measuring aesthetic value.Hence evaluating photo aesthetics proved to be challenging because of several reasons.Distinguishing 'images as high or low quality' is an abstract concept.Data available in images has been increasing exponentially and the solution for this is to select high aesthetic quality images automatically. Besides, there is rising need of organizing huge data without human efforts.

4 Literature Survey

Studying Aesthetic Photographic Images using a computational approach by R. Datta el al., used a set of low-level features followed by a classifier to achieve photo quality assessment.

Evaluating photo aesthetics using Machine Learning by D. Pogacnik et al., used high-level semantic features that

distinguish high quality photos from low quality snapshots. Evaluating Rule of Thirds in Photographs and Paintings by S. A. Amirshahi et al., studies the composition of object in an image on rule of third line.

Assessment of photo aesthetics with efficiency by Kuo-Yen Lo et al., demonstrates an efficient approach to assess photo quality without adopting any computation consuming techniques, such as subject detection or image segmentation.

5 Methodology

5.1 Data Acquiring from Survey

Collected 2650 images data including human rating from dpchallenge.com and photo.net.

5.2 Computable Features Identification

Identified all the important features that are computable by the machine and also affect the image assessing quality by human. We have studied various research papers and computable features on web to get features written in next section.

5.3 Feature Extraction

Extracted the features identified from all the 2650 images and stored the feature values in excel sheet for further machine learning process.
X denotes number of rows pixels
Y denotes number of column pixels.
I_R denotes intensity of red pixel in RGB space.
I_G denotes intensity of green pixel in RGB space.
I_B denotes intensity of blue pixel in RGB space.
I_H denotes intensity of hue pixel in HSV space.
I_S denotes intensity of saturation pixel in HSV space.
I_V denotes intensity of value pixel in HSV space.
The image is divided into 16 equal blocks denoting M_i.
w_i denotes the level i wavelet transform of an image.
The following is formulas of features calculated :

5.3.1 RGB composition

$$\frac{1}{X*Y}\sum_{x=0}^{X-1}\sum_{y=0}^{Y-1} I_R(x,y)$$

Similarly we can calculate for

$$I_G(x,y)$$

and

$$I_B(x,y)$$

5.3.2 Brightness

$$\frac{1}{X*Y}\sum_{x=0}^{X-1}\sum_{y=0}^{Y-1}(I_R(x,y)+I_G(x,y)+I_B(x,y))/3$$

5.3.3 Luminance

1. Ist Method

$$\frac{1}{X*Y}\sum_{x=0}^{X-1}\sum_{y=0}^{Y-1}0.2126*I_R(x,y)+0.7152*I_G(x,y)+0.0722*I_B(x,y)$$

2. IInd Method

$$\frac{1}{X*Y}\sum_{x=0}^{X-1}\sum_{y=0}^{Y-1}0.299*I_R(x,y)+0.587*I_G(x,y)+0.0114*I_B(x,y)$$

3. IIIrd Method

$$\frac{1}{X*Y}\sqrt{\sum_{x=0}^{X-1}\sum_{y=0}^{Y-1}0.299*I_R(x,y)+0.587*I_G(x,y)+0.0114*I_B(x,y)}$$

5.3.4 Exposure and Colourfulness

$$\frac{1}{X*Y}\sum_{x=0}^{X-1}\sum_{y=0}^{Y-1} I_V(x,y)$$

5.3.5 Hue

$$\frac{1}{X*Y}\sum_{x=0}^{X-1}\sum_{y=0}^{Y-1} I_H(x,y)$$

5.3.6 Saturation

$$\frac{1}{X*Y}\sum_{x=0}^{X-1}\sum_{y=0}^{Y-1} I_S(x,y)$$

5.3.7 Rule of thirds

$$\frac{9}{X*Y}\sum_{x=X/3}^{2X/3}\sum_{y=Y/3}^{2Y/3} I_H(x,y)$$

5.3.8 Size and Aspect Ratio

$$X+Y$$

$$X/Y$$

5.3.9 Wavelet Based Transform

$$\frac{1}{Si}\left\{\sum_{x=0}^{X-1}\sum_{y=0}^{Y-1} w_i^h h(x,y) + \sum_{x=0}^{X-1}\sum_{y=0}^{Y-1} w_i^h l(x,y) + \sum_{x=0}^{X-1}\sum_{y=0}^{Y-1} w_i^l h(x,y)\right\}$$

We can calculate for different wavelet transform levels i = 1,2,3 for hue, saturation and value.

5.3.10 Depth of Field

$$\frac{\sum_{(x,y) in M_6,M_7,M_{10},M_{11}} w_3(x,y)}{\sum_{i=1}^{16}\sum_{(x,y) in Mi} w_3(x,y)}$$

For hue,saturation and value.

5.3.11 Blur and Simplicity

This is implemented using opencv methods.

5.4 Machine Learning

Compared different models in azureML using different training datasets. These models include

1. Poisson Regression
2. Boosted Decision Tree Regression
3. Neural Network Regression
4. Bayseian Linear Regression
5. Decision Forest Regression

6. Linear Regerssion

We analysed these regression models on basis of standard metrics :Mean Absolute Error, Mean Square Error,Relative Absolute Error and Coefficient of Determination.

5.5 Aesthetic Score Prediction

Using most accurate regression model, Boosted Decision Tree found from above comparative study that can quantitatively predict the aesthetics score based on features calculated.
Boosting is one of several classic methods for creating ensemble models, along with bagging, random forests, and so forth. In Azure Machine Learning Studio, boosted decision trees use an efficient implementation of the MART gradient boosting algorithm. Gradient boosting is a machine learning technique for regression problems. It builds each regression tree in a step-wise fashion, using a predefined loss function to measure the error in each step and correct for it in the next. Thus the prediction model is actually an ensemble of weaker prediction models.
We tuned our regression model using given parameters in azureML studio and found optimal set of parameters.

5.6 Practical Application

Applying software in practical use case.e.g. organizing images , giving suggestions for good photography.

6 Experiments and Result

- After assessing different features collected, some of the features could not give accurate result and hence need to be removed.
- Increasing the variety in Images improves machine learning model to achieve more real world analysis.
- Increasing the size of training datasets increases the accuracy of Aesthetic score prediction.
- After comparison between different machine learning algorithms, Boosted Decision Tree Regression algorithm is found to be most accurate of about 65%.

7 Conclusions

We implemented a software for photo aesthetics assessment. It is very subjective task to understand the correlation of human emotions and pictures they see by a computational approach. We found that some of the features is not correlated with aesthetic ratings. There are yet a lot of open avenues in this direction.

8 References

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