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Aesthetics in Digital Photography: A Survey

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Abstract: ***Due to the rise in the popularity of digital cameras and digital photography, there are huge volumes of visual data available on the web. Some of these visual pictures are very beautiful and aesthetically pleasing while the others are not so appealing. Photo aesthetics is an emerging field of research which can categorize large image collections into aesthetically good and bad photographs. In our paper we discuss the existing aesthetic image evaluation on the basis of: 1) low level attributes e.g. color, texture, edges 2) Middle level attributes e.g., contours, shapes and regions. 3) High level attributes e.g. image composition, image content and sky attributes. We discuss image retrieval with respect to the relationships between the high, middle and low level attributes to reduce the semantic gap between the high level semantic features and low level attributes .Image aesthetics is a high level image retrieval attribute, we discuss and analyze the various aesthetics classification and prediction methods prevalent for determining the aesthetic inclination of an image.***

Keywords*: Photo aesthetics, aesthetic image evaluation, low level attributes, middle level attributes, high level attributes, image retrieval, semantic gap*

I. INTRODUCTION

Due the advent of photo galleries and social networking websites, digital photography is here to stay. The extraction and retrieval of semantic content of photographs has been equally important and in demand. Humans interpret photographs on the basis of high level concepts/attributes and computers interpret images on the basis on low level concepts/attributes [1] .Thus, there is a necessary semantic gap that needs to be reduced for efficient image retrieval. This paper is organized in the following manner: Section II relates to the discussion of the high/middle/low level image attributes. Section III relates to the discussion of reducing the semantic gap between the various image attributes. Section IV Discusses different techniques in prediction of image aesthetics namely Classification and Regression. Section V Compares the different techniques prevalent for computation of image aesthetics. Section VI is Conclusion.

II. DESCRIBING IMAGE AESTHETCS

A. The Low Level Attributes

Color, contrasting colors, blur, hue, saturation, brightness, texture, edge detection.

1) *Color/ Colorfulness:* It is a global property of a picture and colorful pictures are considered pleasing. A color histogram can be computed and determine its deviation factor from a given set of histograms from prototypic colorful images and less colorful images. Color is represented as RGB image of M X N pixels. A color has Hue, Saturation and Value (Brightness).Common color descriptors include color-covariance matrix, color histogram, color moments and color coherence vector.
2) *Color Contrast:* It consists of opposing colors. Contrasting colors are more attention catching.
3) *Blur:* Blurring is present, to some extent, in all imaging processes, including photography. The presence of blur produces unsharpness
4) *Hue:* which specifies the specific tone of color; it is also the color spectrum. "Hue" differs slightly from "color" because a color can have saturation or brightness as well as a hue.
5) *Saturation:* Saturation is the intensity of a hue from gray tone (no saturation) to pure, vivid color (high saturation).
6) *Brightness:* Brightness is the relative lightness or darkness of a particular color, from black (no brightness) to white (full brightness)
7) *Texture:* is a set of metrics calculated in image processing designed to quantify the texture of the image. The image texture describes the spatial arrangement of color or intensities of an image or its selected region. The popular six tamura features for texture classifications are: - coarseness, directionality, regularity, line-likeness, contrast and roughness. Texture recognition can be supervised [1] or unsupervised [1].Popular approaches like Gabor filters, Multi-channel Gabor decomposition, Wavelet Transforms, Markov random fields are prevalent.
8) *Edge:* An edge characterizes boundaries. Edges in images are areas with strong intensity contrasts and thus a jump in the pixel intensity can create a variation in image quality. Canny edge detection and Sobel approaches are widely used for edge detection.

TABLE I.
Summarization Of The Low Level Features And Their Retrieval Techniques

Low Level Features	Retrieval Techniques
Color	RGB color space, Color co-variance matrix, color histogram, color moments and color coherence vector.
Blur	Harr wavelet transform, Canny edge detection and Hough transform
Hue, Saturation and Value	HSL and HSV are simple transformations of RGB
Texture	Gabor filters, Gabor decomposition, transforms, Markov random fields
Edge	Canny edge detection, Sobel edge detection, Robert, Prewitt

B. Middle level Features

Middle semantics is based on visual dictionary [4]. The step of creating the visual dictionary by first extracting low-level visual features, and then forming visual words through K-means clustering [5].The description of the image transforms the underlying feature into visual words. Some middle level features [4] are:-

1) *Image Regions/Segmentation:* Image segmentation is the process of partitioning a digital image into multiple segments (set of pixels).The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. There are a number of segmentation approaches like grid based, clustering based, contour based, model based, graph based, region growing based.
2) *Contours:* The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (edge detection)
3) *Shape:* Shape does not refer to the shape of an image but to the shape of a particular region that is being required. Shapes will often be determined first by applying segmentation or edge detection to an image.

Table II .
Summarization Of The Middle Level Features

Middle Level Features	Retrieval Techniques
Regions	Grid based, clustering based, contour based ,model based, graph based, region growing based
Contours	Contour detection algorithms(along with edge detection)
Shape	Edge based shape detection methods, generalized Hough transform

C. High Level Attributes

The high level attributes are used by humans to describe an image [6]. The high level attributes for images can broadly fall into three categories [7]:-

Composition of an image is an arrangement of objects and colors that follow some well-known photographic rules. The composition of an image can be described by :-

a) Presence Of A Salient Object: A photo depicting a large salient object that is well separated from its background
b) The Rule of Thirds: A photo where the main subject is located near one of the four dividing lines on the image.
c) Low Depth of Field: The region of interest is in sharp Focus and the background appears blurred.
d) Opposing Colors: A photo that displays color pairs of Opposing hues.
e) Simplicity: The simpler is the scene the more pleasing it is.

1) *The Image Composition Described In Detail*

a) *Presence Of A Salient Object:* There is a lot of literature on detection of a salient object. The salient object detection is an image segmentation problem, where the salient object is separated from the image background. A set of novel features including multi-scale contrast, center-surround histogram, and color spatial distribution is used to describe a salient object. A Conditional Random Field is learned to effectively combine these features for salient object detection The Conditional Random Field is trained on a set of images that contain highly salient objects [4]. A variety of methods have been recently developed to estimate visual saliency from images, algorithms like Graph Based visual saliency[7],Frequency Tuned saliency regions[8] and Global Contrast based salient region detection[9] yield successful salient object detection results.

b) *The Rule of Thirds:* If two imaginary vertical and two imaginary horizontal lines divide the image into 6 equal parts, then the compositional rule of thirds says that the image will be more aesthetically pleasing to place the main subject of the picture on one of these lines or on one of their intersections. The salient object detector should detect the object around the intersection of these lines. Minimum distance between the center of mass of the predicted saliency mask and the 4 intersections of third-lines. The computation of minimum distance between the center of mass of the predicted saliency mask and the 4 intersections of third-lines. The product of these two numbers is used to predict whether an image follows the rule of thirds. There are a lot of classic machine learning techniques including Naïve Bayesian classifiers, Support Vector Machines and, Adaboost, KNN [1]

c) *Low Depth Of Field:* An image displaying a low depth of field (DoF) is one where objects within a small range of depths are captured in sharp focus, while objects at other depths are blurred.SVM classifiers can be trained on daubechies wavelet based features that indicate the blur amount. The wavelet transform is applied to the image and then consider the third level coefficients of the transformation in all directions. Using a 4x4 grid over the image, divide the sum of the coefficients in the four center regions by the sum of coefficients over all regions, producing a vector of 3 numbers, one for each direction of the transformation

d) *Opposing Colors:* Some colors as single, pairs or combinations are more pleasing to the eye than others. This intuition gives rise to the opposing colors rule which says that images displaying contrasting colors (those from opposite sides of the color spectrum/hue) will be aesthetically pleasing. Classifiers are trained to predict opposing colors using an image representation based on the presence of color pairs. At first discretize pixel values into 7 values, then build a 7x7 histogram based on the percentage of each color pair present in an image and train an SVM classifier on 1000 manually labeled images from Image databases.

e) *Simplicity:* The main object should be in focus, and the distracting objects should be kept to minimum. The size of the object and its color brightness/relative brightness are correlated with objects dominance in the scene. Even a smaller object can catch attention with its color combinations

2) *Image Content Attributes:* Content of the image is a major contributor to human aesthetic judgment. Content of the image could have the following:-

a) *Presence of People:* a photo where faces are present.

b) *Portrait Depiction:* a photo where the main subject is a single large face.

c) *Presence of Animals:* Whether the photo has animals.

d) *Indoor-Outdoor Classification:* whether the photo was captured in an indoor setting, or outdoor setting.

e) *Scene Type:* natural scenes/, manmade scenes

i) *Presence of Humans:* The Viola-Jones face detector can detect the image faces with the help of skin detection, so that this can render precise results because there could be false faces in trees and mountain tops. Binary classifiers can be used for this prediction that tells whether face has been detected or no. For portrait detection, images can be classified as positive if the face detection size is greater than 0.25 image sizes.

ii) *Presence of Animals:* SVM classifiers are trained using the intersection kernel computed on spatial pyramid histograms. Image dataset belonging to animal categories can be considered.

iii) *Indoor/Outdoor Classification:* SVM classifiers are trained for classifying the Indoor and Outdoor light settings.

iv) *Natural Scenes/Manmade Scenes:* Natural scenes can be with or without people. The images can be segmented into arbitrary shaped regions and detection of people in the images. The local image regions are classified using low level features into semantic classes like water, sand or sky. Finally frequency of these semantic classed would determine the high level scene category.

3) *Natural Lighting Conditions/Illumination Of The Image:* Illumination can greatly affect the insight of an image – e.g. interesting conditions such as indirect lighting can be more aesthetically appealing. The natural outdoor illumination through the three attributes:

a) *Clear and Bright Skies:* Photos taken in sunny clear conditions with maximum illumination.

b) *Cloudy and Dull Skies:* Photos taken in cloudy and dull conditions.

c) *Sunset Skies:* Photos taken with sun positioned low in the sky.

Sky attribute classifier can be trained if we first extract rough sky regions from images using Hoeim et al's work on geometric context [9]. This work automatically divides image regions into sky, horizontal, and vertical geometric classes using Adaboost classifier on a variety of low level image features.

The predicted sky regions we compute 3D color histograms in HSV color space, with 10 bins per channel, and train three sky features using SVMs on manually labeled images from image databases.

Table III.
Summarization Of The High Level Features

High Level Features	Retrieval Techniques
Objects	Graph Based visual saliency, Frequency Tuned saliency regions, and Global Contrast based salient region detection.
Rules of Third	Naïve Bayesian classifiers, Support Vector Machines and ,Adaboost
Low depth of field	SVM classifiers can be trained on daubechies wavelet based features that indicate the blur amount.
Simplicity	Color combination techniques, RGB.
People	the Viola-Jones face detector with skin detection algorithms
Animals	SVM classifiers
Indoor/Outdoor Natural scenes/Manmade scenes	SVM classifiers
Sky illumination attributes	Region classification features trained on low level characteristics

III.BRIDGING THE SEMANTIC GAP

Humans tend to use high-level features such as keywords or text descriptors to interpret images and measure their similarity, and computers extract usually low-level features, and there seems to be no link between high and low level features [4].

It is sometimes difficult to meet the high level image descriptions of the image with the low level features of the image. Basically content based image retrieval systems basically use low level features [9].

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The CBIR can be designed for a 3 level retrieval.

1) *Level 1:* Retrieval by low level features such as color, texture.

2) *Level 2:* Retrieval of objects of given type identified by derived features that have some degree of logical implications.

3) *Level 3:* Retrieval of high level attributes, this involves high level reasoning.

The gaps between Level 1 and level 2, level 3 together is known as the semantic gap. This does mean that the difference between the low level image features and the richness of the user semantics can be referred to as the semantic gap.

Thus, color , a low level attribute can be mapped to its middle level by segmenting the image based on color , the different segments formed by segmentation process are the middle level attributes, these segments together form to make an object, which is high level attribute.

IV. RELATION OF LOW LEVEL FEATURES TO HIGH LEVEL SEMNATICS

There are several systems for reducing the semantic gap.
In [10] the techniques for reducing the semantic gap are:-

1) *Object Ontology:* Algorithms to applications with simple semantic features, for describing the high level concepts.
2) *Machine Learning:* This concept uses supervised or unsupervised machine learning tools to associate low level features with the high level query concepts. The supervised learning algorithm analyzes the training data and produces a function, which should predict correct output value for any input value. SVM, Bayesian Classifiers, Decision Trees e.g. ID3 and CART. In unsupervised learning the goal is to describe how the labeled input data are clustered. K-means Clustering, NCut, LPC techniques are used.
3) *Relevance Feedback:* These are online methods. The user decides and marks which results he considers "related" and which images he considers "unrelated "The machine learning algorithm learns the users feedback and the user can retrieve other similar images. The process iterates till the user finds relevant images. Re-weighting, Query Point movement, Machine learning in RF loop are popular techniques for relevance feedback.
4) *Semantic Template:* Semantic templates are generated from a collection of images.
5) *Web Image Retrieval:* provides additional information like image URL, and any description related to the image.
6) Frequency Domain Features: Image search and retrieval focuses on feature vectors based on real and imaginary parts of the mathematical complex numbers of image transformed by FFT (Fats Fourier Transform), DST (Discrete Cosine Transform) or WALSH transform.

V. APPROACHES AESTHETICS IN IMAGES

Aesthetics is a high level image perception characteristic. An image can be aesthetically appealing or not so aesthetically appealing. Aesthetics is a high level human semantics that needs to be mapped on to the low level image composition. Positive appraisal of any artwork or positive appraisal of an image is aesthetic appreciation of that art work or image.

A. Issues in Aesthetic Inference

Aesthetic responses are usually very subjective or personal, and difficult to measure even among human-beings. From a computational approach it is necessary to quantify these responses so that mathematical formulations could be made possible. User ratings provide a useful way to capture these values in a numeric form. Though the problem is formulating numeric aesthetic values. The source of data, the nature of data, the categories or prediction ranges vary according to the different learning methodologies adopted.

B. Approaches in Aesthetics:-

The two major approaches in predicting the aesthetics of an image are:-

1) *The Bottom- Up Approach:* This approach uses the low level image features for aesthetics class prediction.
2) *The Top-Down Approach:* This approach uses the high level image features for aesthetics class prediction.

a) The Bottom–up Approach for Aesthetics Prediction: Every image has a set of low level characteristics that define them [10].These low level characteristics or their combinations can be used for feature selection and classification. Classification can be done according to different image categories [11][12][13][14][23] . Image aesthetics can be defined by some prominent low level characteristics like the following:- Low level features like color, texture, saliency, edge and intensity are expected to capture the image perceptual properties, and therefore are widely considered to define image aesthetics.

b) Color Harmony and Aesthetics: Color is a very important low level characteristic in determining the aesthetic quality of an image [15].

i) Color Harmony: When the relative values of hue, chroma, and lightness do not appear ambiguous, the two colors are considered to be in harmony. This model presents three types of color harmony: 'Contrast,' which is a target color that is significantly different from a chosen color, 'Similarity,' which is a resembling color, and 'Identity,' which is the same color. The local regions of an image are sampled, on the basis of simple color patterns and the quantization of these features, finally the image is represented as a histogram of quantized features. The support vector machine (SVM) classifier is trained by using sample images, with aesthetic qualities labeled by various individuals.

c) *Texture and Aesthetics:* Texture is an essential factor for human aesthetic perception [16]. There is a significant relationship between texture feature subsets and aesthetic properties [17].

The well-known texture features the describe aesthetics are:- Coarseness, contrast, directionality, line-likeness, regularity, and roughness [18]. There are many texture analysis methods used for texture categorization, these methods are:-

i) Gray Level Co-occurrence Matrix
ii) Neighborhood Gray-Tone Difference Matrix
iii) The Tamura features
iv) The Fourier spectrum
v) The Gabor filters

d) *Edges and Aesthetics:* Spatial edge detection and the edges are important in image depiction because the edges are responsible for region detection as well as shape of object detection [19] [20].

Table IV.
Summarization Of Image Characteristics And Their Aesthetic Effects

Image Characteristics	Aesthetic effects
Color	Color combinations evoke pleasing emotions and add aesthetic appeal to the image.
texture	Smooth texture adds aesthetic appeal, rough texture do not.
Edge	Edges diagonally dominant adds aesthetic appeal to the image.
Blur	Blurring the background adds aesthetic appeal to the object in focus.

e) *The Top-Down Approach for Aesthetics Prediction:* Photographers usually use semantic/high level terms to describe photographs or aesthetically categorize them [24]. Photographers usually follow the principle of composition that usually comprises the following:-

i) Rule of Thirds
ii) contrasting/complementary colors
iii) Close up shots with high dynamic ranges.

The Rule of Thirds that specifies that the center of interest should lie at one of the four intersections lines on the image, its degree of adherence is measured as the average hue, saturation and intensities within the inner third region of the photograph. It has also been observed that pictures with simplistic composition and a well-focused center of interest are more pleasing than pictures with multiple different objects.

Professional photographers often reduce the depth of field (DOF) to shoot single objects by using larger aperture lens settings. DOF is the range of distance from a camera that is acceptably sharp in a photograph [6].

There are studies that show that aesthetic response to a picture may depend upon several dimensions such as composition, colorfulness, color spatial organization, depth, or presence of human beings [24].

Table V.
Summarization Of Mapping Between High Level Features And Low Level Features

High Level features	Corresponding Low level features	Classification Techniques
Simplicity	Background out of focus color contrast Brightness	Naïve Bayes
Realism	Color Palette, Camera settings Image subject	
DOF Rule of Thirds	Color Edge detection(object) Texture	Support Vector Machines Adaboost Naïve Bayes
Human Faces	Haar features	
Animals	Spatial pyramid of shape features	
Sky illumination	Color histograms	

f) *Image Composition and Aesthetics:* Image composition is considered to be one of the most important attribute in assessing image appeal. Some important rules of image composition are simplicity of the scene and rules of the third. A simple image is said to be more pleasing than a complex one. A simple image could have one or multiple objects. The object could be dominant on the basis of its size or its color contrast. The rule of thirds is a well-known visual balance rule. Any object enhances the composition of the image if the rule of thirds is followed.

VI. COMPUTATIONAL FRAMEWORS FOR AESTHETICS

From a computational perspective it is necessary to attain an aesthetic prediction from an input image [1]. The computational paradigms are as follows:-

1) *Machine Learning:* It is a branch of artificial intelligence, is about the construction and study of systems that can learn from data. A machine learning system could be trained on image characteristics to learn to distinguish between aesthetically appealing and non- appealing images. After learning, it can then be used to classify between the aesthetically appealing and non appealing images. The learning could be supervised or unsupervised.

2) *Supervised Learning:* Supervised learning is the machine learning task of deducing a function from labeled training data. The training data consist of a set of training examples. In supervised learning, each example is a pair consisting of an inputobject and a desired output value. A supervised learning algorithm analyzes the training data and produces an inferred function, which is called a classifier (if the output is discrete) or a regression function (if the output is continuous).

3) *Unsupervised Learning:* Unsupervised learning refers to finding hidden structure in unlabeled data. The examples given to the learner are unlabeled.

4) *Classification:* It identifies to which of a set of categories a new observation belongs, on the basis of a training set of data containing observations whose category membership is known. The various classification approaches such as SVM, decision trees, Fuzzy measure, artificial neural network can be implemented. Classification can be multilayer classification or single layer classification. The SVM frameworks in literature either followed a top down approach or bottom up approach. While [3] [2] [8] [24] [15] mapped high level rules of photography to low level features using SVM classifier and naïve Bayesian respectively on the other hand [16] [21] [9] [16] [4] mapped low level features to high level rules of photography using SVM classifiers.

5) *Regression:* It is a statistical technique for estimating the relationships among variables. It includes many techniques for modeling and analyzing several variables. Regression techniques can be linear regression, non-linear regression, interpolation, extrapolation etc. It allows data to be associated with real numbers, i.e. the aesthetic ratings. A mathematical function associates data with real number space. The regression function learns from the user ratings for further predictions. Regression taking has been used in [12][25] [26][27] to find out the aesthetic score. There are very few systems Where [25] [13] used support vector regression technique to train the system form user surveyed ratings, on the other hand [10] constructed its own aesthetic score prediction equation to predict the aesthetic score of the photograph in literature who predicted the aesthetic score of image The list of the features proposed (high or low) is elaborated in the table given below and also their regression technique is given in the table below.

Table VI.
Summarization Of Features Proposed And Regression Techniques

Author	Features proposed	Regression technique used
M. Yeh et al [25]	SIFT features for detecting Incompleteness, rules of third, Golden ratio, Clarity, Intensity balance, Saturation and Hue	SVR
Renjie et al [10]	Rules of third, visual balance, diagonal dominance	Linear regression technique
Bhattacharya et al [13]	Relative foreground position and visual weight ratio	SVR

6) *Classification vs. Regression:* Classification: In this paradigm the data can only belong to one or a finite number of classes or categories. Classification frameworks whether supervised or unsupervised can be used to classify photos as "good"/"bad" photographs or "pleasing"/ "non-pleasing" photographs etc but they don't give the clear idea "how much" they are pleasing or non-pleasing. Whereas regression quantifies the "pleasingness" or "non-pleasingness" of the photos. Regression techniques give clear idea about the aesthetics of the photos.

Table VII.
Summarization Of Computational Frameworks For Aesthetics Prediction:-

Computational framework	Approach
Machine Learning Supervised learning Un-supervised learning	SVM (support vector machines) CART (classification and regression trees) clustering (e.g., k-means, mixture models, hierarchical clustering),
Multi-class classification	CART(classification and regression trees)
Binary classification	SVM(support vector machines)
Regression	SVM (support vector machines) CART(classification and regression trees) Naïve Bayes

VII. IMPROVING IMAGE AESTHETICS:

Image aesthetics of a given image can be improved in a number of ways [26]. Some of the prominent ways of improving image aesthetics are [28][31].

A. Optimizing Image Composition

Identification of a set of image composition rules. The image composition is modified by cropping and retargeting. The cropping operator selects a subset of image objects and re-targeting operator adjusts the relative position of salient regions in the image.

B. Saliency Retargeting

Image aesthetics can be improved by saliency retargeting. This method alters the low level image features such that the computed saliency measurements in the modified image become consistent with the intended order of their visual importance. The aesthetic score prediction model measures image aesthetics. An optimization algorithm is devised to produce an image to match the target importance values. The major low level features that are modified are: luminance, color saturation and sharpness.

C. Image Retouching with Impainting Algorithm

Image Impainting tries to restore damaged regions of an image. Impainting algorithms fill in small or long and thin missing regions. Impainting algorithms fill large and thick damaged regions. Several classical inter-polation based Impainting methods are used. Algorithm can propagate information from known areas into damaged areas. It can restore linear and composite structures. The region filling is based on morphological erosion, and region restoration of structure/texture features at every erosion step. This approach also produces pseudo-images.

Table VIII.
Summarization Of Computational Frameworks For Aesthetics Prediction:-

Image aesthetics improvement techniques	Approach
Optimization of image composition	crop and re-target on the basis of composition rules
Saliency retargeting	Saliency retargeting algorithm
Image retouching and Impainting	Image Impainting algorithm based on morphological erosion

VIII. CONCLUSION

The main aim of this paper was to survey the aspect of aesthetics in digital photography or digital imaging. Any image can be retrieved on the basis of its low, middle and high level features that describe it. To be able to understand image aesthetics, it is important to understand the relationships between high, middle and low-level features. Moreover, there exists an “aesthetic gap” as stated by Datta et al “The aesthetics gap is the lack of coincidence between the information that one can extract from low-level visual data (i.e., pixels in digital images) and the aesthetics response or interpretation of emotions that the visual data may arouse in a particular user in a given situation” . Thus it is important to have a clear understanding of the mapping of low level attributes to high level semantics. Aesthetics is a high level image description attribute. On the basis of image characteristics and their combinations images can be categorized as aesthetically pleasing or non-pleasing. The SVMs have been used for classification and Naïve Bayesian technique is preferred for regression. The techniques for improving image aesthetics have also been discussed.

IX. FUTURE WORK

Nowadays Deep Learning has been used for assessment of image aesthetics [32][33].This field is under search to explore the gains that Deep learning has in comparison to machine learning techniques.

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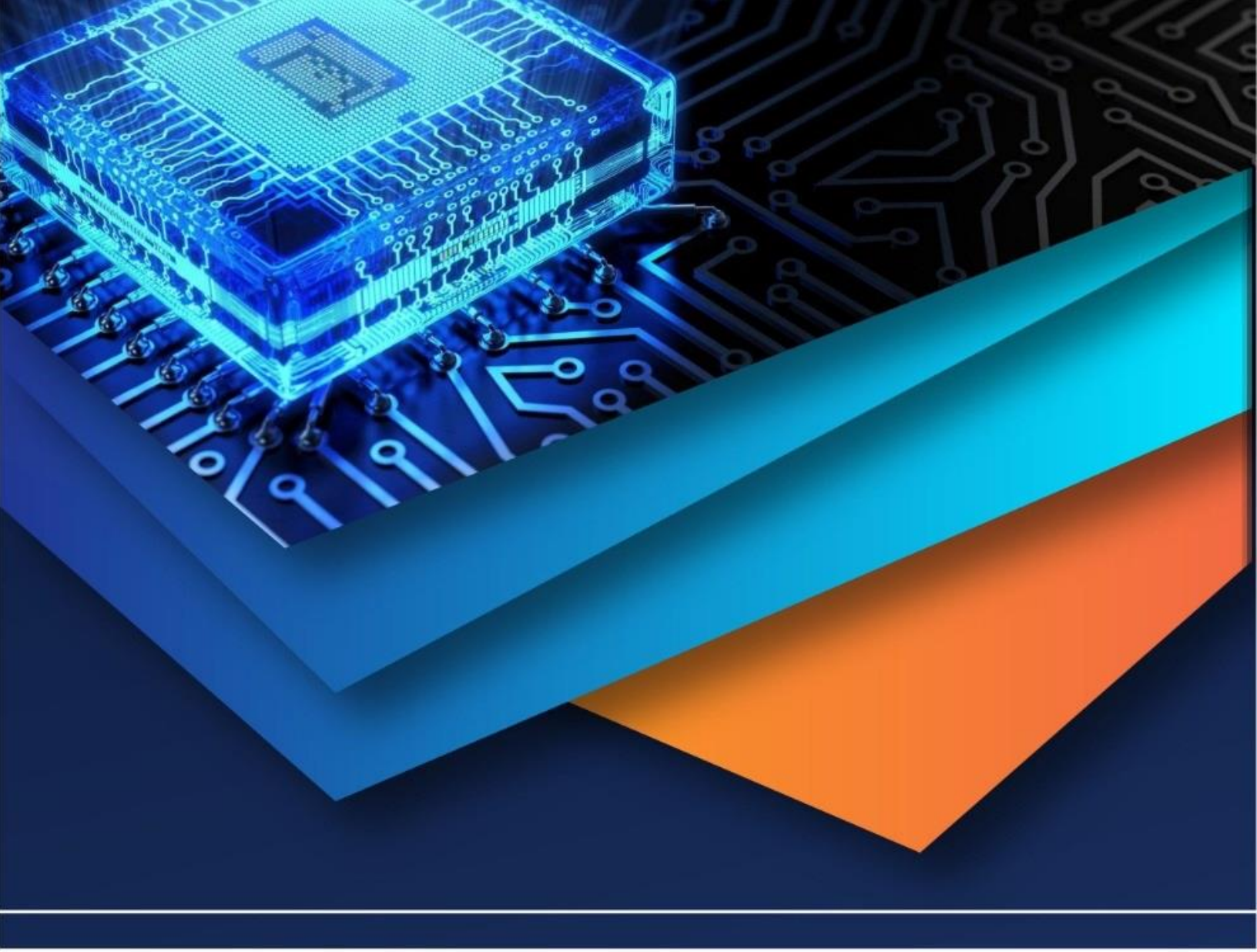
REFERENCES

[1] Datta, D. Joshi, J. Li, and J. Z. Wang, "aesthetics and emotions in images," IEEE signal processing magazine, 2011.
[2] Wei Jiang,Kap Chan,Mingjing Zhang, "Mapping low level features to high level semantic concepts in region based image retrieval",IEEE,2005
[3] Daniela Stan,Ishwar Sethi "Mapping low level features to semantic concepts",IIEL USA,2002
[4] Qianni Zhang,Ebroul Izquierdo "From mid-level to high-level:semantic inference for multimedia retrieval",IEEE 2010
[5] L Ngyugen,Ghim Yap,Ying Liu,Ah Tan,Liang Chia,Joo Lim "Baysian approach integrating regional and global features for semantic learning" IEEE 2009
[6] Sagnik Dhar,Vicente Ordonez,Tamara Beg, "High Level attributes for predicting aesthetics and interestingness",Stony Brook University,2010
[7] Kristina Lidayova, "semantic categorization and retrieval of natural scene images",CESCG 2012
[8] Yin Liu,Denshang Zhang,G Lu,Wei Ying Ma, "A survey of content based image retrieval with high semantics",Pattern recognition society,Science Direct,2006.
[9] Ishwar Sethi,Coman "Mining association rules between Loe level image features and high level concepts",Syracuse University,2000
[10] Yaowen Wu,Christian Baukhage,Christian Thurau "The Good,the bad and the ugly:predicting aesthetic image labels",IEEE 2010
[11] Aitor Gila "Aesthetic quality inference of photographic images: survey and future trends " Gjovik University,Norway 2010
[12] Datta, D. Joshi, J. Li, and J. Z. Wang, "Studying aesthetics in photographic images using a computational approach," in Proc. ECCV, 2006.
[13] Luca Marcheshotti,Florent Perronnin,Diane Larlus,Gabriela Csurka "assessing the aesthetic quality of photographs using generic image descriptors" IEEE international conference on computer vision,2011
[14] Hsiao Su,Tse-Wei, Chen,Cheinh-Chi Kao,Winston Hsu,Shao Yi Chen "Scenic Photo quality assessment with Bag of Aesthetics preserving features", ACM 2011
[15] Yan Ke, Xiaoou Tang2, Feng Jing "The Design of High-Level Features for Photo Quality Assessment",Microsoft Research Asia ,IEEE 2006
[16] www.wikipedia.com
[17] Fauzi,Paul Lewis "A fully unsupervised texture segmentation algorithm"University of Southampton,UK
[18] Branislav Micusik,Allan Hanbury "Supervised texture detection in images" Vienna University of technology,Austria
[19] Maninder kaur,Vivek Thapar "A novel method for edge detection of natural color images",IJCSITS,2012
[20] Ramadevi,B Poornima,T sridevi "A novel threshold based edge detection algorithm" IJEST,2011
[21] Hanshang Tong,Mingshing Li,Zhang,Jingrui He "Classification of digital photos taken by photographers or home users" Microsoft Reasearch Asia
[22] Lai Kuan Wong,kok Lim Low "saliency enhanced image aesthetics class prediction" National University of Singapore 2006
[23] Kuo-Yen Lo, Keng-Hao Liu and Chu-Song Chen. "Assessment of Photo Aesthetics with Efficiency", International Conference of Pattern Recognition (ICPR2012).
[24] Che-Hua-Yeh, Yuan Chen Ho,Brian Barksy,Ming Ouhyoung "Personalized Photograph ranking and selection system", ACM,2010
[25] Lai-Kuan Wong, kok-Lim Low "Saliency retargeting :An approach to enhance image aesthetics " IEEE 2010
[26] Ligang Liu, Renjie Chen "Optimizing photo composition" ,Zhejiang University,China,2010
[27] M.-C. Yeh and Y.-C. Cheng, "Relative features for photo quality assessment," in IEEE International Conference on Image Processing(ICIP). IEEE, 2012, pp. 2861– 2864.
[28] Hao Guo "Aesthetic photo retouching with an image impainting algorithm" IEEE 2009
[29] Wei Jiang Alexander Loui Catheleen Daniels "Automatic aesthetic value assessment in photographic images" IEEE 2010
[30] Gabriele Peters "Aesthetic primitives of images for Visualization" , IEEE 2007
[31] Yong Jin,Qingbiao Wu,Ligang Liu "Aesthetics photo composition by optimal crop and warp",Science Direct 2012
[32] Simone Bianco, Luigi Celona, Paolo Napoletano, and Raimondo Schettini, "Predicting Image Aesthetics with Deep Learning",Springer International Journal,2018
[33] Hui-Jin Lee, Ki-Sang Hong, Henry Kang, and Seungyong Lee, "Photo Aesthetics Analysis" via DCNN Feature encoding,2017 IEEE transactions on Multimedia Vol 19,no 8.



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