International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

DIAMOND QUALITY ASSESSMENT SYSTEM USING MACHINE LEARNING APPROACH

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Abstract - *Diamonds should be cut with correct shape and extent before they can indicate dazzling appearance for most of the part. Precious stones ought to be dull on the off chance that they are solidified from unadulterated carbon molecules. At present, jewels are regularly estimated and evaluated by experienced graders with some extraordinary devices like amplifying glasses, standard ace stones, colorimeters, ideal scopes, and so forth. Nonetheless, manual estimation and evaluating has various disadvantages, for example, restricted exactness, subjectivity, poor view of respectability, low proficiency and mind-boggling expense. Therefore, it has become important and challenging research topic to develop an integrated auto measuring system for diamond grading. Based on color of diamond, texture and clarity this system performs diamond quality grading. A special hardware source is employed to get accurate diamond images. Quality assessment for grading is done through three important quality extraction of the diamond like color, texture and clarity. Then extracted features are passed to the classifier for grading. Based on the grading, quality of a diamond will be determine.*

Key Words: Image Processing; Convolutional neural network; Pre-processing; Machine learning; Classification

1. INTRODUCTION

Normal precious stones for the most part should be cut with correct shape and extent before they can demonstrate shining appearance. Jewels ought to be boring on the o chance that they are solidied from unadulterated carbon particles. On account of a little measure of Nitrogen in most regular precious stones, jewels regularly demonstrate different shades of yellow shading. Since common precious stones regularly demonstrate distinctive shading, different considerations or then again surrenders, and characteristic cutting mistakes, they should be re viewed. Other than carat reviewing, jewel evaluating incorporates shading re viewing, clearness evaluating, and cut evaluating. Now-a-days jewels are estimated and evaluated by experienced graders with some extraordinary devices like amplifying glasses, standard ace stones, colorimeters, ideal scopes, and so forth. Manual estimation and evaluating also has various disadvantages, like restricted exactness, subjectivity, poor view of respectability, low proficiency and mind-boggling expense. Particularly, after continuosly laboring for 60 minutes, the graders eyes regularly progress toward becoming extremely well worn, and wronged value acting can be made effortlessly. Therefore, it has become important and challenging research topic to develop an integrated auto measuring system for diamond grading. Suggested system works on diamond quality grading based on color of diamond, texture of a diamond and clarity. In order to get accurate diamond images, a special hardware source is employed. Quality assessment done through three important feature extraction of the diamond like color, texture and clarity. Then extracted features are passed to the classier for grading on the basis of grading quality of a diamond will be determine.

Fig 1– Diamond color grading

2. LITERATURE SURVEY

[1] Diamond Color Grading Based on Machine Vision: This paper shows a powerful strategy for precious stone shading reviewing dependent on machine vision. So as to get attractive precious stone pictures, an unique light source based on a coordinating circle is utilized. Ensuing to repay the variance of the light source, the compositive shading highlights, including free and joint circulation highlights of Hue and Saturation, are extricated in portioned uniform areas. At that point, based upon a prepared BP Neural Network, jewels can be assessed by shading. Perceptual Correction for Color Grading of Random Textures

[2] Performance analysis of a Colorimeter designed with RGB color sensor: This paper shows a viable technique for jewel shading evaluating dependent on machine vision. So as

to protect palatable precious stone pictures, an exceptional light source based on a coordinating circle is utilized. In the wake of remunerating the vacillation of the light source, the focused shading highlights, including autonomous and joint dispersion highlights of Hue and Saturation, are separated in portioned uniform districts. At that point, contingent upon a prepared BP Neural Network, jewels can be evaluated by shading. Examination results demonstrate that the proposed strategy can achieve an acceptable precision to substitute manual reviewing for genuine precious stones. The proposed strategy can likewise be utilized to group different questions by little shading distinction

[3] Correction for color grading of random textures, Machine Vision and Applications: This paper presents a technique for shading shade evaluating for mechanical investigation of irregular. Surfaces, the differences of which are at the edge of human observation. This strategy utilizes picture rebuilding strategies to recoup an unblurred form of the picture, and after that obscures it indistinguishable path from the human visual framework does, to copy the procedure of the picture being caught by the human sensor. In this following way, the shading picture is converted into a perceptually uniform shading space, where shading evaluating happens

[4] A Threshold Selection Method from Grey-Level Histograms: A nonparametric and unsupervised technique for programmed limit determination for picture division is exhibited. An ideal limit is chosen by the discriminant rule, to be specific, in order to boost the detachability of the resultant classes in dim dimensions. The method is exceptionally simple, using just the zeroth-and the main request aggregate snapshots of the dark dimension histogram. It is simple to stretch out the technique to multi level issues. A few exploratory outcomes are additionally exhibited to help the legitimacy of the technique.

[5] Development of a Colorimetric sensor for monitoring of fish spoilage amines in packaging headspace: A methodological report on essentialness of picture preparing and its applications in the field of PC vision is completed here. In the middle of a picture preparing task the information given is a picture and its yield is an upgraded into a excellent picture according to the systems used. Picture handling normally are suggested as advanced picture preparing, yet ocular and simple picture handling likewise are conceivable. Our examination gives a strong prologue to picture handling alongside division strategies, PC vision essentials and its connected applications that will be of worth to the picture preparing and PC vision look into networks.

3. EXISTING SYSTEM

The diamond grading system based on its colour classification has been tested on many diamonds. The results confirm that this study conducted in the paper has established an effective approach for diamond colour grading to replace manual grading.

This system only works on colour grading so 100% quality assessment is not achieved through this.

4. PROPOSED SYSTEM

Proposed system

Proposed system works on diamond quality grading based on color of diamond, texture of a diamond and clarity. In order to get accurate diamond images, a special hardware source is employed. Quality assessment done through three important feature extraction of the diamond like color, texture and clarity. Then extracted features are passed to the classifier for grading. Based on the grading, quality of a diamond will be determine.

Pre-processing –

In image pre-processing, image information observed by sensors on a satellite or taken by uncommon resources limit mistakes identified with geometry and grandeur estimations of the pixels. These blunders are amended utilizing suitable scientific models which are either distinct or factual models. Picture upgrade is the alteration of picture by changing the pixel splendor esteems to enhance its visual effect. Picture upgrade is the adjustment of picture by changing the pixel brilliance esteems to enhance its visual effect. Picture upgrade includes an accumulation of procedures that are utilized to enhance the visual appearance of a picture, or to change over the picture to a shape which is more qualified for human or machine elucidation.

Convolutional neural networks - CNN are similar to feed forward neural networks, where the neurons have learnable weights and biases. Its application has been in signal and image processing which takes over OpenCV in field of computer vision.

In convolutional neural network, the input features are scheduled in batch wise like a filter. This will provide help the network to remember the images in portions and can compute the operations. These computations involve transformations of the image from RGB or HSI scale to Gray-scale. Once we accquire this, the changes in the pixel value will help to detect the edges and images can be classified into different categories.

ConvNet are applied to techniques like signal processing and image classification techniques. Computer vision techniques are influenced by convolutional neural networks because of their precision in image classification. This technique of image analysis and recognition, where the agriculture and weather features are drawn out from the open source satellites like LSAT to forecast the future growth and capitulate a particular land are being implemented. In proposed system CNN is used for image classification it includes image dataset belong to six different classes.

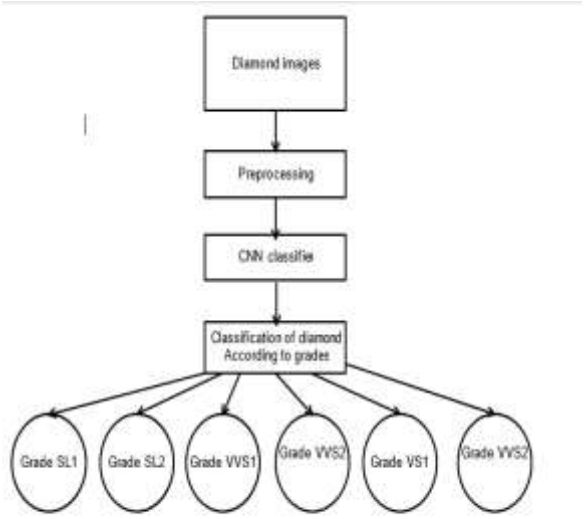

Fig 2: Proposed system architecture diagram

5. RESULTS

Methodologies

The first step is convolution operation. In this step, we will assess on feature detectors, which eventually serve as the neural network's filters. We will further discuss feature maps, learning the parameters of such maps, how patterns are detected, the layers of detection, and how the findings are mapped out.

- **Step 1(b): ReLU Layer**

The next part of this step will use the Rectified Linear Unit or ReLU. We will understand ReLU layers and traverse how linearity works in the context of Convolutional Neural Networks.

Although, it is not necessary to learn ReLU for CNN, but there is no harm to learn it to improve your skills.

- **Step 2: Pooling**

In this part, we'll cover pooling and understand exactly how it works. Our point of focus here is, however, will be a specific type of pooling that is max pooling. We'll cover various approaches including mean (or sum) pooling. This part will end with a demonstration made using a visual interactive tool that will definitely sort the whole concept for us.

- **Step 3: Flattening**

In this part, we will see brief breakdown of the flattening process as well as how we move from pooled to flattened layers while working with CNN's.

- **Step 4: Full Connection**

In this step, we will be merging every step together that we have covered till now. By learning this, you'll get to visualize a picture at a greater level of how Convolutional Neural Networks operate and how the "neurons" that are finally produced learn the classification of images.

Working implementation & Algorithm Results: -

Setp1: - Take input should be any of the diamond image.
Step2: - The CNN will apply for pre-processing the diamond images and finding the diamond quality as per the user requirements.

Sr. No	Algorithm	Accuracy
1	Neural Network Classifier (CNN)	0.926547856

The above results show the Deep Convolutional Model that can be process the diamond 7 qualities through finding best quality of that diamond and it will generate the diamond color, texture, and segmented output establishing the neural network classifier.

Dataset: - Download specific images through Google or real time images for checking diamond qualities.

Libraries: Python-Flask, Keras==2.2.4, TensorFlow==1.15.0, OpenCV-Python, Pymysql, Pywin32-ctypes**.**

6. CONCLUSION AND FUTURE WORK

This system grades diamond quality very effectively with the image processing techniques and deep learning concepts. Quality of assessment is increased as compared to the existing system as all the quality measurements are taken into the consideration while determining grading like texture, color and clarity of a diamond.

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