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Sports Equipment Analysis by Using Image Processing Technique

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Abstract

The Sports equipment material quality testing usually goes over the human eye which is tedious and tiring. Application of Image Processing Technique for sports equipment surface analysis provides fast, easy and accurate study. Image of various sports equipment are captured with Digital camera and particular section of the image is computed for color and shape difference, edge and hole detection. This paper proposes Object Roundness Algorithm for measuring the roundness shape in rugby ball and shin pad. The output metrics values are directly proportional to the roundness in the input image. The experimental result shows that the proposed method runs quickly and accurately.

Keywords: Image processing, Color and Shape Difference, Object Roundness.

Introduction

Sports are emerging as an important industry over the entire globe. Therefore, quality should be maintained at high level. Research and knowledge development in sports sectors are needed. Sports equipment material quality testing is tough task which causes fatiguing due to continuous observation, attention and also requires experience to detect correctly the fault occurrence. To overcome these issues we propose to implement MATLAB environment, the Image Processing Tool for easy way to identify defects like scratch, hole, fading etc , in sports equipments. Presently image processing technique is applied in Human (athlete) detection and tracking using background subtraction for velocity estimation[1], which is well suitable for real-time detection. Similarly, Region growing segmentation is chosen for ball detection[2]. Image processing is very special that no other instrument or any testing machine can't execute with the graphical input, this may be the main reason it is proposed and accepted in all industrial products testing systems. For example in PCB defects detection[3] the fault detecting method and results are promising. In this paper, the image processing tool for sports equipment analysis is implemented. Shape & color differences and hole detections techniques are carried over the captured image of sports equipment. Images of rugby ball and shin pad are executed in object roundness algorithm and who have to sustain an activity for long periods of According to rugby ball aerodynamics [4], the pimples over the ball surface plays major role in hand grip and long distance travel. Therefore, pimple pattern study is essential. Image of various sports equipment are captured with Digital camera and particular section of the image is computed in the below flow diagram figure 1 for object roundness determination.

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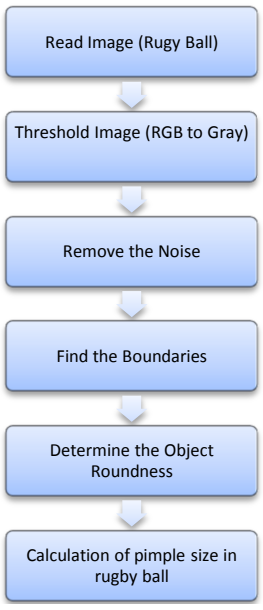
Figure I. General Flow Diagram of Object Roundness Determination



Roundness Detection Process

There are five steps involved in the process,

Step 1: Read Image in Jpg file.

Step 2: RGB to Gray Conversion

Step 3: Remove the Noise, unwanted pixels
Step 4: Find the boundaries of each pimple
Step 5: Determine the round object size.

Read Image

The first step is to Read the image from graphical file. The MATLAB Function is used to read and process the input image is: *RGB = imread (ball 3. jpg); Imshow(RGB);*

Figure II. Input Image of a rugby ball

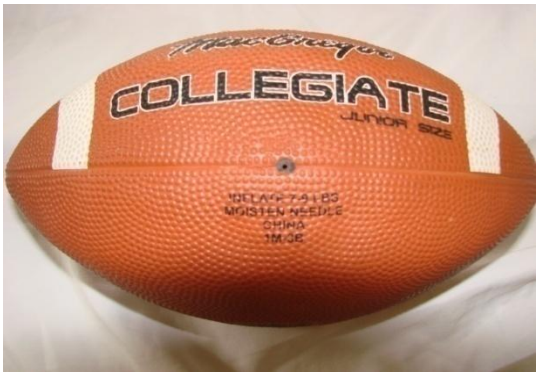


Figure II, Image of the rugby ball captured in Sony Camera-Cyber Short (7.2 megapixel & 12X optical Zoom). Then the JPG file is uploaded into MATLAB S/W for calculation of pimple size.

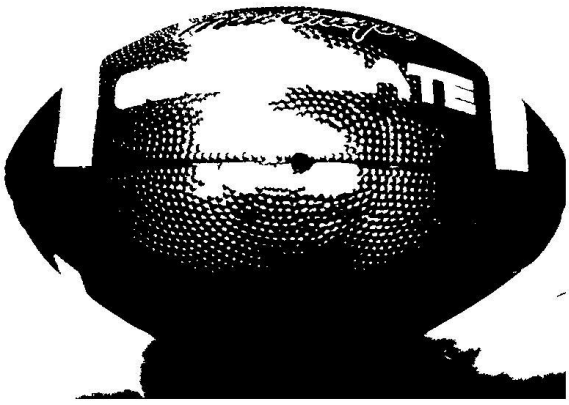
Threshold the Image

In this step the input image is converted to black and white in order to prepare for boundary tracing. Algorithm for Gray scale conversion is:
I = rgb2gray(RGB);
Threshold =graythresh(I);
Bw = im2bw(I,threshold);Imshow(bw)

Remove the Noise

Using the morphology functions, remove pixels which do not belong to the object of interest. MATLAB function is given below for noise removal,
Bw = bwareaopen (bw,30);
Remove all object containing fewer than 30 pixels.
Bw = imfill (bw,'holes');
Fill any holes, so that regionprops can be used to estimate the area enclosed by each of the boundaries. Figure III unwanted pixels noise is removed.

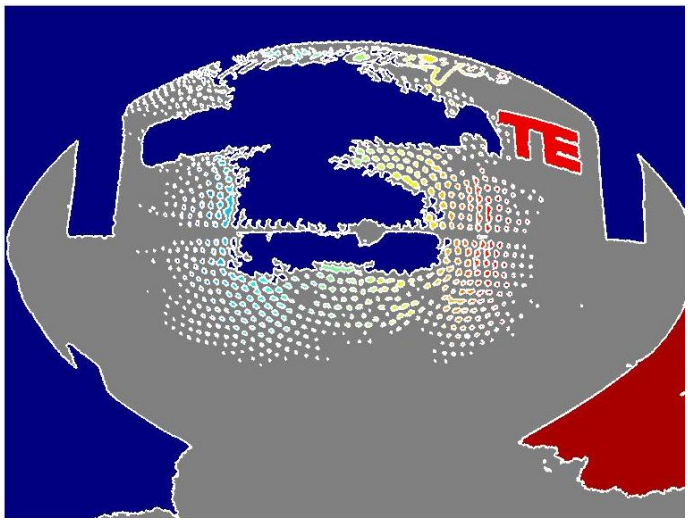
Figure III. Noise Removal



Find the Boundaries

Here only exterior boundaries are concentrated. Option 'noholes' will accelerate the processing by preventing (bw boundaries) from searching for inner contours. MATLAB function is declared for marking the boundaries over the pimples in rugby ball in order to process for further step[5].
[B, L] = bw boundaries (bw,'noholes');
Figure IV with the above function display of label matrix and each boundaries for pimple are drawn.

Figure IV. Display the each boundary of pimple in rugby ball



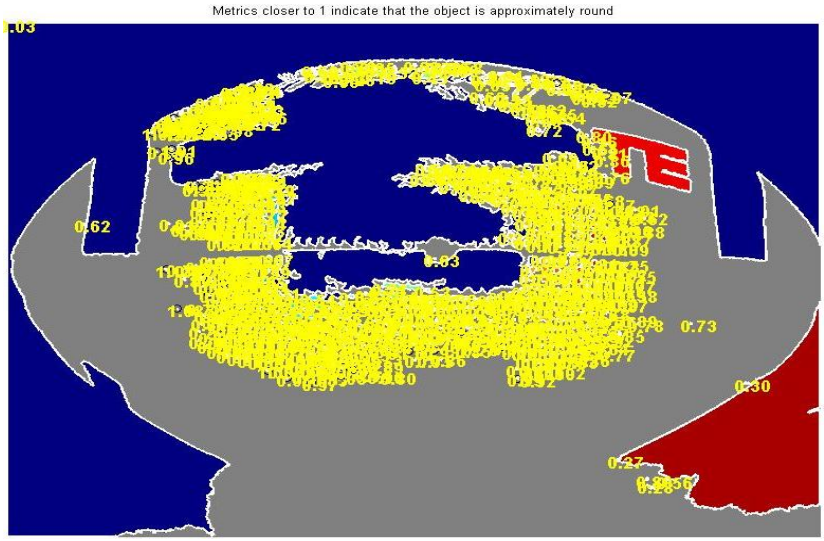
Experiment and Results

Determine Object Roundness.

Each object (pimple) area and perimeter is estimated, to form a simple metric indicating the roundness of an object. This metric is equal to one for a circle and it is less than one for any other shape[6]. The discrimination process can be controlled by setting an appropriate threshold. In this algorithm we set threshold value of 0.94, so that only the pills will be classified as round:

Stats = regionprops (L,'Area','Centroid');
Threshold = 0.94;

Figure V. Output Image



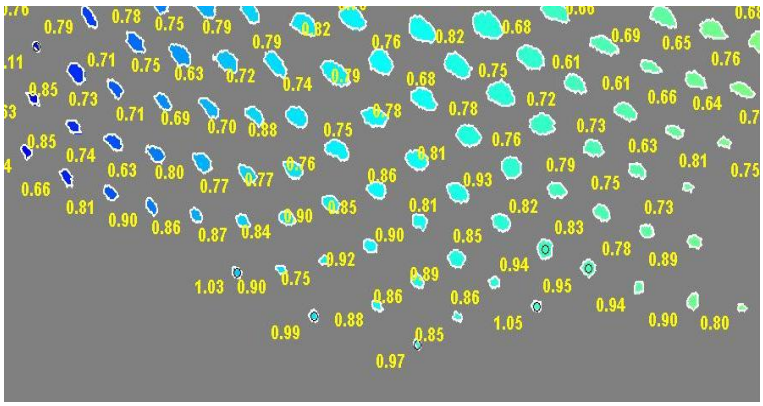
Compute the roundness metric and display the results.

Simple estimation of the object perimeter and area calculation is obtained corresponding to label 'K' with this algorithm:

Delta_sq = diff(boundary).^2
Perimeter = sum(sqrt(sum(delta_sq,2)));
Area = stats(K).area;
*Metric = 4*pi*area/perimeter^2;*

In order to identify the objects, marking is done with black circle for above threshold value metric. Figure V shows the Final result of processed image, Figure VI is the magnified image of the output which shows each pimple has obtained its own value, Metrics closer to 1 indicate that the objects are approximately round.

Figure VI. Magnified image of final output showing pimple valves



Roundness analysis in shin pad

A shin guard or shin pad is a piece of equipment worn on the front of a player's shin to protect them from injury. These are commonly used in sports including football (soccer), baseball, ice hockey, field hockey, lacrosse, rugby, cricket, and other sports. Mesh construction provides airflow and lightweight design[7]. Object Roundness Algorithm is implemented and metrics value closer to 1 indicates that the objects are approximately round. The result Fig Vd clearly shows that, the roundness in the mesh type shin pad is in uniform size.

Figure Va. Read image

Figure Vb. RGB to Gray Scale

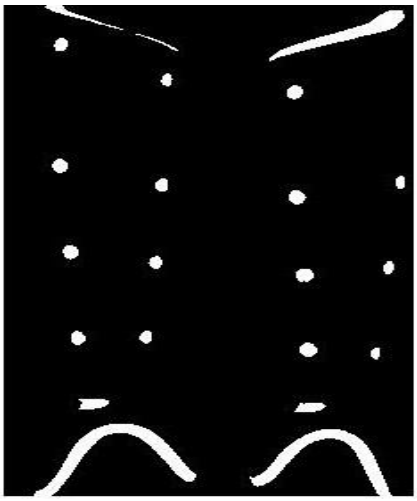


Figure Vc. Boundaries Marking

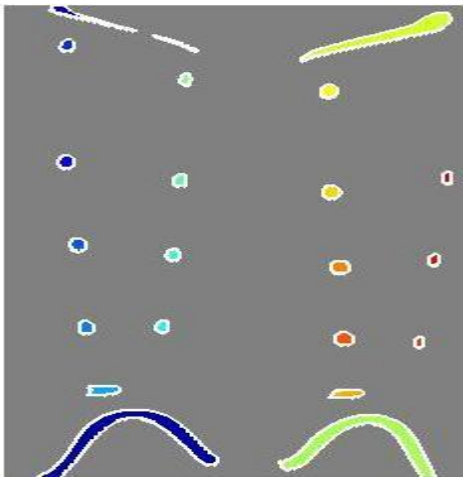
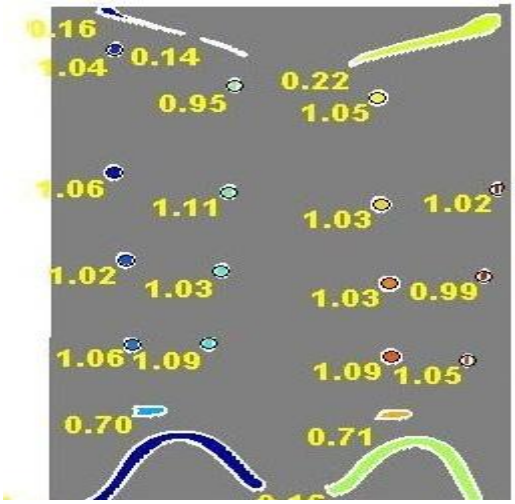


Figure Vd. Determination of Roundness



Conclusion

The experimental results shows, simple and reliable method for analysis of pimple in rugby ball. Algorithm is easy to understand and results are accurate than manual inspection. The proposed technique can be implemented during the production process of sports equipments in order to maintain hi-tech quality standards of the product. Also, this technique is well suitable for sports equipment defects analysis. In order to improve the durability of the equipment image processing tool is highly reliable, because it has ability to differ the color and shape. Sensing the equipment defect in advance is possible. Similarly, the technique is also suitable for On-line application, the ball can be monitored during practice session or in Match and quality standard could be judged. Future work can be processed with 3-D image input with fine details.

References

1. R. Manikandan, R. Ramakrishnan," Human object detection and tracking using background subtraction for sports applications"IJARCCE, Vol. 2, No. 10, Oct 2013.
2. B.L Velammal, P. Anandha Kumar "An efficient ball detecting framework for cricket" IJCSI, Vol. 7, No. 2, May 2010.
3. KaurKamalpreet, KaurBeant, "PCB defect detection and classification using image processing" IJERMT, Vol. 3, No. 8, Aug 2014
4. Djamovski, Pascal, Harun, Firoz, Tom "A Comparative study of rugby ball aerodynamics" Science Direct, March 2012.
5. R. Lewis , J.carry, S.E Tominson " Effects of surface texture, moisture, and wears on handling of rugby ball" Tribiology International.
6. Kalyan KumarHati, Pankaj Kumar Sa, BanshidharMajhi, "Intensity range based background subtraction for effective object detection" IEEE, Vol. 20, No, 8, Aug 2013
7. R.Thilepa, M. Thanikachalam, "A Paper on automatic fabrics fault processing using image processing technique in matlab" SIPIJ, Vol. 1, No. 2, Dec 2010.
8. Wikipedia.com, the free encyclopedia.