Fault Detection of A Hot Metal Body

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Abstract— In this paper a new methodology is proposed to provide a constructive solution to the problem of fault detection when processing metals and steel manufacturing process for automatic hot spots detection and histogram of the hot body by Blob analysis. We used a method that at first convert the original color of the picture into B/W using a particular threshold value. B/W image provides statistic of all the white pixels. Here statistics are the coordinates and the dimensions of the rectangle of the hot spot. At first the hottest region of the image is detected and then the histogram of the whole image is plotted. Simulation is carried out and results are discussed to illustrate the proposed procedure. The result is very good as compared to other procedures.

Keywords: Fault detection, Bi-histogram Equalization, Blob analysis.

I. INTRODUCTION

Measuring the temperature of hot body or molten pig iron is not an easy task. The fault detection of metallic body is a mandatory requirement for steel plants. This process ensures that the materials meet the product specification and prevent defects in the metal. Our objective is to detect the faulty region of an image of a hot body. Spectral and spatial details of visible hot image are captured through camera. In this paper hot bodies can be distinguished from the whole region based on color intensity. A target that is warmer or colder then it's background can be easily identified through this process without using infrared camera. There are other methods available for the detection of fault detection. The hot spot is detected using temperature using lens, a thermocouple, and electronic thermometer [1]. It has also high operating expenses [2]. In an infrared-based temperature measurement method is used for this purpose but non connecting devices cannot be used here [2]. Here some variants of histogram have been proposed. In Bi-histogram Equalization (BPBHE) is used [4]. This procedure separates the input image's color intensity and then the sub-histograms are equalized independently. In this paper, we proposed alternative solution to detect the faulty region in an image of hot body without using an infrared camer.

II. PROCESS FLOW

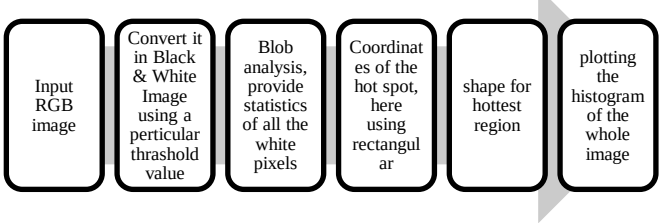

Fig. 1: Flowchart of hot spot detection

III. METHOD TO DETECT HOTTEST REGION

1) The original hot image is shown in Fig.2.
2) Next convert the original color of the image into B/W using a particular threshold value in Fig.4.
3) The Blob analysis is done in the B/W image which provides statistics of all the white pixels.
4) Here statistics are the coordinates and the dimensions of the rectangle of the hot spot in Fig.5.
5) Now taking the coordinates of the hot spot we insert a shape which is basically a rectangle in Fig.5.
6) Then the image profile of the selected region is plotted.
7) Finally the histogram of the whole image is plotted in Fig.6.

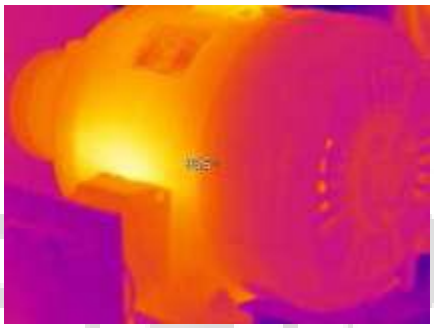

Fig. 2: Original Image

IV. BLOB ANALYSIS

Analyzing the connected region for a specified image that connected region is called the Blob. Blob analysis can detect the position, shape, topological relation between objects and orientation of that Blob for the images. The main concept of Blob analysis is in Fig.5. Before blob analysis it is necessary to segment images. It is very obvious that a blob region should be associated with minimum one local extremum [6].

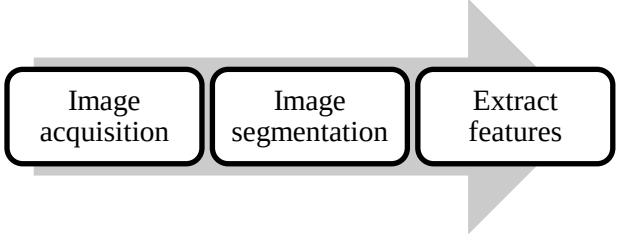

Fig. 3: Main concept of Blob analysis

V. DETECTION OF THE REGION OF INTEREST

The location of the hot spot is not every time at the same level. This is because the hot region cannot be detected always from the same position, as it varies with the color intensity. So it is essential to detect the location of the hot spot in the region**.** Region of interest (ROI) is the commonly used term to refer to the portion of an image of particular

interest. In this case, the ROI is the portion of the image where the flame front is located. The part of the image where the sintering pallet is located is not of interest and must be removed. Once the ROI is defined, there is no need to process the whole image to detect the position of the flame front. Thus, the computational cost is greatly reduced .The ROI in the image is located above the sintering pallet. In the moving strand, there are many sintering pallets moving on rails. When the pallet reaches the discharge end of the sintering process, it rotates, and the sinter falls into the crusher. It is at this point where the key frames are detected [4].

VI. DISCUSSION

The technique used here is cost effective as it does not require infrared camera. The detection becomes very easy as no complicated instruments are not required .The results are plotted using MATLAB and shown in Fig.3-7 and also histogram of the hot image is shown.

In the Fig.3-7 we can see that the intensity variation is not much in the hot spot region. Select the hot body image. Set the threshold by trial and error method carefully.

Fig. 4: B/W Image

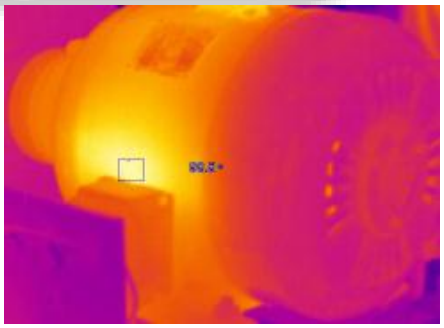

Fig. 5: Rectangle show the fault spots of Image

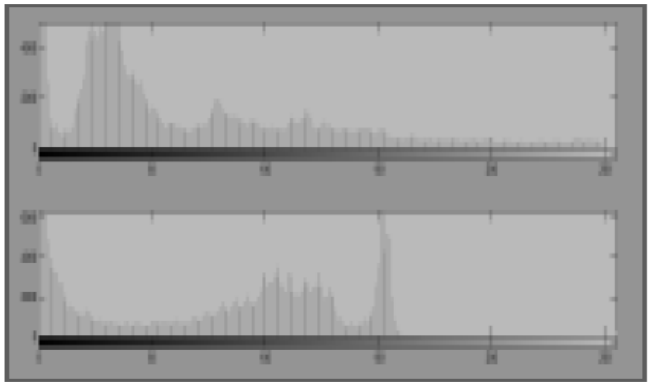

Fig. 6: Histogram of the hot image of metal

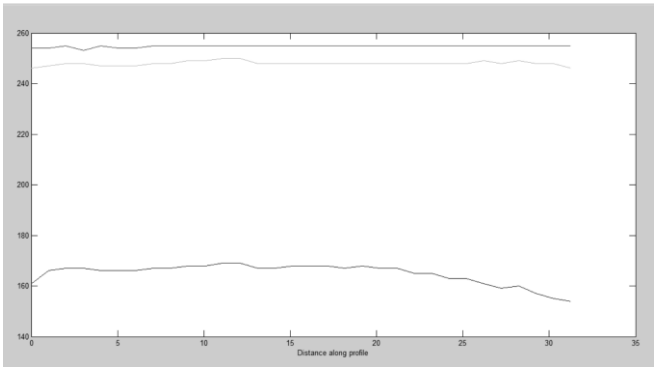

Fig. 7: Image profile of the selected region

VII. CONCLUSION

In this paper it is successfully established that without using infrared camera we can be able to detect hot spots in the region under consideration. Simulations results and detailed discussions are given to justify the effectiveness of the procedure.

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