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ijirset@gmail.com



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Segmentation and Counting of Somatic Cells for Milk Quality Identification Using Machine Learning

Shabnam Fathima D M¹, Sneha S², Subhashree S M³, Sowmya S⁴

U.G. Student, Department of Electronics and Communication Engineering, Meenakshi Sundararajan Engineering College, Chennai, Tamilnadu, India¹

U.G. Student, Department of Electronics and Communication Engineering, Meenakshi Sundararajan Engineering College, Chennai, Tamilnadu, India²

U.G. Student, Department of Electronics and Communication Engineering, Meenakshi Sundararajan Engineering College, Chennai, Tamilnadu, India³

Associate Professor, Department of Electronics and Communication Engineering, Meenakshi Sundararajan Engineering College, Chennai, Tamilnadu, India⁴

ABSTRACT: In dairying, the SCC is an indicator of the quality of milk specifically, its low likeliness to contain harmful bacteria, and thus its high food safety. Somatic cell count (SCC) is broadly used as an indicator for mastitis and thus the basis for udder health management programmes, e.g. through dairy herd improvement (DHI) testing. The methods of determining grade a milk quality are well established, and are based on the somatic cell count and the bacteria plate count. Generally a lower somatic cell count indicates better animal health, while the bacteria plate count indicates improved equipment sanitation. Normally a reliable direct method of measuring SCC is by using an automatic cell counter either by using a portable cell counter at the farm, or by sending milk samples to a laboratory for measurement in, for example, a Fossomatic cell counter. But these measuring devices are at high cost and large in size so to avoid this technique we propose an image processing based somatic cell detection process by using machine learning.

KEYWORDS: Somatic cells, .

I. INTRODUCTION

Somatic cell counts are broadly speaking used as a proxy for measurement IMI and milk quality at quarter, cow, herd, and population levels since many decades. A ordinarily used cut-off to tell apart between cows seemingly to be infected and traditional is at two hundred, 000 cells/mL. Regular SCC testing and associated mammary gland health observation programmes (i.e., through milk recording/dairy herd improvement (DHI)) have a considerable positive influence on single animals furthermore because the entire herd. However, a serious drawback of the unfold and persistence of rubor at intervals dairy farm herds continues to be the subclinical kind, a condition wherever the mammary gland and also the milk seem traditional though the exocrine gland is inflamed, infected, or both. Subclinically infected cows are celebrated to act as a reservoir for microorganism, leading to an unnoticeable unfold of rubor to healthy herd mates and so early detection and effective management of it may result in economic profit for dairy farm farmers. Inflammatory infections, which, successively cause elevated SCC, are celebrated to impair milk yield, milk elements like fat, protein, and milk sugar, and cheese yield furthermore as quality. As a result, elevated SCC results were delineate to impact the economy and gain of a farm negatively. Factors associated with farm economic performance (e.g., economic losses thanks to rubor and premium payment supported bulk milk SCC) largely inspire dairy farm farmers to enhance rubor management. New technology permits the synchronic determination of SCC. a lot of specifically, DSCC indicates polymorphonuclear neutrophils (PMN) combined with lymphocytes as a proportion of total SCC. To the most effective of our data, solely very little is delineate regarding DSCC within the literature.



II. RELATED WORK

THE COLOR IMAGE PROCESSING OF MILK SOMATIC CELLS by Yuedong Wang et al 1. This paper carries on the pre-processing to the milk somatic cell images firstly. Then in the foundation of the selection of the color space and the analysis based on the SOM algorithm, the milk somatic cell color images are segmented using the SOM neural network in a specific color space, and the overlapping cells are separated. Ultimately obtains the image of somatic cell count through the Fire Spread method.

DIFFERENTIAL SOMATIC CELL COUNT by Malin Damm et al 2. used a method which is sought to be applied in central milk testing laboratories, so that existing DHI infrastructures can be used. The DSCC represents the combined proportion of polymorphonuclear leukocytes (PMN) and lymphocytes expressed in percentage. The proportion of macrophages can be calculated by subtracting DSCC from 100%. Our research revealed increasing proportions of PMN, but decreasing proportions of macrophages as SCC increased.

EFFECTS OF SOMATIC CELLS SCORE ON MILK YIELD AND MID-INFRARED PREDICTED COMPOSITION TECHNOLOGICAL TRAIT by Brown Swiss et al 3. confirmed that an increase of SCC impairs milk productivity, profitability, and quality following a third-order polynomial regression, and highlighted that very low SCC (<6,250 cells/mL, corresponding to SCS < -1.00) had similar or worse detrimental effects on milk yield and quality than high SCC (>200,000 cells/mL, corresponding to SCS > 4.00). Moreover, cows with SCS < -1.00 in a test day were 7 times more likely to present with high SCC within the following 90 ± 5 d than were cows with SCC between 6,250 and 12,500 cells/mL, corresponding to SCS between -1.00 and 0.00. The best SCC, resulting in the highest milk yield and quality, was found between 12,500 and 25,000 cells/mL, corresponding to SCS from 0.00 to 1.00, but quality of HF milk started to decrease at lower SCS compared with the other breeds, even if the effect on production at increasing SCS was less pronounced for HF.

III. METHODOLOGY

INPUT: Read and display the input image using the imread command. Here is a microscopic image of the milk sample taken from the kaggle website. We have got 50 data set images to train and tested for 10 images.

PROCESSING: To preprocess a picture, resizing the datasets is completed. Resizing a picture involves dynamic the dimensions of the image while not cropping to win most image quality. The size of the input image is 136x175x3. The input image is resized to 1024x1360

RGB COLOUR CONVERSION: The RGB colour represent images has an m-by-n-by-3 numeric array whose elements specify intensity values of red, green and blue channels. For single or double arrays, RGB values ranges from [0,1]. RGB colour conversion can also be skipped in our project, but it is done just to show the comparison between the previous one.

SEGMENTATION: Partition of image into segments. This technique aids in the extraction of important image characteristics based on which information can be easily perceived.

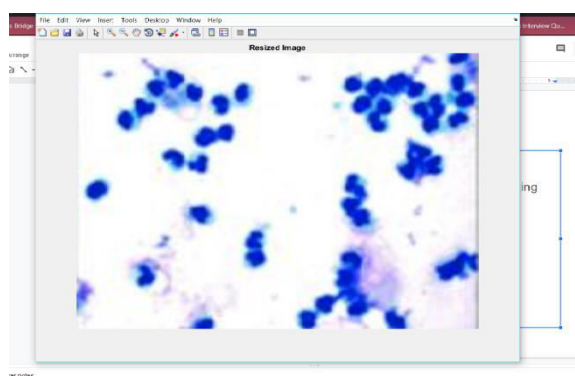
FEATURE EXTRACTION : Feature extraction could be a set of ways that map input options to new output options. One typical use of feature extraction is finding options in pictures. Using these options will result in improved classification accuracy.

CLASSIFICATION: It refers to the task of extracting data categories from a multiband formation image. The ensuing formation from image classification is wont to produce thematic maps. The image classification accepts the given input pictures and produces output classification for characteristic whether or not the illness is gift or not.

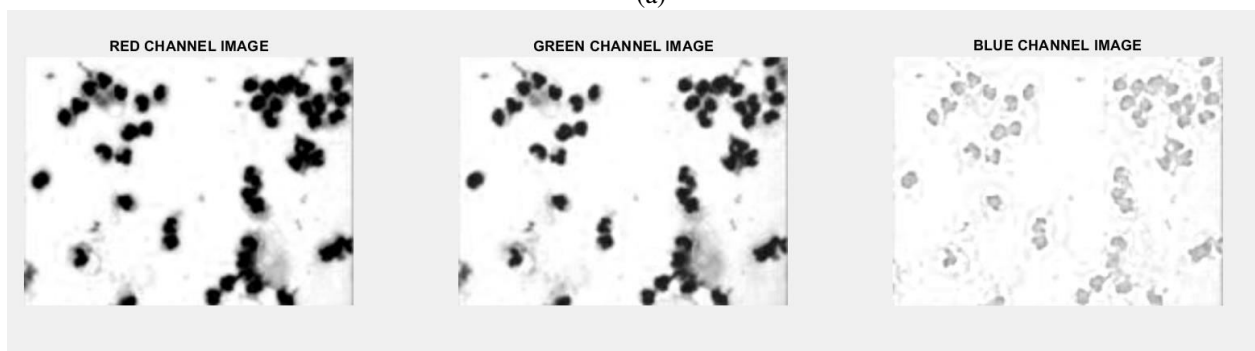
IV. EXPERIMENTAL RESULTS



Figure 1: Input Image

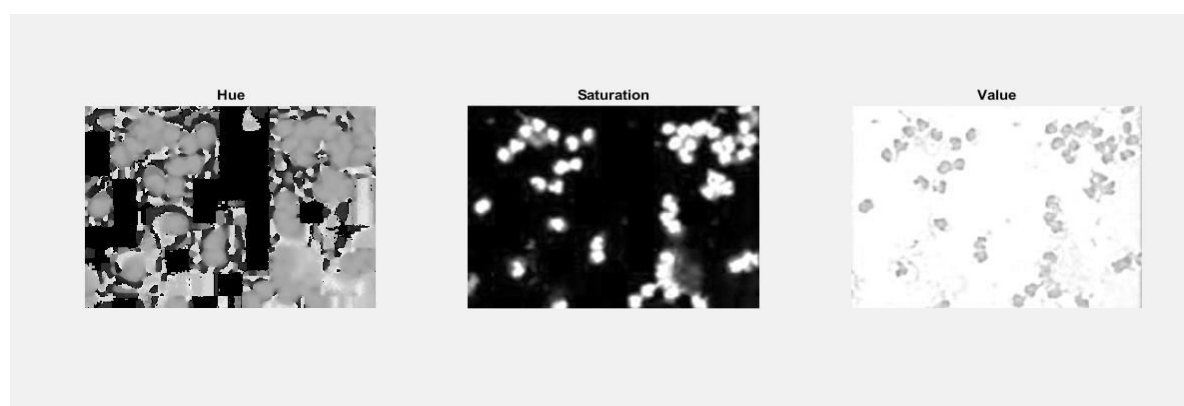


(a)

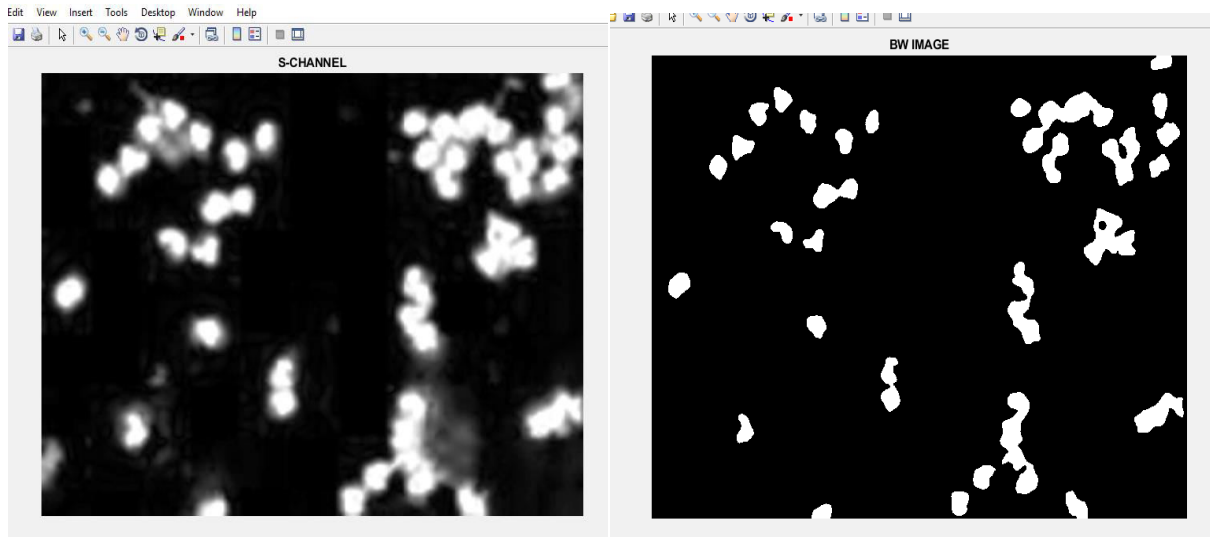


(b)

Figure 2: Preprocessed Image (a) Resized image (b) RGB colour conversion

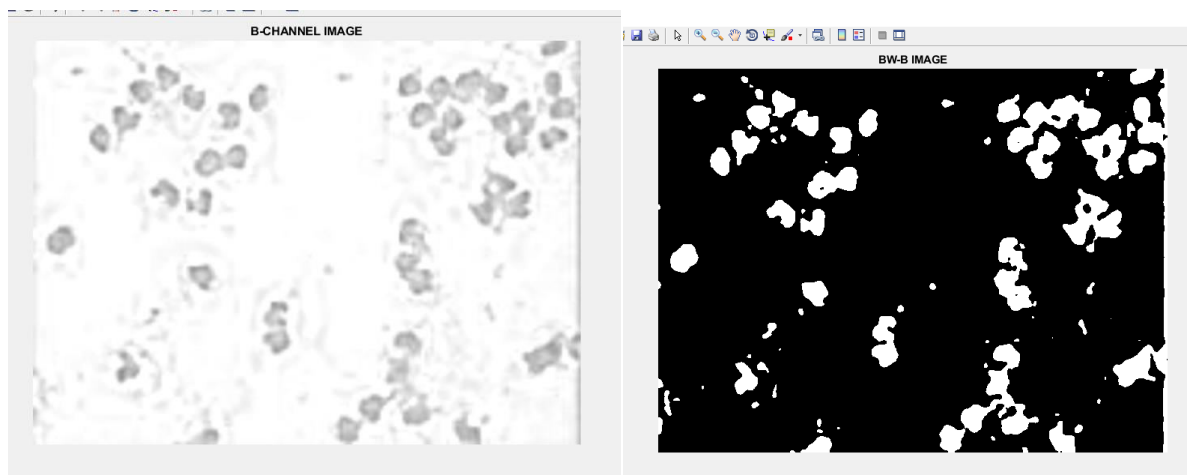


(a)



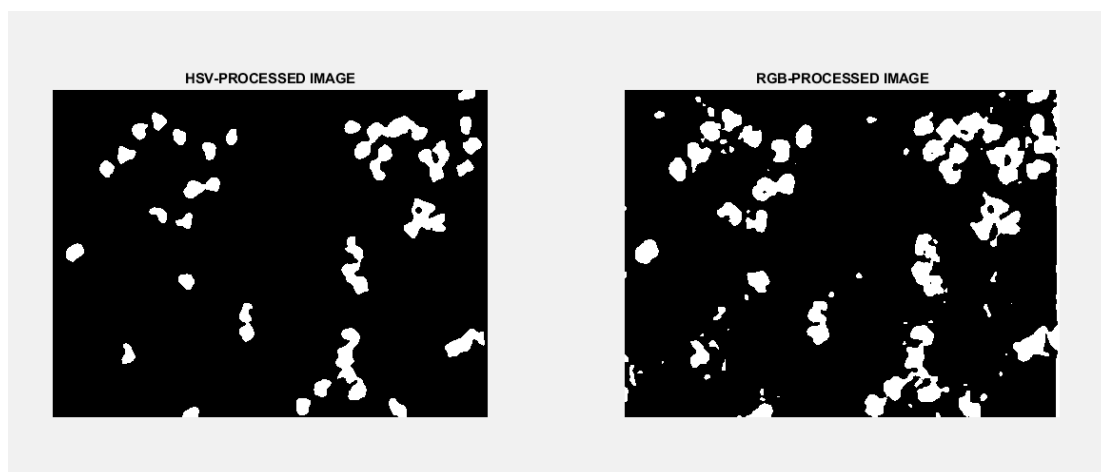
(b)

(c)

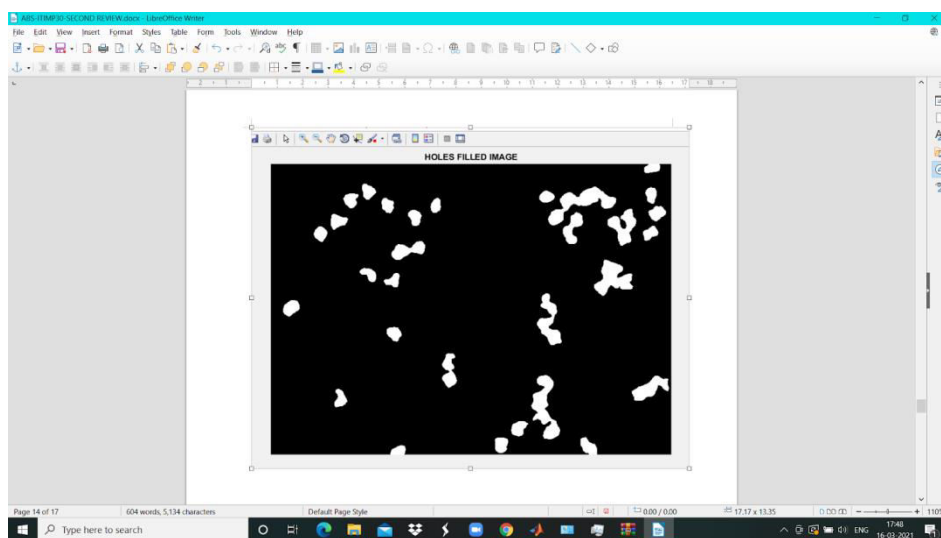


(d)

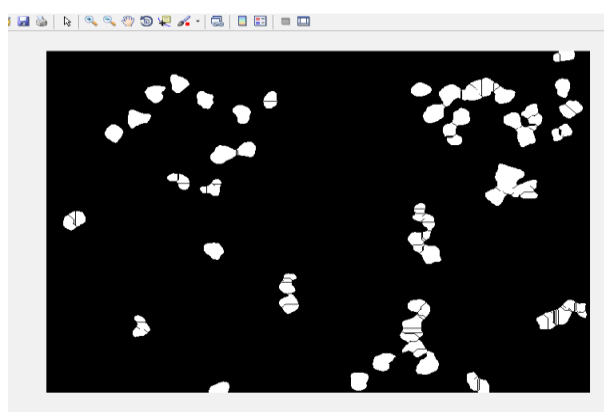
(e)



(f)



(g)

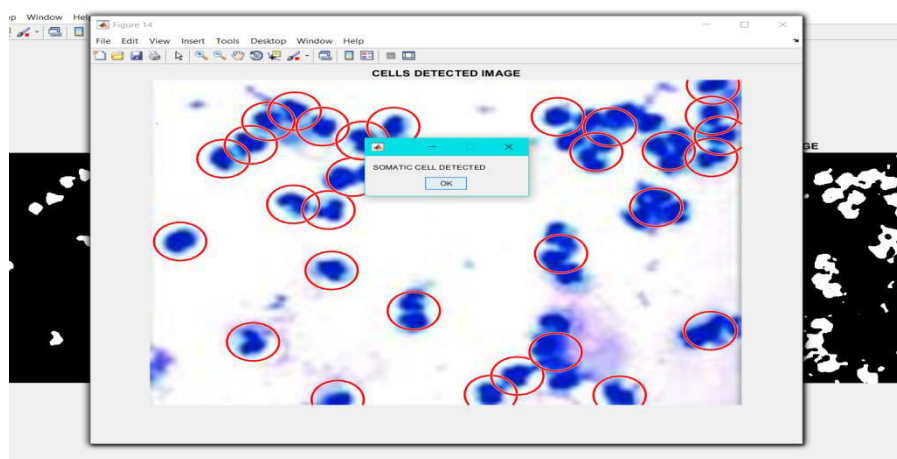


(h)

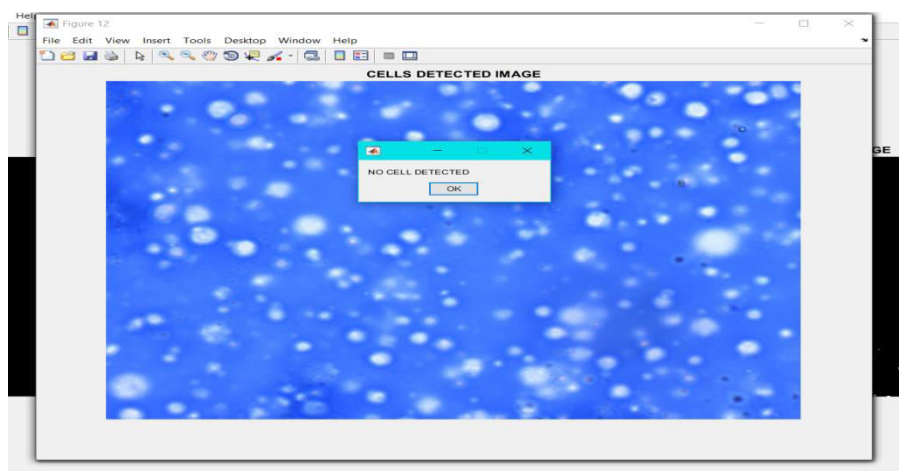


(i)

Figure3: Segmentation (a) Hue saturation value (b) Selecting saturation channel (c) Binary image of saturation channel image (d) Selecting red channel (e) Binary image of red channel (f) HSV and RGB processed output (g) Holes filled image (h) Watershed algorithm performed image (i) Segmented image



(a)



(b)

Figure 4 Classification (a)Cells detected image(b)Nil cells detected

V. CONCLUSION

In this paper, we presented a system for the detection and counting of somatic cells present in the milk microscopic images. Somatic cells are an important component naturally present in milk, and somatic cell count is used as an indicator of udder health and milk quality. The immune function of somatic cells in the udder defense and their protective role in milk will be primarily considered. Normally this is done by electronic devices which is high in cost. In order to avoid this we have used image processing based detection of somatic cells on microscopic images of milk. The HSV clustering technique is used to extract the cell region from the image more accurately and efficiently. Textural and color features extraction techniques are used to obtain best-suited features for classification. In this way, our proposed technique has been able to detect and count the somatic cells present in the microscopic images of milk efficiently.

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