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Segmentation of Overlapping Wheat Grains for Quality Detection

Deepak Singh Rana
PG Scholar, Department of Computer Engineering, G.B.P.U.A.T., Pantnagar, Uttarakhand, India
deepaksinghrana049@gmail.com

Abstract: ***This paper presents an approach for segmentation of overlapping wheat grain in the process of quality detection of wheat. The process of detecting wheat quality from image is divided into parts, i.e. pre-processing, feature-extraction and detection. For quality detection process depends on every grain present in an image, therefore feature extraction has to be done on every grain. For doing a proper feature extraction every grain has to be isolated from other part of the image to get better feature values. The isolation process is the segmentation of wheat grains by using Sobel operation and flood filling.***

Keywords: ***Image Processing, Image Segmentation, Wheat, Wheat Quality, Sobel Filter.***

I. INTRODUCTION

The increasing e-commercial market in the field of agriculture demands method for solving problems like quality detection of grains, prediction of production of crops and etc. Hence there is a requirement of portable and fast method for grain quality detection with less intervene of human, like detection of grain quality by image, etc. There are many approaches were proposed for wheat grain quality detection ([1] [3] [4] [6] [8]). In general the wheat grain quality detection process consist of three parts pre-processing, segmentation and detection. Pre-processing deals with the removing unnecessary aspect of image like noise, brightness effect and contrast. After pre-processing segmentation is done which isolates the grains for feature extraction and also an important part because if grains are not segmented in isolated form than the extracted feature are not efficient. Finally the extracted feature are used for grain quality detection.

In case of wheat grain segmentation it is not only process of separating grain images form back ground, but also required separate overlapping grains from one another. So, in this paper our main concern is the segmentation part of the wheat quality detection process. Where segmentation is divided in two parts (Prakhar et. al., 2017), where first part segments grain images from background and second part segments overlapping grains from one another. The section II consist the process of segmentation and explanation of its various parts. In Section III the results of segmentation is presented and section IV consist the conclusion and future improvements that can be done.

II. WHEAT GRAIN SEGMENTATION

The segmentation is a process separating the object of interest from background in the given image. In this paper the object of interest are wheat grains in an image and everything else is background. The segmentation process for wheat grain extraction is divided into two parts ([5]) i.e., level one and two segmentation.

A. Level 1 Segmentation:

In level 1 segmentation a threshold value of grey image is used to extract wheat grains form the given image and the process of extraction is given in procedure 1.

Procedure 1:

1. Removing noise from the given image.
2. Generation of grey image of the given colour image.
3. Calculating threshold by Otsu method ([2]) for grey image.
4. Generating a mask using grey image using threshold value.
5. Using the mask for extracting grain parts and applying an area filter for filtering out very large or vary small segments.

First step consist of cleaning of image by removing the noise for the image. In second step, colour to grey transformation, which can be done in many ways like taking only red component of an RBG colour image or blue component or maybe an average of two or three components (in the our tests the red components of RBG-image is used as grey image). Third step the threshold values is calculated by Appling Otsu method on grey image, which later used in fourth step for mask generation (mask generation process is given in Algorithm 1).

Algorithm 1:

1. for all pixel in grey_image:
2. if pixel[i, j] < threshold:
3. mask[i, j] = 0
4. else:
5. mask[i, j] = 1

In the final step, the generated mask is used for extraction of wheat grains segments from the background. A special area filter (in equation 1-3) is applied to the extracted wheat grains segments to discard very small and large segments. The whole process is also given in Fig. 1.

$$area_{avg} = \frac{\sum_{i=2^a}^{n-2^a} area_i}{n-2^{a+1}} \quad (1)$$

$$area_l = \frac{area_{avg}}{2^b} \quad (2)$$

$$area_u = area_{avg} * 2^b \quad (3)$$

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Where a, b are constant (a=2, b=2 in testing for Level 1 an Level 2 segmentation) and n is the number of segments, $area_i$ is the area of i^{th} grain segment out of n grain segments, $area_{avg}$ average area, $area_l$ is the lower area threshold and $area_u$ is the upper area threshold. Therefore the area filter discards any segment that is smaller than $area_l$ and greater than $area_u$. The area filter maintain the uniformity in the segments so, the processing proceed smoothly.

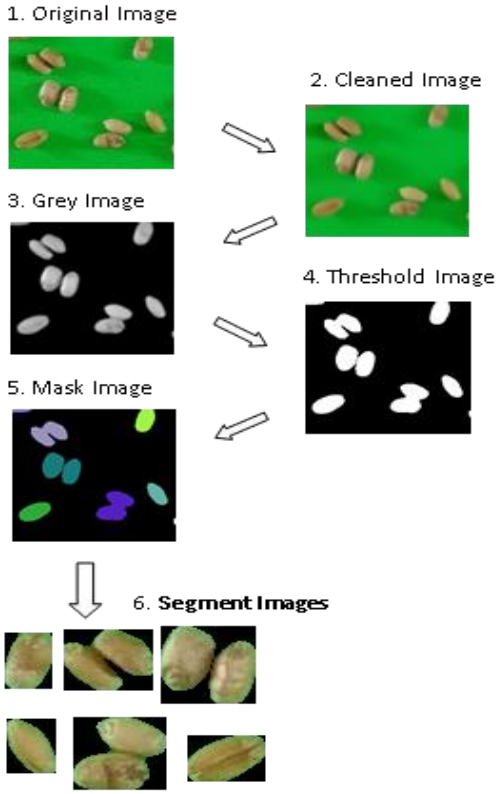

Fig. 1 Level 1 Segmentation Process

B. Level 2 Segmentation:

The level 2 segmentation is done for segmenting two or more overlapping grains into separate grains. This segmentation phrase exploit the dark areas respect to other area of a given grain image as edges of grain by applying the Sobel filter [7] and dilation operation. The Level 2 segmentation is given in procedure 2.

Procedure 2:

1. Generating grey image of grain image.
2. Generating the Sobel image by applying Sobel filter to grey image.
3. Otsu threshold is calculated on Sobel image and applied to get a bordered image.
4. Dilation of Sobel image is done which makes border thick.
5. The area in between thick border is extracted with different colour or number.
6. The extracted is then selected or rejected based of area filter.
7. Now the left in-between area is then flood filled until it encounters other colour/number or boundary of grain image.
8. Finally, the filled colour/number works as a mask and help in extracting different grain.

In first step, the grain image out of cleaned image (i.e. image after 1 step of level 1 segmentation) is take and grey image is extracted (i.e. red components of RBG-image). 2 and 3 step extracts the border of overlapping grain image by Appling Sobel filter while 4 step thicken the border to divide overlapping grain image into separate areas by Appling dilation on Sobel image. In 5, 6 and 7 step generate a mask for grains. Finally in 8 step the generated mask is used to extract grain out of given grain image. The whole process in given in Fig. 2. The main ingredient of level 2 segmentation is the Sobel filter which highlight the dark areas on the overlapping grains and these highlighted area are then used for segmentation of overlapping grains.

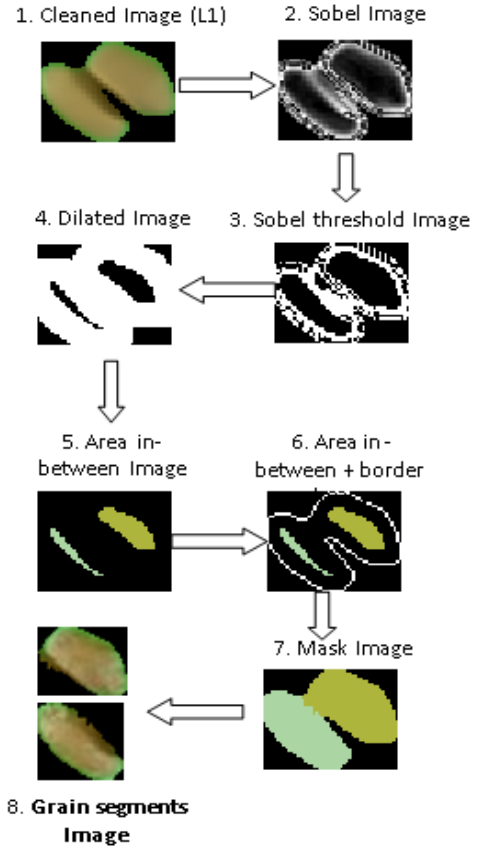

Fig. 2 Level 2 Segmentation Process (Where Cleaned Image (L1) is the Segment of Cleaned Image from Level 1 Segmentation).

III. RESULTS AND DISCUSSIONS

The Level 2 segmentation is testing on a dataset of 70 images of wheat grains out of which 10 are single grain,

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44 are two-overlapping grains and 16 more than 2 overlapping grain images is used for testing. The results are given in TABLE 1.

Table 1. Result of Segmentation on Dataset Of 70 Grain Images. (Results and Code Present [9])

Grain Image Type	Number Of Images	Correctly Segmented	Not Correctly Segmented
Single Grain	10	6	4
Two Grain	44	34	9
More Than Two	16	10	5

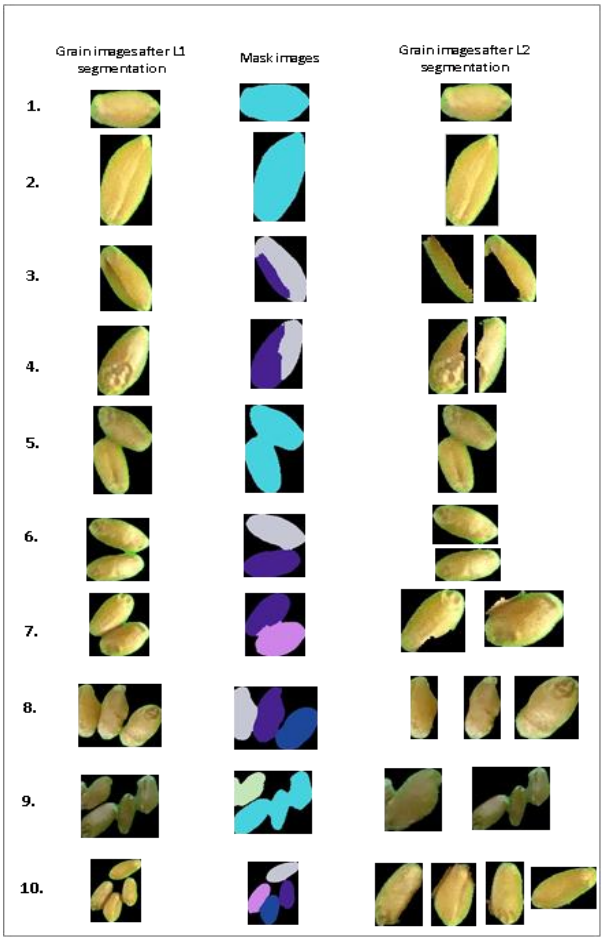

Fig. 3. Result Images of Segmentation Test on Dataset of 70 Grain Images

This segmentation method provide a fair estimation of grain but still does not gives satisfactory results. There are still some improvements to be made to segmentation process to get better results. There are some observation made based on results obtained by the described segmentation process first, it fails in some case like where image is not very clear, if grains are highly overlapping fig. 3 (5, 9). Secondly if a single grain contain a cut or deep mark then the grain's mid-part is mistreated as border which in return gives a mask of more than one grain fig. 3 (3, 4,). Also the problem of disoriented grain image after segmentation fig. 3 (7, 10).

IV. CONCLUSIONS

As the result shows there is three problems need to be solve for better segmentation result:

1. Classification of image of single grain from image of overlapping grain.
2. Shape approximation for recovering grain shape lost or added while segmentation overlapping grains.
3. Separating highly over lapped grains.

V. REFERENCES

[1] Mebatsion, H.K., Paliwal, J. and Jayas, D.S., 2013. Automatic classification of non-touching cereal grains in digital images using limited morphological and color features. Computers and electronics in agriculture, 90, pp.99-105.

[2] Otsu, N., 1979. A threshold selection method from gray-level histograms. IEEE transactions on systems, man, and cybernetics, 9(1), pp.62-66.

[3] Pabamalie, L.A.I. and Premaratne, H.L., 2010, June. A grain quality classification system. In Information Society (i-Society), 2010 International Conference on (pp. 56-61). IEEE.

[4] Patil, N.K., Malemath, V.S. and Yadahalli, R.M., 2011. Color and texture based identification and classification of food grains using different color models and haralick features. International Journal on Computer Science and Engineering, 3(12), p.3669.

[5] Prakhar K., Anurendra Kumar, Satyam Dwivedi, 2017. AUTOMATIC WHEAT GRAIN QUALITY ESTIMATION. EE604 Project Report, IIT Kanpur.

[6] Shantaiya, S. and Ansari, U., 2010, November. Identification of food grains and its quality using pattern classification. In 12th IEEE international conference on communication technology (ICCT), Nanjing, China (Vol. 1114, p. 35).

[7] Sobel, I., 1990. An isotropic 3× 3 image gradient operator. Machine vision for three-dimensional scenes, pp.376-379.

[8] Zhang, D., 2016. On Detection Method of Wheat Quality Based on Image Processing and Support Vector Machine. Revista de la Facultad de Ingeniería, 31(7).

[9] Segmentation of wheat connected in a picture (2017) https://github.com/deepakrana47/segmentation-of-wheat-connected-in-a-picture.