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The Detection of Straight and Slant Wood Fiber through Slop Angle Fiber Feature

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Abstract

Quality control is one of important process that can not be avoided in industry. Image processing technique is required to distinguish the quality of wood. If it can be done automatically by the computer, it will be very helpful. This paper discusses the detection of straight and slant wood fiber to distinguish its quality. This paper proposes an algorithm by using only two features i.e. mean (average value of slop angle fiber) and maximumangle (the maximum value of slop angle fiber). Then the classification method is used by tresholding. The result shows the performance is achieved on accuracy 79.2%

***Keywords**: detection, slop angle fiber feature, algorithm of feature extraction*

1. Introduction

Image classification technique requires a fairly long step. It starts from image segmentation, object identification, feature extraction, feature selection and classification [5]. Wood image real-time segmentation algorithm based on video processing has been proposed by Ratri [1] and has achieved 100% accuracy. This paper is a continuation of the research paper [1] to distinguish the straight and slant fiber. The samples are taken from previous studies on paper [1] and this paper only focus to the feature extraction algorithm.

2. Research Method

Figure 1 is the flowchart of algorithm proposed. The samples are taken using webcame and IP camera. Bwareaopen is used to eliminate the noise (small objects) in binary image. The “bwlabel” is used to find connected objects in binary image. Example of binary image taken and output “bwlabel” results is shown in Figure 2.

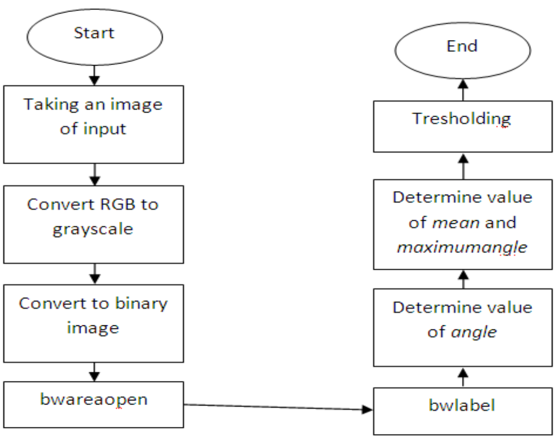

Figure 1. Flowchart of algorithm proposed

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1	1	0	0	1
1	0	0	1	1
0	0	0	0	0
1	1	1	0	0

(a)

1	1	0	0	3
1	0	0	3	3
0	0	0	0	0
2	2	2	0	0

(b)

Figure 2. (a) Example of binary image taken and (b) Output bwlabel results from Figure 2(a)

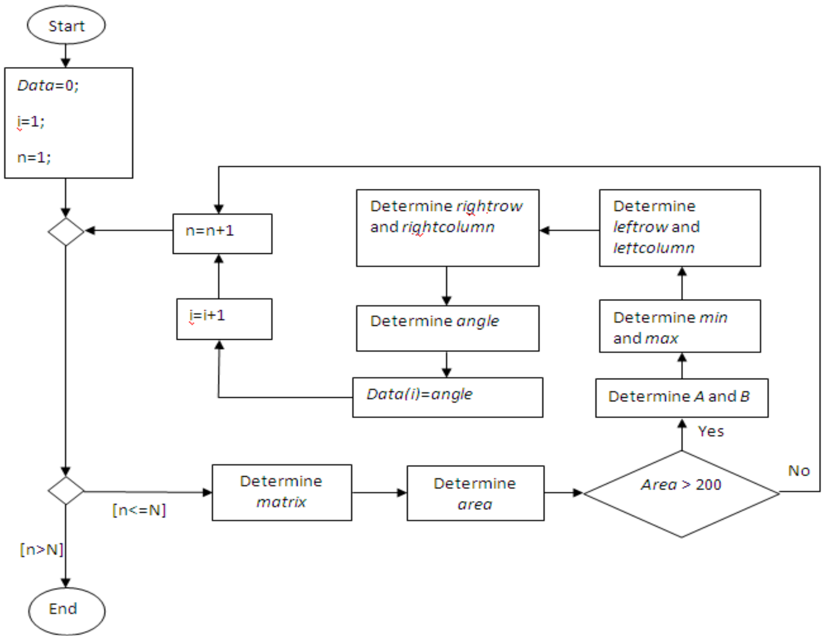


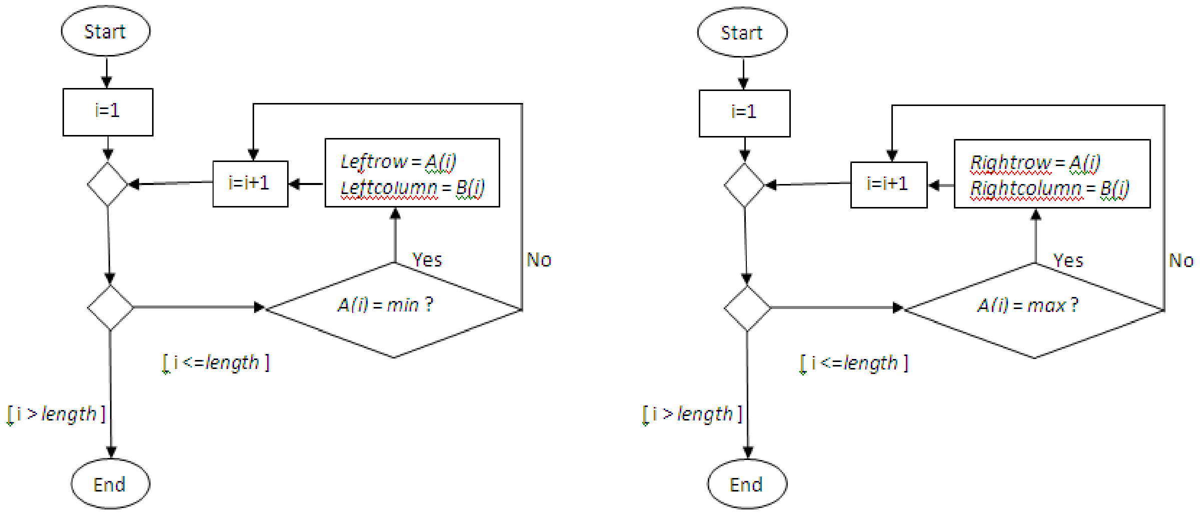
Figure 3. Flowchart to find *angle* and *data*

N from Figure 3 is the number of connected objects in bwlabel result. From Figure 2(b), there are 3 connected objects so it get N=3. *Matrix* is binary image of a connected object. There are 3 *matrixs* on Figure 2(b).

0	0	0	0	1
0	0	0	1	1
0	0	0	0	0
0	0	0	0	0

Figure 4. Third *matrix* from Figure 2(b)

Area is the amount of 1 valued pixel in *matrix*. It is obtained *area*=3 from Figure 4. Then, *A* is 1-dimensional matrix which is represent the row position of 1 valued pixel taken from *matrix*. while *B* is 1-dimensional matrix which is represent the column position of 1 valued pixel taken from *matrix*. From Figure 4, it is obtained *A*=[2 1 2] then *B*=[4 5 5]. It means that there are 3 pixels of 1 valued pixel in coordinate (2,4), (1,5), and (2,5). *Min* is the lowest value of *A*, while *max* is the highest value of *A*. If *A*=[2 1 2] then obtained *min*=1 and *max*=2.



(a) (b)

Figure 5. (a) Flowchart to find *leftrow* and *leftcolumn* and (b) Flowchart to find *rightrow* and *rightcolumn*

length is the length of *A*, If *A*=[2 1 2] so it is obtained *length* =3. Then, *angle* is an object slope angle (wood fiber) and can be found with this equation:

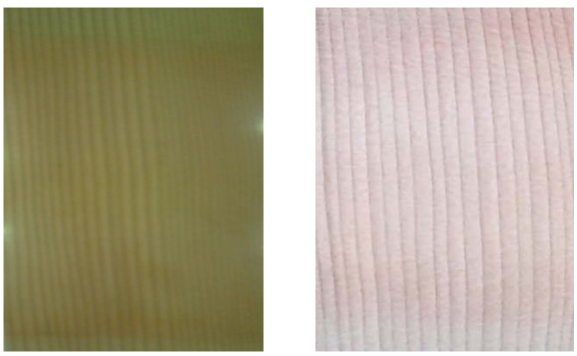
$$angle = \tan^{-1}\left[\frac{|rightcolumn - leftcolumn|}{|leftrow - rightrow|}\right]$$

Data is a 1-dimensional matrix contains the values of *angle* at a wood image. M*ean* is the average of *angle* value while *maximumangle* is the highest *angle* value. These *mean* and *maximumangle* are used as feature vector. Whereas, the classification uses tresholding method. Tresholding is done by the following rules:

a) If *maximumangle* < *x* or *mean* < *y*, It is decided as straight fiber
b) If *maximumangle* >= *x* and *mean* >= *y*, It is decided as slant fiber

3. Results and Analysis

The samples which are used are taken from wood processing industry with the size 20cm x 8cm. Figure 6 is the sample:



(a) (b)

Figure 6. (a) Sample taken through webcame and (b) Sample taken through IP camera

To see the performance of the proposed algorithm, it is tested by using the three scenarios:

a) The samples are taken by using two types of cameras to find out which is the best.
b) Do the optimization of *x* to find out the best value of *x*
c) Do the optimization of *y* to find out the best value of *y*

Table 1. The result of first scenario

No	Type of Camera	Number of samples		Total	Accuracy (%)
		Straight fiber	Slant fiber		
1	Webcam	592 woods	356 woods	948 woods	71.73
2	IP Camera	150 woods	100 woods	250 woods	77.2

The experiments in Table 1 is done with a value of x = 4 and y = 3.2 then, the results show the accuracy using IP camera is higher than webcame. These results are used as a reference for using the sample of IP camera in the next scenario.

Table 2. The result of second scenario

No	Value of *x* (degrees)	Accuracy (%)
1	2	77.2
2	3	77.2
3	4	77.2
4	10	77.6
5	15	74
6	20	66.8

The experiments in Table 2 is done with a value of y = 3.2 then, the results show that optimal value is on the value of x = 10. In other words, straight wood fiber has a value of slope angle fiber below 10 degrees, and for slant fiber wood has a value of slop angle fiber began over 10 degrees.

Table 3. The result of third scenario

No	Value of *y* (degrees)	Accuracy (%)
1	2.2	68.4
2	3.2	77.6
3	3.7	78.4
4	4	79.2
5	4.2	78.4
6	4.7	74.8
7	5.2	72

The experiments of table 3 is done with a value of x = 10 then, the results show that optimal value is on the value of y = 4. In other words, straight wood fiber has an average value of slop angle fiber below 4 degrees, and for slant fiber wood has an average value of slop angle fiber began over 4 degrees.

4. Conclusion

This research has an algorithm with 79.2% accuracy by using only two features i.e. *mean* (average value of slop angle fiber) and *maximumangle* (the maximum value of slop angle fiber). This algorithm can be adapted to other cases that have a same typical object.

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