



# Image Processing for Combat Charcoal Identification Based on Maturity Level

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## ARTICLE INFO

## ABSTRACT

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At this time the processing of coconut shells into shell charcoal is very much done by ordinary people, especially in villages that have a large coconut population. This is because the benefits obtained from the processing of coconut shells can meet the needs of the community. The many desires of the people who want to do the processing of coconut shells, but not accompanied by sufficient knowledge and knowledge of the quality of charcoal desired by buyers, so it is undeniable that the number of coconut shells that have been processed into charcoal but not sold in the market. o with this, it is expected that after using the image processing method can provide knowledge and knowledge to the public about the quality of charcoal that buyers expect, especially to identify the difference in coconut shells that are still not charcoal, coconut shells that are half into charcoal and coconut shells that have become charcoal. This image processing method will classify coconut shell charcoal based on digital imagery with a media interface GUI (Graphical User Interface) that utilizes matlab software.

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## 1. Introduction

The development of technology today is very rapid, especially technology in the field of information technology that can be widely utilized in many other fields[1]. One of the technologies that is growing rapidly is in the field of digital imagery, which is a two-dimensional image that can be displayed on a computer screen as a discrete set of digital values called pixels / picture elements[2]. The image referred to here is a still image (photo) or a moving image (derived from a webcam). While digital here has the intention that the processing of images / images is done digitally using a computer[3]. According to Sinambela, et al (1983) shell charcoal experts are charcoal made by carbonization of coconut shells. According to Jacob (1949), activated charcoal is a form of charcoal that has been activated using CO<sub>2</sub>, water vapor or chemicals, so that the pores are open and thus its adsorption power becomes higher against color and odor. Activated charcoal contains 5-15%, 2-3% ash and the rest consists of carbon[4]. The good quality of coconut shell charcoal is black and when crushed / broken on the edge of the former fault is shiny. Based on the opinion of these experts, it can be concluded that charcoal that has good quality is charcoal that is black and the edge of the former fault is shiny[5]. Digital image processing in this study will classify into 3 parts of the maturity of the shell charcoal, namely charcoal that is brown (immature), charcoal that is blackish brown (half-cooked) and charcoal that is black (ripe). This can be seen in figure 1 below:





Fig 1. Maturity level of shell charcoal

## 2. Research Method

The methods carried out in this research consist of several stages, namely literature studies, design and program design, testing, and analysis[15].

### 2.1 Literature Studies

Literature studies are conducted by looking for information and references from various sources related to image processing and its implementation.

### 2.2 Design

The design consists of a cover design, a Matlab GUI design and an exit design. Cover design in the form of a design to start the application by using 1 button and named start.

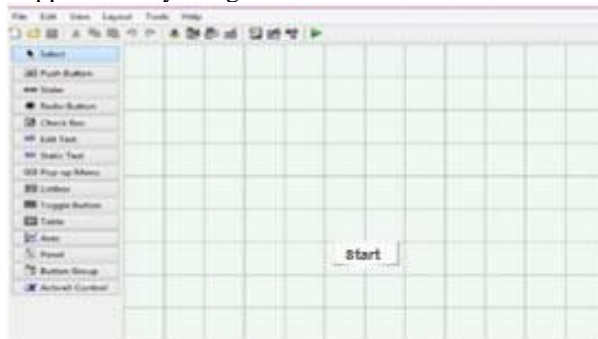


Fig 2. Cover Design

Matlab GUI design in the form of a design for processing images with: (1) 4 axes used to display images; (2) 6 edit text used to display image information; (3) 4 labels are used to provide information; (4) 3 buttons; (5) Open image is used to select images; (6) Results are used to start the editing process. (7) Exit is used to exit the GUI.

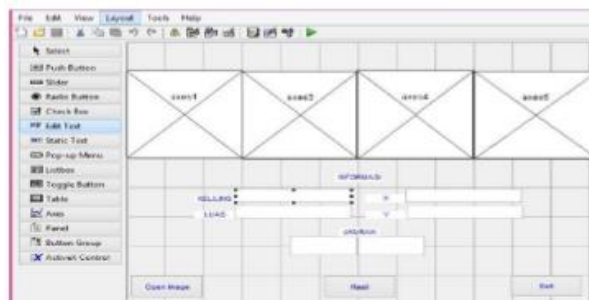


Fig 3. Design

The exit design is used to display a question dialog where users can opt out or not.

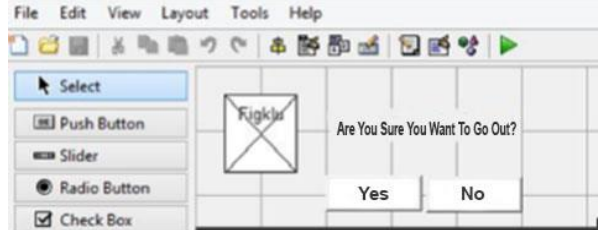


Fig 4. Design Out

2.3 Planning Program

Program design using matlab software with programming language used is C language. The program is created using m files and can be programmed in every toolbox icon used. The program also contains a fuzzy logic intelligent system for processing charcoal image reading data so that the gui is able to provide size decisions quickly. The entire program flowchart can be seen in the image below.

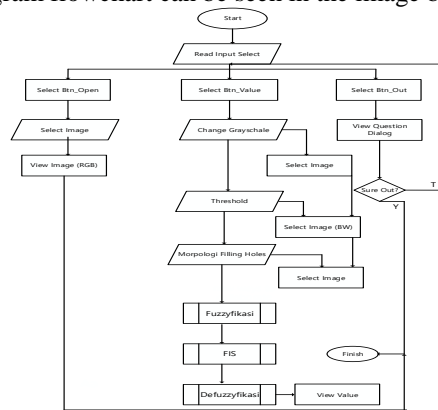


Fig 5. Flowchart overall

a. Fuzzyfikasi

The fuzzyfication stage is the stage of formation of the membership function. In the Input section there are 2 input variables, namely area variables and PERIMETER variables. Area Variables and LinGUistics PERIMETER Variables each have 3 linGUistik values. LinGUistik value is determined from the experiment of 3 types of charcoal and each condition 3 charcoal, so get linGUistik value from each condition. Figures 5 and 6 show the AREA and PERIMETER membership functions.

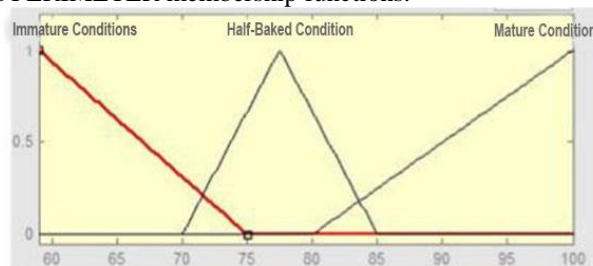


Fig 6. Fuzzyfication AREA

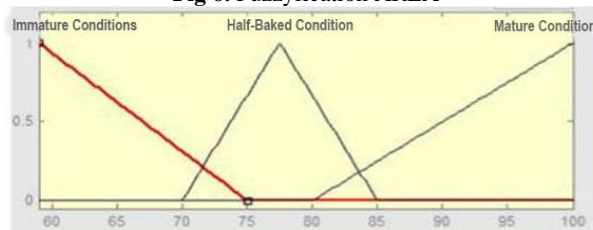


Fig 7. Perimeter Fuzzyfication



### b. Basis Rules

At this stage each output of the fuzzyfication stage in the form of membership degrees and linguistic variables from both AREA and PERIMETER will be combined using evaluation rules. In the evaluation of the rule there are linguistic rules to determine the action of control over the input value of fuzzyfication. The first step is the evaluation of the relationship or antecedent degree of each rule. Next, a degree of truth is performed for each rule, using an "AND" relationship or a minimum value. Once the degree of truth is obtained for each action the same will be sought the highest value. This method is called inference "MIN-MAX".

### c. Defuzzyfikasi

The output result of the evaluation stage of the rule will be used as the most correct rule and will be multiplied by the value of the degree of membership. The method used in defuzzyfikasi is the Center of Gravity (COG) or centroid. The sum result of all membership function outputs multiplied by the singleton of each action. From these results are then searched for an average with total fuzzy output. So the end result is a firm value. This final value is used to determine the color of the charcoal.

### 2.4 Testing

Image capture using a 5 mp hp camera with a distance of 15 cm. The image testing process uses a format (.jpg) and with a dark background with the same pixel dimensions of 720 x 1280.

### 2.5 Analysis

At this stage, analysis of test results data is carried out that aims to find out the results and conclusions of some of the tests that have been done. From this analysis will be known shortcomings and advantages in image processing, controllers used and intelligent systems fuzzy logic applied.

## 3. Results and Analysis

**Table 1**  
Immature Conditions

Immature		Size(pixel)	
Manual	Automatic	Area	Perimeter
TM	TM	48324	850.767
TM	TM	65929	997.377
TM	TM	63941	977.335
TM	SM	68143	1028.1
TM	TM	63367	992.105

**Table 2**  
Half-Baked Condition

Half-ripe		Size (pixel)	
Manual	Automatic	Area	Perimeter
SM	SM	72240	1061.28
SM	SM	74357	1100.49
SM	M	67959	1027.03
SM	SM	72035	1038.55
SM	SM	71729	1092

**Table 3**  
Mature Condition

Ripe		Size (pixel)	
Manual	Automatic	Area	Perimeter
M	SM	81314	1101.6
M	M	81913	1110.83
M	M	82676	1124.73
M	M	82706	1108.63
M	S	79805	1091.95

**Table 4**  
Results Comparison Table between Manual and Automatic

No	Citra	Area	Perimeter	Early Conditions	Conditions Should
1	Q1	68143	1028.1	TM	TM
2	Q2	63907	970.063	TM	TM

No	Citra	Area	Perimeter	Early Conditions	Conditions Should
3	Q3	63836	969.235	TM	TM
4	Q4	67959	1027.03	SM	TM
5	Q5	81314	1101.6	M	SM
6	Q6	79805	1091.95	M	SM

Automatic charcoal maturity decision making uses a smart system of fuzzy logic and from the results of the above experiment there are several errors caused by human errors from experts working in the field of charcoal making. As for the conditions: (1) In table 2 position 4 can then be called (Q1) there are conditions of immature should include immature. (2) In table 3 position 1 can then be called (Q2) and position 2 (Q3) is in immature condition should include immature conditions. (3) In table 4 position 3 can then be called (Q4) there is a half-baked condition should include immature. (4) In table 5 position 1 can then be called (Q5) and position 5 (Q6) is in a mature condition should include half-baked conditions. Based on some of these conditions, it can be shown that there is an error in determining the condition of the expert charcoal maker. This led to human error in 24% of the total trials.

#### 4. Conclusion

Based on the tests that have been done, it can be concluded: (1) The system "image processing for the identification of shell charcoal based on maturity level" was successfully created with the Matlab GUI. (2) Gui is used as an output to display the results of digital image processing according to its stages, and can display the results of maturity decisions. Fuzzy logic also works well. (3) The software used to realize this system is Matlab software to program the Matlab GUI. Overall, the program is working in accordance with the purpose. The total success of testing an image processing system for the identification of this maturity is 76% and the error is caused by human error experts working in the field of charcoal making.

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