

# MILKFISH SIZE CLASSIFICATION METHOD USING IMAGE PROCESSING

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# ABSTRACT

This paper proposes a realistic method for measuring the size of fish that is efficient and simple. Since the fish that are measured have different in size, the key technical challenge when we calculate the fish size is to measure accurately based on standard. Photographs and measurements of the length and width of 150 fish were taken at the same time. A set of 100 images had background-labeled pixels. This classified dataset was then used to automatically segment images into certain pixel groups for the training of Deep Learning Networks. So I present the classification and sorting scheme of fish size without any interaction with them. The portable device consists of an adjustable height camera mounted on a rod and the camera will be connected to a computer for capturing images, four adjustable intensity lights to be used for illumination, and an image processing program in which we have built to calibrate and measure the length and width of the fish. Lastly, the actual data on length and width will be registered. This paper provides tests and analysis that will check the system's practicality and effectiveness.

Keywords: non-contact measurement system, image processing, automatic control.

#### INTRODUCTION

The most important stage of the Fish Classification is the extraction of the characteristics, consisting of two appearance-based types (such as colors and textures) and the extraction of geometric characteristics, derived from fish images of local characteristics such as length of fish mouth, length of anal fin, angle of fish head, angle of eye-end mouth, and length of caudal fin. [M. K. Alsmadi, et al. 2020]. A Mask R-CNN based morphological feature segmentation and measurement scheme that can detect different morphological features of fish. [C. Yu, et al. 2020]. A research uses Deep Learning models for the creation of a computer vision framework for the measurement of morphometric features of live fish and the prediction of body weight and carcass weight [A. Fernandesa, et al. 2020]. The fish size knowledge is important for the economy of any aquaculture enterprise. We can use the size data to track fish growth, decide the quantity of feed and sort or harvest fish in the fisheries field. [F. Westling, et al. 2014]. The calculation of fish size and sorting is a task. There are several fish size calculation methods and some different kinds of mechanisms and techniques have been developed over the years. [5] - [9]. These approaches can be classified into two categories: methods for contact and methods for non-contact. The measuring board is the typical equipment for measuring fish size. Attached to the hardwood or acrylic plastic is the scale on it. Using the board with the eyes of the observers, which is unreliable and inaccurate, the fish were measured, so we should be conscious of the limitations of the human visual system. [M. Y. Ibrahim et al. 2009]. Another approach for determining fish thickness is to use a roller grader [Zhaorui Gu et al. 2017]. From the thickness, the fish's length is determined. The outcome, however, is not acceptable. This paper therefore provides a clear method of calculating fish size and sorting the fish. The system's

methodology is defined in Section 2. Next, Section 3 shows the experiment and outcome study. Finally, Section 4 concludes that the proposed system is successful.

# **Objectives of the Study**

Two questions were identified to guide the study:

- proposes a realistic method for measuring the size of fish that is efficient and simple.
- provide the fish producer with a successful means of ensuring and checking for customers that the commodity is of high quality by scale.

#### METHODOLOGY

In this analysis, the image acquisition system is shown in Figure-1. The design concept prototype device built consists of a USB camera connected to a computer to capture fish images for size processing. The camera's height is adjustable. In addition, there are two adjustable intensity lights that will be used for illumination to prevent the measurement precision from being compromised by the shadow and for image consistency. The Prototype uses a conveyor belt to carry the sample fish and separates them accordingly.

# A. Design Concept



Figure-1. Design concept of the prototype.

Figure-2 illustrated the flowchart of the image processing. The image of a single fish is taken one by one for measuring or calculating. Each image will go through the process below.



Figure-2. Flow diagram for scanned image.

It should acquire the image needed for calibration before capturing fish images. Via Hough transform, we can detect straight lines and get the total line picture length. We can then obtain the ratio between the total real length of the line and the total length of the representation of the line. The ration can be calculated as the following equation (1) shows.

$$\mathbf{r} = \frac{\mathbf{a}}{\mathbf{b}}$$
(1)

where a represents the total line image length, b represents the total actual line length, and r represents the ratio between total actual line length and total line image length.



Figure-3. Fish detection and recognition sample.

# **B.** Fish Size Computational Method

The numerical process of fish size is not difficult. There are some assumptions to be considered. The assumptions made are the w and x parameters shown below:

w = fish image sizex = actual fish size

Now, with these parameters and the equation (1), we can calculate the fish scale. Figure-3 is the picture of the fish which we need to calculate. We should ensure the location of the fish before taking the picture of the fish and the background should be dark and not shiny as it would interfere with the image attainment. Equation (2) can be used to measure the actual size of the fish, where x is the actual fish size in the picture frame.

$$\mathbf{x} = \mathbf{w} * \mathbf{r} \tag{2}$$

The Philippine National Standards (PNS) for frozen milkfish was prepared as part of the project of the Bureau of Agriculture and Fisheries Products Standards (BAFPS) with the Bureau of Agricultural Research (BAR) entitled "Quality Standardization on Selected Fishery Products" (Table-1).

Table-1. Size Classification - Frozen whole milkfish.

| Size        | Weight range (g) |  |
|-------------|------------------|--|
| Small       | < 200            |  |
| Medium      | 200-249          |  |
| Large       | 250-350          |  |
| Extra Large | >350             |  |

## **RESULTS AND DISCUSSIONS**

#### **A.** Calculation Result

As for Table-2, the start and end of the length or width of the fish that we need to calculate should be determined by the actual fish size. Next, in Matlab, we can get the fish image length and the fish image width. The decision making for the size classification of banana will be specified by the fuzzy logic algorithm. The table shows the tabulated result at a fixed distance and under the same light intensity at the time of imaging.

Table-2. Data result in excel.

| Image<br>Name | Measure<br>length<br>(cm) | Measured<br>width<br>(cm) | Fish<br>image<br>Length | Fish<br>image<br>Width |
|---------------|---------------------------|---------------------------|-------------------------|------------------------|
| Fish1         | 33.5                      | 9                         | 779.9906                | 398.7332               |
| Fish2         | 27                        | 7.1                       | 692.8966                | 486.647                |
| Fish3         | 28.2                      | 7.8                       | 695.8226                | 492.356                |
| Fish4         | 28.4                      | 7.6                       | 694.5525                | 181.4915               |

| Fish5  | 21.8 | 5.6 | 526.6005 | 135.6378 |
|--------|------|-----|----------|----------|
| Fish6  | 22.1 | 5.5 | 544.5986 | 140.7328 |
| Fish7  | 21.0 | 5.4 | 447.8448 | 192.7491 |
| Fish8  | 21.7 | 5.8 | 515.8055 | 199.0601 |
| Fish9  | 21.9 | 5.9 | 538.4945 | 138.6662 |
| Fish10 | 23.3 | 5.6 | 570.2114 | 133.0366 |

In Table-3, shows the size classification based on Quality Standardization on Selected Fishery Products where the measured weight of the fish is compared to the calculated weight in Matlab which is 86.2% accuracy.

|--|

| Image<br>name | Measured<br>Weight (g) | Classification | Calculated<br>Weight (g) |
|---------------|------------------------|----------------|--------------------------|
| Fish1         | 640                    | Extra Large    | 177494                   |
| Fish2         | 320                    | Large          | 70653                    |
| Fish3         | 323                    | Large          | 71956                    |
| Fish4         | 380                    | Extra Large    | 144068                   |
| Fish5         | 120                    | Small          | 38230                    |
| Fish6         | 123                    | Small          | 46686                    |
| Fish7         | 110                    | Small          | 27233                    |
| Fish8         | 111                    | Small          | 28654                    |
| Fish9         | 115                    | Small          | 36313                    |
| Fish10        | 180                    | Small          | 52024                    |

Figure-4 Show the membership function of Length and Width and Figure-6 for the Membership function of output.



**Figure-4.** Membership function of input: (a) Width (b) Length.



Figure-5. Membership function of output.

## CONCLUSIONS

The purpose of this research is to create a prototype used for sorting to calculate the standard size of milkfish. The measured standard parameters are the length and width of the fish. The image captured in real time by Milkfish was transferred to the laptop containing the database for the standard fish image algorithms. In order to assess the quality of the findings, the Philippine National Standards (PNS) for frozen milkfish are in place. This research has provided the fish producer with a successful means of ensuring and checking for customers that the commodity is of high quality by scale.

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