Estimating Fish Length Based on Web Service Application

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Abstract. One parameter for identifying a fish is its body length. To identify the length of fish, it is still done manually using a meter. Manual measurement results in difficulties that are considered inappropriate, less effective and require a long time, especially in large quantities. For this reason, a fish length measuring system is implemented using a web service application that can facilitate measurement to be more effective and efficient. The stage starts from the fish shooting process using an Android camera. Furthermore, in the web application, the image is pre-processing, which is to change the color image into a grayscale image and do the color equation in the background. The grayscale image is segmented object in the form of separation of objects that are not needed in an image of the fish and remove the non-important part of the object to be addressed. Then proceed with the feature extraction process to get the estimated length of the fish. The simulation results show that the web service application system is able to produce an accuracy rate of estimated fish length from 90% to 98%.

1. Introduction

One parameter for identifying a fish is its body length. So far, the measurement of the length of the fish is still done manually. Manually measuring the length of the fish is considered inappropriate, less effective and takes a long time, especially in large quantities. The use of computer technology and digital image processing techniques can facilitate the work of measuring fish lengths to be more effective and efficient when compared to what is commonly done.

The purpose of this research is to design a simulation system of web service using a web service application to automatically estimate the length of the fish. The stages start from the design of a mobile application that can capture fish images and can instantly display the estimated value of the length of the fish through a web service. Initially the fish was taken using an android camera, then in the web application, the image was pre-processed, which is to change the color image into a grayscale image and do the color equation in the background. The grayscale image is segmented by the object in the form of separation of objects that are not needed in an image of the fish and remove the non-important part of the object to be addressed. Then proceed with the feature extraction process to get a comparison between the length of fish measured manually with the length of the fish calculated using a web service application. Here, labeling is done to eliminate binary images for all interconnected components that have less than the specified pixel. Then, image modeling in the form of fish length estimation is calculated through the scaling process to equalize and reduce the size so that it is easier to calculate in the system. Through this research, researchers hope to contribute to the development of
an automation system for estimating the length of fish and making it easier for stakeholders to do their work.

Fish have different shapes and sizes. This indicates the existence of certain features of characteristics, shape, and size of the fish in nature. The features of the fish are visible, including body shape, color, the form of the operculum, and the gap among body parts of the fish [1] [2] [3]. The connection between length and weight of the fish is one of the complementary information in managing fishing resources, converting catch statistics, predicting population size and mortality rates, and determining which kind of dragnet should be used for capturing certain-size fish [2] [3] [4] [5].

Image is a representation (picture) of similarities or imitation of an object. The image as output of a data recording system might have an optical feature in the form of a photograph, analogue feature in the form of video signals such as a picture on a television monitor, or digital feature which can be directly stored in a specific medium [6]. In digital images, data is represented in the matrix form [7]. An image can be defined as the function of the f(x, y), M lines and N columns [7], with x and y are spatial coordinates, and the amplitude f at the x, y coordinate point is called the intensity or gray level of the image at that certain point [7], [8].

Blob detection invented around the 1990s when it detected the same angle in image objects with different scales [9], [10]. In 1993 Professor Tony Lindeberg published a paper using mathematical methods to handle feature variations on different scales. The corner detector cannot detect with accuracy. The features on the image are multi-scale so new methods should be made for changes in the scale of the image. Poor feature detection can lead to inaccurate object detection. A blob is an area where a group of pixels are the same. Each area has different features compared to its surrounding area, so each blob differs from one another [9]. In image processing, detecting low-level objects in an image is important. A 2D or 3D image is called a blob. Blobs appear in a different way depending on the size and can be detected using a simple method in image representation [11]. 3D blob is an elliptic feature in space-scale proportioned by convex hull (boundary of minimal convex set containing one set of voxel blob). Blobs occur in different shapes and places. For example, a blob can be found in a hand drawing, as shown in Figure 1.

Figure 1. A hand is overlaid by some blobs and ridges [11]

Error is the difference of sum or the difference between the estimated value (approximation) to the exact value. This error usually arises because of the measuring process or the use of approximation [12]. The magnitude of the error of an estimated value can be expressed quantitatively and qualitatively. The magnitude of the error expressed quantitatively is called Absolute Error. The magnitude of the error expressed qualitatively is called the Relative Error [12]. The exact value can be formulated as the relationship between the approximate value and the following error value [12]:

\[ v = v' + \xi \]  

where:

\[ v = \text{exact value}, v' = \text{approximate value}, \xi = \text{error value} \]
The absolute error shows the magnitude of the difference between the exact value and the approximate value [12]:

$$\xi_a = |v - \xi_a|$$  \hspace{1cm} (2)

Absolute error does not indicate the magnitude of the error rate, but simply shows the differences between the exact value and the estimated value [11]. Whereas, the relative error indicates the magnitude of the error between the approximate value and the exact value which is calculated by comparing the absolute error to its exact value (usually expressed in %) [12].

$$\xi_r = \left| \frac{\xi_a}{v} \right| \times 100\%$$  \hspace{1cm} (3)

where:

- $v =$ exact value; $\xi_r =$ relative error; $\xi_a =$ absolute error

The smaller the relative error, the better the estimated value [12].

2. Methodology

In this study using 25 images of tuna (as in Figure 2). The initial process that is carried out is the manual measurement process of tuna data obtained in accordance with the measurement of the magnitude of the fish based on the length of the fish measured horizontally from the tip of the maxilla to the tip of the tail using a meter. This is done to make a comparison between the length of the fish that is measured manually and the estimated length of the fish using a web service application.

![Sample of actual fish image](image-url)

**Figure 2.** Sample of actual fish image
Figure 3. Research System Design

The design of the research system for estimating the length of the fish is described in Figure 3. Initially, in the mobile application there is an image acquisition process in the form of capturing fish images through photo taking using an Android camera with digital image output resolution of 4160 x 3120 pixels. There is no determination of the distance between the camera and the fish object as long as the camera is able to capture the whole body of the fish. After obtaining fish photos, the image of the fish is continued to the introduction process which is done by determining the server to do the calculations. Here, researchers use the same server between Android and backend. After obtaining the same server, proceed with uploading the acquired image.

Fish images that have been captured using android are then received on the server to estimate calculations. The first stage of estimating calculations carried out in the server is pre-processing. Pre-processing is the initial process of image recognition systems. The initial process in pre-processing is to change the color image into a grayscale image. This is used to simplify the image model and perform color equations in the background by detecting clustered background color pixels.

Then, the grayscale image is segmented by the object in the form of separation of objects that are not needed in an image of the fish and eliminating the unimportant part of the object to be addressed. At this stage, the researcher focuses on the appropriate algorithm and can function properly to be able to process image segmentation, which is using the canny edge detection method. In the initial stage this method performs a smoothing process to reduce noise in the image, followed by calculating the image gradient, and non-maximal supression of the image gradient to localize the image edges.

The next step is to do a calculation in the form of feature extraction process. In the extraction process the feature is labeled to eliminate binary images for all interconnected components that have less than the specified pixel. Furthermore, image modeling in the form of fish length estimation is calculated through the scaling process to equalize and reduce the size to make it easier to calculate in the system. So that the results are obtained from the estimation of the length of the fish automatically.

3. Results and Discussion
Estimated length of fish through a web service application using anaconda navigator. Bounding boxes from fish show that fish is estimated by estimating their body length from the tip of the jaw to the tail. The results of the estimation of the length of fish from 25 fish samples measured using a more detailed application are found in table 1.
**Figure 4. Results of the Research Process**

**Table 1.** Comparison of length values measured manually with a long value, which is measured using a web service application system

| Image | Measured manually | Measured by web service application |
|-------|-------------------|-------------------------------------|
| fish 1 | 24,0              | 22,965                              |
| fish 2 | 25,0              | 20,955                              |
| fish 3 | 26,0              | 27,685                              |
| fish 4 | 27,0              | 26,303                              |
| fish 5 | 27,5              | 27,685                              |
| fish 6 | 28,4              | 29,363                              |
| fish 7 | 30,0              | 24,829                              |
| fish 8 | 30,5              | 26,302                              |
| fish 9 | 31,7              | 24,053                              |
| fish 10| 32,0              | 31,505                              |
| fish 11| 32,4              | 33,328                              |
| fish 12| 33,0              | 31,767                              |
| fish 13| 34,9              | 35,060                              |
| fish 14| 35,8              | 35,209                              |
| fish 15| 36,0              | 35,976                              |
| fish 16| 36,3              | 34,296                              |
| fish 17| 36,5              | 35,586                              |
| fish 18| 36,9              | 36,905                              |
| fish 19| 37,8              | 36,594                              |
| fish 20| 40,0              | 41,067                              |
| fish 21| 46,0              | 42,630                              |
| fish 22| 48,0              | 48,812                              |
| fish 23| 49,0              | 47,680                              |
| fish 24| 50,0              | 51,379                              |
| fish 25| 52,0              | 53,432                              |
| Total | 886,7             | 861,366                             |

Based on the results of the comparison above, it was found that the estimated length values were calculated using the web service approaching the length value measured manually, so an error was needed to test the accuracy of the system. The specified error value is 50% for accuracy rate and 50%
for error rate. The error calculation process performed in this study uses equation (1), (2), and (3), with PM (Manual Length), PH (Estimated Result Length), as follows:

\[
\text{Error rate} = \frac{|\text{Total PM} - \text{Total PH}|}{\text{Total PM}} \times 100\%
\]

\[
\text{Relative Error} = \frac{25,334}{886,7} \times 100\% = 2,857 \%
\]

So, the accuracy of the system is 100% - 2,857% = 97,143%

So, the smaller the relative error, the better the estimated value will be. Error results from system accuracy are shown in graph 1 below.

![Comparison chart of fish length measured manually with long estimation value using web service](image)

**Figure 5.** Comparison chart of fish length measured manually with long estimation value using web service

4. **Conclusion**
This research designed a system of simulation of fish length estimation automatically using a web service application. Measurement results show that the system is able to calculate the estimated length of 97.143%. This shows that this system is capable of producing accuracy rate of 90% to 98%. With this system, it is expected that it can facilitate the work of stakeholders and can be a useful technology that is useful especially in the field of fisheries. The use of this system can also facilitate the work of measuring fish length to be more effective and efficient when compared to what is normally done.

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