A Prototype of Raspberry Pi Camera Morphometric Measurements on Sheep Using Digital Image Processing

by Bakhtiyar Hadi Prakoso

A Prototype of Raspberry Pi Camera Morphometric Measurements on Sheep Using Digital Image Processing

To cite this article: Angga Rahagiyanto *et al* 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **980** 012064

A Prototype of Raspberry Pi Camera Morphometric Measurements on Sheep Using Digital Image Processing

Angga Rahagiyanto[1*], Bakhtiyar Hadi Prakoso[1] and M. Adhyatma[2].

[1]Medical Record Department, Politeknik Negeri Jember[3] Jalan Mastrip PO BOX 164, Jember 68121, Indonesia
[2]Livestock Department, Politeknik Negeri Jember[3] Jalan Mastrip PO BOX 164, Jember 68121, Indonesia.

**rahagiyanto@polije.ac.id*

Abstract.
Quantitative data are needed to identify and predict opportunities for increasing livestock productivity. The increase in livestock productivity can be assessed from the dimensions of the body of the livestock by measuring directly using morphometric. Morphometric data is an important parameter used to study livestock anatomy, productivity, growth rate, and performance quality of livestock. This research is focused on how to make a prototype development of a camera tool that can measure livestock morphometrics at a distance. The Camera use in mini camera with a raspberry pi as a microcontroller. And method to process the capture of data is Artificial Neural Network that downloaded from tensor flow. The result of this experiment show that the accuracy of the system is 50%. However, the camera has not been able to identify the object of farm animals correctly. There are several livestock objects detected as dog or cat. For the future work the library must be modified so it can only detect the sheep or goat so the morphometrics can be done.

1. Introduction

The existence of livestock, especially sheep in Indonesia, has enormous potential. In 2018, the population of sheep in Indonesia reached 17.611.000 heads. This population continues to increase in 2019 to 17.794.344 individuals [1]. The Ministry of Agriculture through the Directorate General of Animal Husbandry and Animal Health noted that the national sheep and goat population continues to increase [2]. This is in line with the vision of the Minister of Agriculture for Indonesia to become a world food barn by 2045 [3]. The role of livestock, especially sheep and goat cattle, is very important to note. Sheep and goat cattle are used as a provider of meat to meet food needs. On paper, the population of sheep and goats in Indonesia is quite large. However, the ever-increasing demand has made the supply of this small ruminant commodity in short supply. Requests come not only from hospitality (hotels, restaurants, catering) but also from religious activities such as *aqiqah* and *qurbani*. The efforts to increase the productivity of sheep and goat cattle is by collecting quantitative data (body dimensions). Quantitative data are needed to identify and predict opportunities for increasing livestock productivity. The increase in livestock productivity can be assessed from the dimensions of the body of the livestock by measuring directly using measuring instruments. This technique is called

morphometrics with quantitative analysis technique (body dimensions) that includes shape and size. Morphometric data is an important parameter used to study livestock anatomy, productivity, growth rate, and performance quality of livestock. Conventional morphometric measurements are carried out by directly measuring livestock body parameters using a ruler, measuring stick, measuring tape regarding the body prominence starting from height, body length, chest circumference, hip height, and so on [4]. This technical approach causes livestock to become stressed, aggressive, and difficult to control. [5]. Based on these problems, the researchers made a prototype development of a camera tool that can measure livestock morphometrics at a distance. This method is expected to be applied for safer morphometric measurements, produce more accurate data, and livestock that can be measured at the same time and can provide more data that cannot be taken in direct measurements [6]. To support this prototype, the first thing to do is to build a system that can detect goats or sheep at a distance. This will be focus to this research. The camera prototype was made using a Raspberry Pi minicomputer. The Raspberry Pi will be connected to a mini camera that will be programmed with an algorithm to be able to recognize sheep objects. The higher the camera accuracy in recognizing sheep objects will be the first step in formulating real-time morphometric camera recognition.

2. Materials and Methods

Making a morphometric camera begins with determining the type of device to be worked on. Researchers use a mini camera with a raspberry pi as a microcontroller to create a program that is able to measure with a morphometric approach. The first step in making this morphometric camera is to assemble the camera components that will be used:

Table 1. Morphometric camera prototyping tools and materials

No.	Description
1.	Raspberry Pi Model B RAM 4 GB
2.	Camera Module for Raspberry Pi Zero – Standard
3.	Raspberry Pi case alumunium metal with dual fan
4.	Flex Cable for Raspberry Pi Camera
5.	USB cable to type-C
6.	Cable RJ45

The tools and materials used for the hardware assembly process and software creation are as shown in Table 1. Once assembled, the supporting software installation process is carried out to create programs on the hardware using MobaXterm and PuTTY.

Figure 1. Camera Raspberry pi Prototype light up

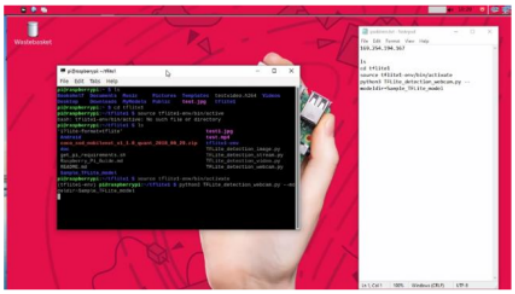

Figure 2. Build software and camera running processes with MobaXterm

The raspberry pi camera prototype assembled so that it can run properly is shown in Figure 1. The raspberry pi program is run on windows using virtual MobaXTerm and putty so that the raspberry pi can run on windows, shown in Figure 2.

2.1. Material

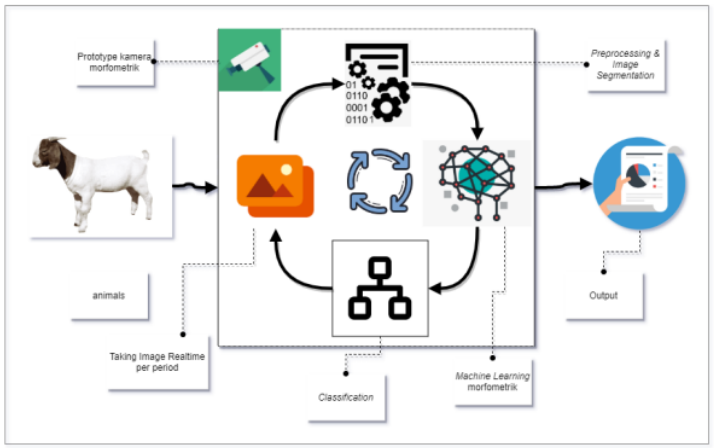

Figure 3. Block Diagram of the Proposed Work

At this stage (Figure 3) the researcher developed a camera tool that was not only able to recognize moving objects. However, it can also determine & recognize detected livestock objects for the needs of morphometric calculation techniques with a machine learning approach - Neural Network.

2.2. Methods

The fundamental idea of the Artificial Neural Network (ANN) is to adopt the thinking mechanism of a human-like system or application, both for processing various received element signals, error tolerance and parallel processing. In ANN, neurons are grouped into layers, which are called neuron layers (figure 11). Usually, each neuron of a layer is connected to all neurons in the back and front layers (except input and output). Information sent in an NN is propagated layer by layer from input to output without or through one or more hidden layers.

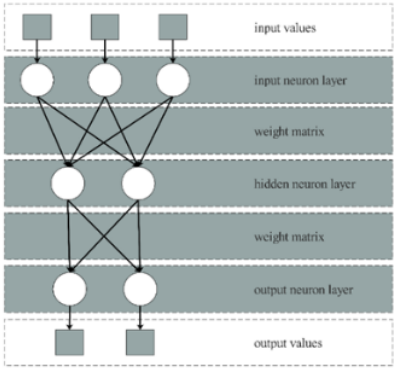

Figure 4. The Illustration of Neural Network that being used

In this research, researcher will utilize the ANN library which is derived from tensor flow. The advantage of this tensor flow is that the data set used for the data training process is quite large, resulting in the level of accuracy when detecting objects.

3. Results and Discussion

The researcher tested the camera hardware & software that had been made to the predetermined target of livestock. Camera testing was carried out on sheep and goats belonging to the Politeknik Negeri Jember. The testing process is carried out in an indoor place, as follows:

Figure 5. The process of capturing the target object with a raspberry pi camera in the environment (indoor)

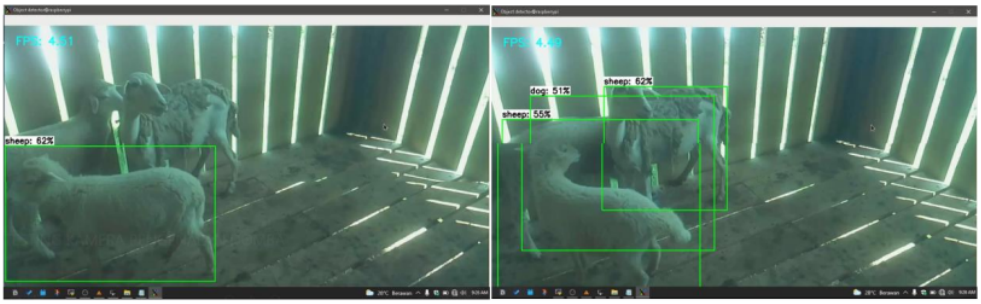

Figure 6. The accuracy of the detection results of livestock objects in the room (indoor).

Figure 7. There is an object detection of livestock that is still wrong

The testing process is carried out in real time by researchers directly detecting livestock objects with the camera condition still alive. Thus, allowing the object of sheep and goats to move freely and it involve 10 sheep. Based on this process (Figure 6 and Figure 7), Of the 10 goats, 5 were detected correctly. The accuracy of the system is 50%. However, the camera has not been able to identify the object of farm animals correctly. There are several livestock objects detected as cats and dogs as shown in table 2.

Table 2. Analyze The Results of Classification Performance Convolution Neural Network

Livestock	Accuration	Detection
Sheep 1	62%	sheep
Sheep 2	61%	Sheep
Sheep 3	55%	Sheep
Sheep 4	51%	Dog
Sheep 5	58%	Sheep
Sheep 6	64%	Cat
Sheep 7	51%	Cat
Sheep 8	64%	Sheep
Sheep 9	50%	Dog
Sheep 10	53%	Cat

From that issue, it will be caused by the library of the tensor flow has many dataset of the animal both livestock an wild animal. In this case we must modified the library so it can only detect the sheep or goat.

4. Conclusions

From the tests that have been carried out on 10 goats, the results show that the accuracy of the system made is 50%. Of the 10 goats, 5 goats were detected correctly. So that morphometric measurements cannot be done. This is because the Artificial Neural Network library used to process images from raspberries can detect various kinds of objects other than goat or sheep. So that, the ANN library used needs to be modified, so the camera can detect more specific objects, in this case, goats or sheep. If that can be done, the morphometric can be calculated. On the prototype camera raspberry pi that researchers have done, there are still many things that can be developed in this morphometric measurement technique.

5. Acknowledgments

The author would like to thank the Department of Health and Department of Animal Husbandry, State Polytechnic of Jember so that this review article can be realized and beneficial for the development of health science.

References

[1] TROBOSLivestock 2020 Darurat Bibit *TROBOSLivestock Media Agribisnis Peternak*. 1–2
[2] Direktorat Jenderal Peternakan dan Kesehatan Hewan 2019 Statistik Peternakan dan Kesehatan Hewan. 2019. 2–236
[3] Irawan F 2020 Jumlah Populasi Sapi Nasional Meningkat 113% Sepanjang 2019 *Jurnalis Okezone* 1–3
[4] Rahagiyanto A, Adhyatma M and Nurkholis 2020 A Review of Morphometric Measurements Techniques on Animals Using Digital Image Processing *Proc. Third Int. Food Agric.* **3** 67–72
[5] Winiar Putra B, Maria Fuah A, Nuraini H and Priyanto R 2016 Penerapan Teknik Citra Digital Sebagai Metode Pengukuran Morfometrik Ternak pada Sapi Bali dan Peranakan Ongole (Application of Digital Image Technique for Morphometrics Measurement on Bali and Ongole Cattle) *J. Ilmu Pertan. Indones.* **21** 63–8
[6] Ozkaya S 2012 Accuracy of body measurements using digital image analysis in female Holstein calves *Anim. Prod. Sci.* **52** 917–20

A Prototype of Raspberry Pi Camera Morphometric Measurements on Sheep Using Digital Image Processing

ORIGINALITY REPORT

19%	10%	5%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	publikasi.polije.ac.id Internet Source	3%
2	www.er-c.org Internet Source	3%
3	Angga Rahagiyanto, Achmad Basuki, Riyanto Sigit, Aditiya Anwar, Moh. Zikky. "Hand Gesture Classification for Sign Language Using Artificial Neural Network", 2017 21st International Computer Science and Engineering Conference (ICSEC), 2017 Publication	2%
4	Submitted to Universitas Jember Student Paper	2%
5	"Fault Diagnosis of Analog Integrated Circuits", Springer Science and Business Media LLC, 2005 Publication	2%
6	www.semanticscholar.org Internet Source	2%

7	Submitted to Nottingham Trent University Student Paper	1 %
8	Submitted to SDM Universitas Gadjah Mada Student Paper	1 %
9	en.industry.co.id Internet Source	1 %
10	seminar.bio.unsoed.ac.id Internet Source	1 %
11	businessdocbox.com Internet Source	1 %
12	centaur.reading.ac.uk Internet Source	<1 %
13	sipora.polije.ac.id Internet Source	<1 %

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		