Design of Leaf Detection Application using Deep Learning Convolutional Neural Network (CNN) Case Study Lambosir (Blok Leuweung Buah) Mountain Ciremai National Park

Iwan Lesmana*, Toni Khalimi, Rachmat Ismaya, Hegar Paningkat Bagja

Universitas Kuningan, Kuningan, Indonesia

{iwanlesmana@uniku.ac.id}

Abstract. The Leuweung Buah Lambosir area of Mount Ciremai National Park is included in the rehabilitation zone, the plant diversity index in Lambosir is in the medium category. Increased knowledge and skills regarding the introduction of plant species for officers in Mount Ciremai National Park is often carried out, but for some officers there are some difficulties in identifying plants quickly and accurately. Deep learning is a branch of machine learning (ML) that uses deep neural networks to solve problems in the ML domain. This study aims to create a leaf detection application using a deep learning Convolutional Neural Network (CNN) approach. The types of leaves used in this study were 6 types of leaves including Sonokeling (Dalbergia latifolia Roxb.), Kuray (Trema orientalis), Bungur (Lagerstroemia sp) , Kibeusi (Rhodamnia cinerea), Guava Rivet (Syzygium densiflorum), and Huni (Antidesma Bunius). Tests were carried out with a total of 600 images: 400 images as training data and 200 images as testing data. Testing of each object produces an accuracy rate above 80%.

Keywords: Leaf Detection; Deep Learning; CNN

1 Introduction

Mountain Ciremai National Park (TNGC) is geographically located at the coordinates of 108020' East Longitude – 108040 East Longitude and 6040 South Latitude – 6058 South Latitude. The topography of Mount Ciremai varies from sloping to steep. The slope of the land which includes sloping land (00 – 80) is only 26.52% and above 80 is 73.48%. The total area of TNGC ± 15,500 Ha is divided into two areas of 6,800.13 Ha in Majalengka Regency and 8,699.87 Ha in Kuningan Regency. Administratively, the TNGC region covers 2 regencies, namely the west including Majalengka Regency, and the east including Kuningan Regency with 7 sub-districts consisting of 25 villages in Kuningan Regency and 20 villages in 7 sub-districts in Majalengka Regency [1]. The Leuweung Buah Lambosir area of Mount Ciremai National Park is included in the rehabilitation zone, the plant diversity index in Lambosir is in the medium category.

The flora in Mount Ciremai National Park is very diverse, there are thousands of species of trees and plants in the area. To find out the types of plants there is a classic way, namely by looking at the basic organs, namely roots, stems, skin, fruits and leaves, but there are still many people who have not been able to distinguish the types of plants from the classical method. This is because there are several types of trees and plants that have the same

UNISET 2021, December 02, Kuningan, Indonesia

DOI 10.4108/eai.2-12-2021.2320309

characteristics and the limited human ability to distinguish between types of plants. Types of plants can be recognized based on the unique characteristics found in these plants. Leaves are one of the characteristics of plants that can be used to identify plant species because each plant has leaves and is easier to distinguish than tree bark [2]. One approach for detection using images is by using deep learning techniques which can make the detection process faster and more accurate [3,4,5]. Deep learning is one of the fields of machine learning, which is doing deeper learning with many layers.

This study aims to create a leaf detection application using a deep learning Convolutional Neural Network (CNN) approach. The types of leaves used in this study were six types of leaves including

Sonokeling (Dalbergia latifolia Roxb.), Kuray (Trema orientalis), Bungur (Lagerstroemia sp), Kibeusi (Rhodamnia cinerea), Jambu Keling (Syzygium densiflorum), and Huni (Antidesma Bunius).

2 Methodology

2.1. Study Area

Field research was conducted to obtain leaf types based on preliminary studies and input from national park officials, there were six types of leaves to be sampled in this research. The location of the research is the Leuweung Buah Lambosir in Mount Ciremai National Park. Field research was carried
out in August 2021.

Figure 1. Research Location

2.2. Research Stages

Referring to the SDLC Extreme Programming stage, the following steps were taken in completing the research as shown in the figure 2:

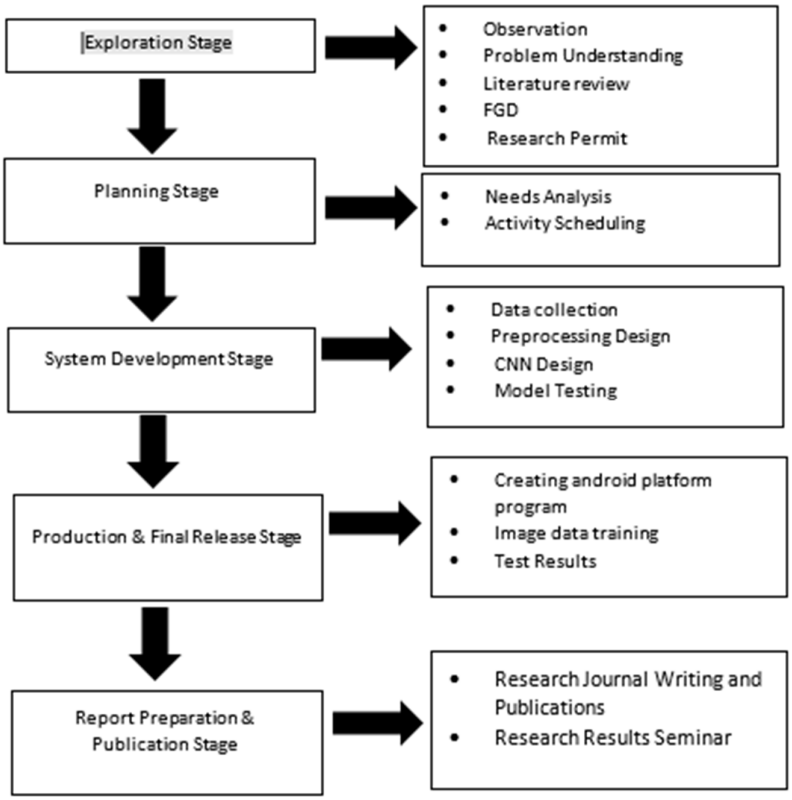

Figure 2. Research Methodology Schema

2.3. Exploration Stage

At this stage the researcher has observed the research site, and communicated with the officers BTNGC. In this process, the researcher conducted an interview process related to the condition of the area, the types of plants in the area. The BTNGC officers for the classification process or recognizing plants in the salty GCNP area use the manual method, namely by looking directly at the leaves, tree stands and roots so that the plant detection process takes a long time. Based on the results of the interviews, it was agreed that for the initial research to take 6 types of plants to be research objects including Sonokeling (Dalbergia latifolia Roxb.), Kuray (Trema orientalis), Bungur (Lagerstroemia sp),

Kibeusi (Rhodamnia cinerea), Guava Rivet (Syzygium densiflorum) , and Huni (Antidesma Bunius). The place of sampling is in the area of Leuweung Buah Lambosir National Park of Mount Ciremai.

2.4. Planning Stage

At this stage is the needs analysis process, namely the need for data and the need for research supporting equipment and making a schedule of research activities. For the test data needs, 600 images were taken from each type of leaf as many as 100 images, by taking pictures from a distance of approximately 20 cm. The following is an example of a leaf shooting technique.

Figure 3. Image capture technique

2.5. System Development Stages

At this stage the researcher collects data either from reference sources or from experts at

BTNGC, in this process the preprocessing design and deep learning algorithm design in this case uses the CNN (Convolutional Neural Network) method. Inside the CNN model there is feature learning where the feature extraction process is carried out automatically and adaptively by the model. Here is an overview of CNN's architecture.

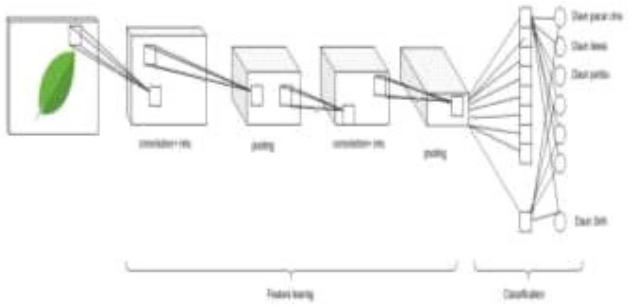

Figure 4. CNN Architecture

2.6. Production Stage and Final Release

After the previous stage process is complete, the next step is the production stage, where at this stage the implementation process will be carried out on an Android-based smartphone. Seeing that the research location cannot receive internet or GSM signals, in this study the

application does not require an internet connection or offline application to make it easier for officers to detect objects.

2.7. Report Preparation Stages

The last stage is the researcher will compose the final research report and the preparation of journals and conduct seminars on research results.

3 Result and Discussion

3.1. Algorithm Testing

From several stages that have been designed in the previous section, the results are in the form of leaf detection applications using Deep Learning Convolutional Neural Networks with an average accuracy rate of above 76%. In testing the algorithm used cross validation. Cross validation is a statistical method for evaluating and comparing learning algorithms by dividing the data into two segments, one segment for training data and the other used for data testing[7]. In cross-validation the training and validation sets must be crossover successively so that each data has a chance to be validated. In this study using a comparison of 80% for training data and 20% for testing data.

This test divides the data set into 6 folders where each folder contains 100 images which are divided into training data and testing data randomly. The total number of images is 600 images, 400 images for training data and 200 images for testing data. Each type of leaf was tested 5 times and the accuracy was calculated. The test results using K-Fold Validation can be seen in table 1.

Table 1. Experimental Results with the K-Fold Cross Validation method

Leaf Type	Test-1 (%)	Test -2 (%)	Test -3 (%)	Test -4 (%)	Test -5 (%)	Average (%)
Sonokeling (Dalbergia latifolia Roxb.)	78	76	83,5	76	78	78,3
Kuray (Trema orientalis)	80	79	82	83	82	81,2
Bungur (Lagerstroemia sp)	79	82	81	78,5	79	79,9
Kibeusi (Rhodamnia cinerea)	80	81	83	81,5	80	81,1
Jambu Keling (Syzygium densiflorum)	81	79	79,5	79	80,5	79,8
Huni (Antidesma Bunius)	78,5	81	82	82	82	81,1

3.2. Application Interface

In the leaf detection application there are several views including Home, About, Tips, News and Caputre views, for the first time the user will be presented with a display like the following

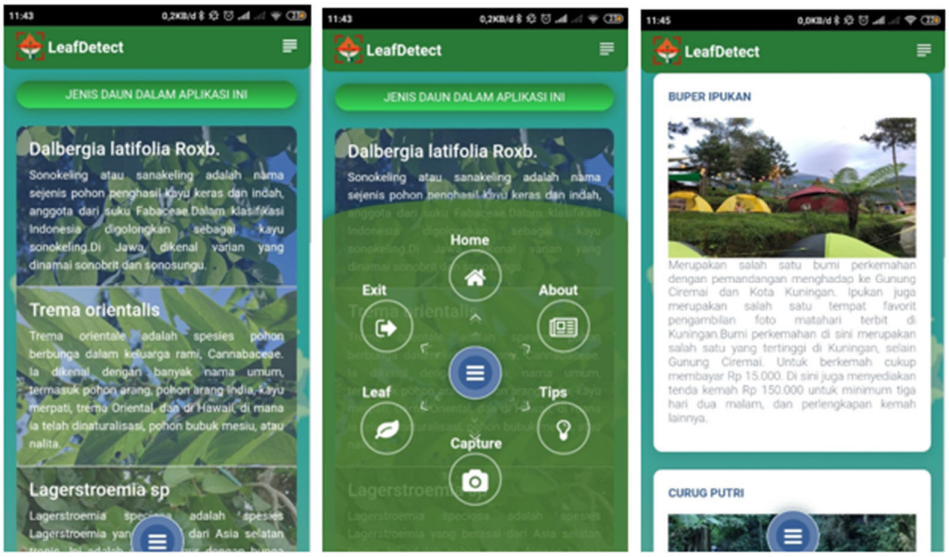

Figure 5. Application View

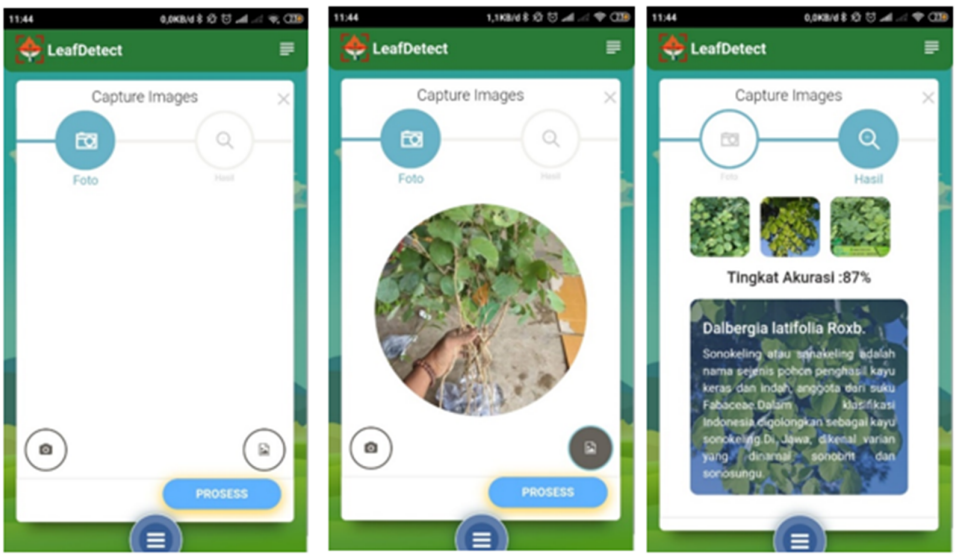

Figure 6. Leaf Detection Process Display

4 Conclusion

The results of observations from the research stages that have been passed as well as the application testing process, it can be concluded that: The picture taking experiment with the results using fold cross validation for leaves of the Sonokeling type (Dalbergia latifolia Roxb.) obtained an average value of 78%, Kuray (Trema orientalis) got an average value of 81.2%, Bungur (Lagerstroemia sp) got an average value of 79.9%, Kibeusi (Rhodamnia cinerea) got an average value of 81.1%, Jambu Keling (Syzygium densiflorum) obtained an average value of 79.8%, Huni (Antidesma Bunius) obtained an average value of 79.8%. With an average overall application get an accuracy rate of 80.2%.

References

[1] BTNGC. (2010). Rencana strategis Taman Nasional Gunung Ciremai tahun 2010-2014. Balai Taman Nasional Gunung Ciremai, Kuningan. Budhi, GS. Tok Fenny H., & Rudy A. (2008). Aplikasi Pengenalan Daun untuk Klasifikasi

[2] Tanaman dengan Metode Probabilistic Neural Network. Depok: Universitas Gunadarma.

[3] R. Kaur and M.. M. Kaur" An Adaptive Model to Classify Plant Diseases Detection using KNN"International Journal of Trend in Scientific Research and Development (IJTSRD) ISSN: 2456-6470.

[4] P. V,Rahul Das,and V. Kanchana (2017).Identification of Plant Leaf Diseases Using Image Processing Techniques" 978-1-5090-4437- 5/17/$31.00 IEEE International Conference on Technological Innovations in ICT For Agriculture and Rural Development.

[5] M. J. Vipinadas. , A.Thamizharasi.(2015). A Survey on Plant Disease Identification. InternationalJournal of Computer Science Trends and Technology (IJCST) – Volume 3 Issue 6, Nov-Dec 2015

[6] Alamsyah Slamet fifin (2019). Implementasi Deep Learning Untuk Klasifikasi Tanaman Toga Berdasarkan Ciri Daun Berbasis Android. Ubiquitous: Computers and its Applications Journal

[7] Ilahiyah Sarirotul,Nilogiri Agung (2018). Implementasi Deep Learning Pada Identifikasi Jenis Tumbuhan Berdasarkan Citra Daun Menggunakan Convolutional Neural Network. JUSTINDO (Jurnal Sistem & Teknologi Informasi Indonesia), Vol. 3, No. 2