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Implementation of Bot Telegram as Broadcasting Media Classification Results of Convolutional Neural Network (CNN) Images of Rice Plant Leaves

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ABSTRACT

Rice plants play an important role in the life of the Indonesian people because rice is the raw material for rice as a staple food. The rice production process does not rule out the possibility of interference by pests and diseases resulting in losses that cause crop failure. Meanwhile, pests on rice plants can be caused by various types, namely types of fungi (leafblast, hispa, brownspot) and types of nuisance animals. In this research, it will be carried out how to classify the image of rice plant leaves using the deep learning Convolutional Neural Network (CNN) algorithm, then the results of the classification are sent to users by utilizing the telegram chat application. The rice plant leaf image dataset is grouped into 4 groups (leafblast, brownspot, hispa and healthy). From several experiments it can be seen the results of system performance, namely the classification speed takes 30-60 seconds.

Keywords: CNN, Quality of Service, Rice Plants, Deep Learning

1. INTRODUCTION

Food needs are a basic need for humans to survive and there are various types of staple foods that are often consumed by Indonesian people, including rice, corn, wheat, cassava, sago and others (Putri Dewi & Purwidiani, 2015). However, of the various types of staple food, rice ranks first in the food category consumed by Indonesian people. As much as 98% of Indonesia's population makes rice as a staple food. Dependence on rice is very high with a marked increase in rice production by 4.4 million tons of rice from 2010 to 2014 (Mahar Maligan et al., 2019). Meanwhile, on a global scale, rice is consumed by a large proportion of the Asian population (Anami et al., 2020) and nearly 75% of the world's population consumes rice (Sreevallabhadev, 2020). Rice production plays an important role in the sustainability of human life globally. Therefore rice production must be maintained and new ideas are needed to maintain rice production.

One of factors for the success of rice production as a raw material for rice is the monitoring of pests and diseases. There are various types of pests in rice plants, whether caused by fungi or pests. Pest attack detection is needed in a fast, accurate and precise way so that crop failure can be avoided. Monitoring rice growth from the beginning of the planting season to before harvest can be done with a touch of deep learning technology as its scientific foundation. Deep learning as a scientific part of artificial intelligence is very capable of being applied in monitoring pest attacks on rice plants (Chen et al., 2020). Even the results of monitoring the development of rice plant growth can be monitored in real time by implementing internet of things (IoT) technology

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(Cobantoro, 2018; Masykur et al., 2020).

The existence of Artificial Intelligence (AI) technology is able to overcome monitoring of the development of rice plants in real time, but the presence of farmers in traditional monitoring is also still needed as a comparison of diagnoses. The problem is, application of Artificial Intelligence has stopped at the process of developing a classification model using the CNN algorithm for infected plants and healthy plants. The development of a classification model requires sustainability so that the benefits of the classification model can reach farmers. This means that a web server is needed as a bridge between the models being developed and farmers as users. In this study, the telegram bot will be used because the telegram bot is free. Apart from being free, the chat application also has the advantage of being able to exchange files, small file size (16 MB), cloud-based and can be accessed from various devices (Fitriansyah, Fifit, 2020). The telegram chat application is very capable of bridging 2 parties to be able to communicate with each other in real time by applying the API (Application Programming Interface) concept (Gentia et al., 2020).

2. LITERATURE REVIEW

Various studies on image classification by applying the Convolutional Neural Network (CNN) deep learning algorithm have been carried out by several researchers. In research conducted by Sibiya in 2019, the classification results obtained an accuracy value of 92.85% by specifying 3 categories of corn plants. While the CNN architecture used implements 50 hidden layers consisting of a convolution layer with a kernel filter having a median of 24, a rectifier liner unit and a pooling layer. In Sibiya's research, a dataset of 100 images per class was used with a ratio of 70% and 30% (Sibiya & Sumbwanyambe, 2019).

Image classification with CNN cannot be separated from the training process in finding the best model. In the training model, the epoch size is determined as a training repetition. An experiment on the best epoch was carried out by Fauzan in 2022 which stated that the higher the epoch value, the better the accuracy and the smaller the loss. Research on the epoch was carried out with variations of 50, 100 and 150 and the results showed that epoch 150 got the best score (Defriani & Jaelani, 2022; Masykur et al., 2022).

Telegram bots as a medium of communication between users using the Telegram chatbox application have received special attention because of several conveniences and can be applied to various scientific fields(Haryono Wibowo & Ratna Widiasari, 2023). One of the research that have been conducted on telegram bots is applied to online learning communication media. This research uses telegrams to convey information from teachers to students in the form of files, videos, images and voice notes (Fitriansyah, Fifit, 2020).

The Android-based Telegram chatbox application is used to monitor computer network performance in the form of monitoring the performance of routers, switches and access points. The real-time monitoring system is sent to the Telegram chatbox application by utilizing the ICMP protocol and the API Bot Telegram (Wibowo. ;Kurniawan, 2019). The test results show that the performance transfer speed is around 4-5 seconds when there is an interference with the computer network system (Adhiwibowo et al., 2021). The telegram API diagram from https://code.tutsplus.com shows telegram getting messages with 2 paths namely long polls and webhooks (figure 1).

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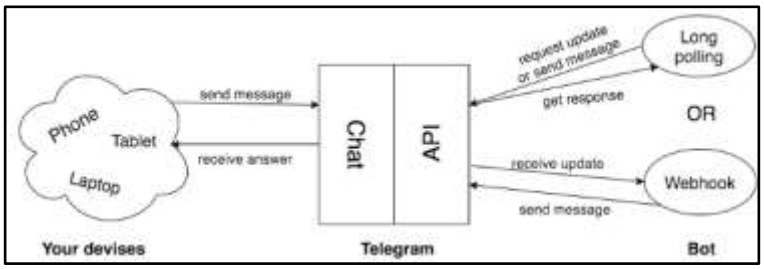


Figure 1. Diagram of Telegram API

3. METHOD

The flowchart design for implementing research on the use of telegram bots will go through several stages starting from categorizing dataset classes, training model processes, inputting models to web servers, connecting telegram bot API. Figure 2 shows the workflow of implementing broadcasting classification results with telegram bot. Training model uses Google Colab Pro with various epoch variations to find the best accuracy results before the model is input as the core of the system being built.



Figure 2. Workflow Broadcasting CNN Classification

This research only discusses the performance of the web server as a media that bridges between the user and the model. The web server works as a model translator and conveys information to the telegram bot on the smartphone. The telegram application as a medium for inputting images from farmers will then be adjusted to the model to produce a decision.

Image acquisition is taken by the user (farmer) to be inputted to the server via a website that has been provided. Image resolution or camera type is not determined by certain specifications. The web server processes the image by comparing it with the CNN model to determine its classification. Classification results are sent to the telegram server to be sent to the user through a request-response process. Users in this case are provided with 2 types of user interfaces, namely the Telegram application and the application in the form of a website. The classification results are sent in real time so that the user quickly receives the classification results from the inputted image. The flow of the input image process to become an information for the user can be seen in Figure 3.

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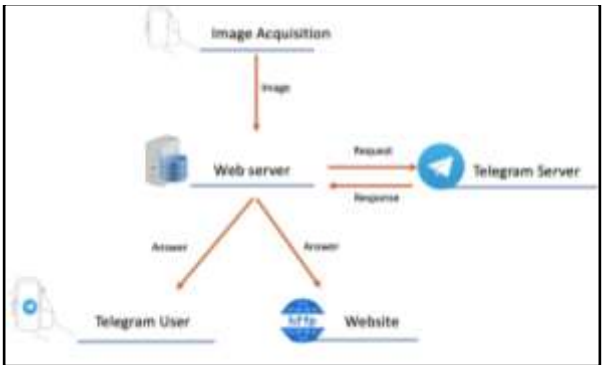
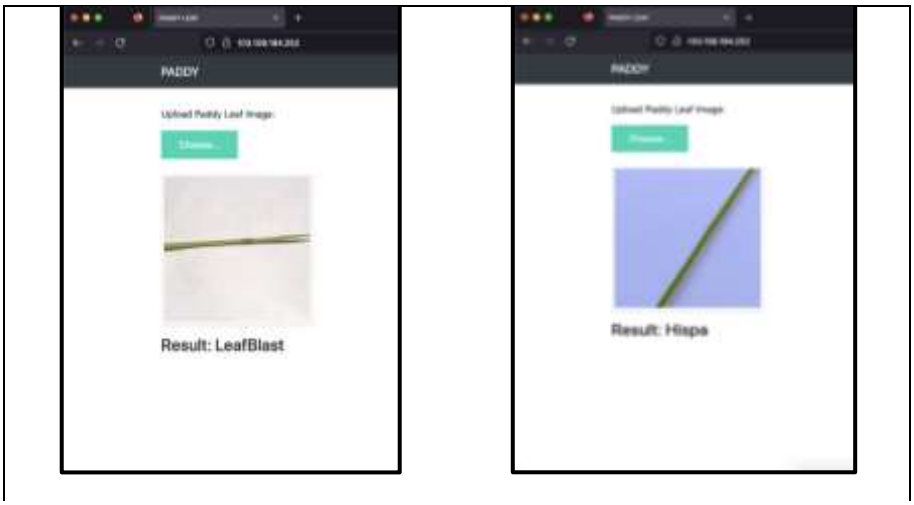


Figure 3. Request-Response Flow

3. RESULT AND DISCUSSIONS

The CNN classification model that has been built by training a number of datasets has produced a classification model to be used as a deep learning engine on websites. The CNN classification model is embedded on the website to make it easier for users (farmers) to input images of rice plants for diagnosis. Thus the results of the CNN classification model are not only used on the model development side but can also be used easily by the user. Figure 4 shows the results of the image classification of rice leaves on the website. The classification results show 4 classes according to the number of classes at the time of training the CNN model. The classification results are as expected, namely leafblast, hispa, healthy and brownspot. However, the classification results on the website do not fully produce correct predictions because the model built still produces errors (losses) so that predictions on the website also produce wrong predictions. The prediction speed calculation when the image is submitted to produce a prediction takes 30 – 60 seconds. Variations in prediction speed are influenced by several factors including image size, internet connection conditions, server performance and image resolution.



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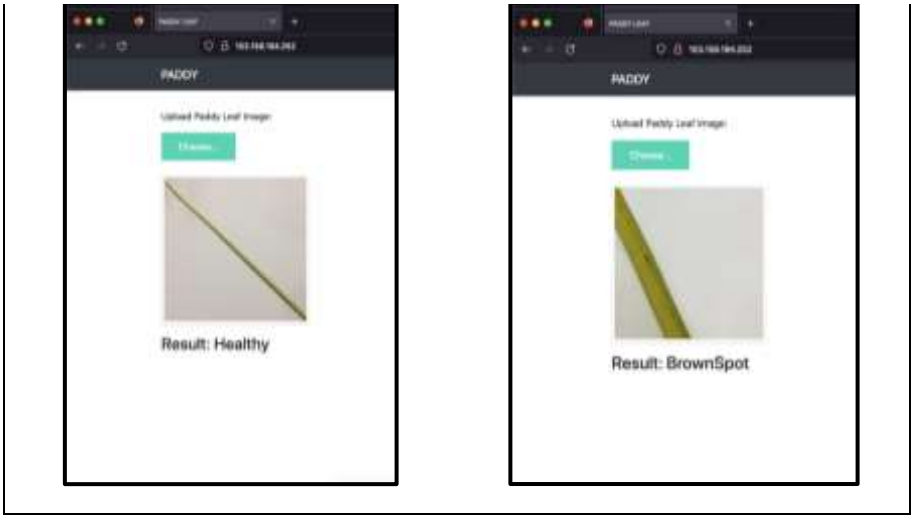


Figure 4. Classification Results on the Image of Rice Leaves

The classification results listed on the website will be sent to the telegram application by utilizing the telegram API. The existence of this API bridges between users and the Telegram application in real time all the time. Figure 5 shows the results of the classification on the telegram bot by displaying the classification results of 4 categories of rice leaf images. When the website sends a request to the web server it will be forwarded to the telegram server and then the results of the classification from the telegram server are forwarded to the telegram application. The handshake process on request-response communication takes time to handle it. The telegram application available on PlayStore or Google Play can be easily installed on users' mobile devices. As previously explained, there are still errors (losses) found in the CNN classification model, which means that the classification results in the Telegram application still contain discrepancies.

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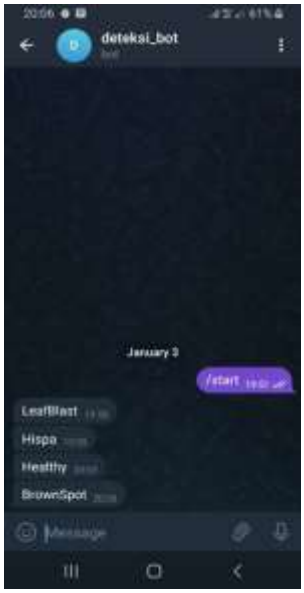


Figure 5. Telegram Bot Classification Results

The CNN architecture that was built during the model training process is the MobileNet architecture where this architecture has the advantage that the computation process is lighter and suitable for use on mobile devices. The CNN classification model is embedded in the website as an inference in terms of image and rice classification. Figure 6 shows the source code for calling the CNN classification model file to be called when there is a request-response process. The source code displays the model that was built during the training process for a number of datasets. When the classification model that is listed on the website can be replaced by calling another classification model, of course, the results of previous training.

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```
from __future__ import division, print_function
# coding=utf-8
import sys
import os
import glob
import re
import numpy as np
import cv2
import requests
# Keras
from keras.applications.imagenet_utils import preprocess_input, decode_predictions
from keras.models import load_model
from keras.preprocessing import image
from flask import Flask, redirect, url_for, request, render_template
from werkzeug.utils import secure_filename
from gevent.pywsgi import WSGIServer

# define
app = Flask(__name__)

# load
MODEL_PATH = 'models/MobileNet.h5'
model = load_model(MODEL_PATH)

def model_predict(img_path, model):
    img = cv2.imread(img_path)
    img = cv2.resize(img, (224,224))
    if img.shape[2] ==1:
                img = np.dstack([img, img, img])
    img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
    img = img.astype(np.float32)/255.
    img=np.expand_dims( img,axis=0 )

    preds = model.predict(img)
    return preds
```

Figure 6. Source Code Calling Model Classification

Testing the performance of the broadcasting system from the results of the CNN classification uses a telegram bot, which is a measurement of the speed from submitting rice leaf images on the website to receiving the classification results in the telegram application. The test results for the time required in the request-response process can be seen in table 1. The test results show that the results vary from one test to another, but the speed variations are still within a small time span or the speed differences are still within reasonable limits. The difference in the test results against time indicates that there are factors that influence it, including internet connection conditions, image file sizes, server performance, camera specifications used and also image resolution.

Table 1. The results of Time Test Request-Response

Testing to-	Time to Submit Image on Website (WIB)	Prediction Speed (Second)	The speed of prediction results received by telegram (Second)	Prediction Results
1	19:00	45	2	Leafblast
2	19:10	27	1	Brownspot
3	19:15	55	2	Brownspot
4	19:20	35	2	Hispa
5	19:25	31	1	Healthy
6	19:39	29	1	Healthy

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4. CONCLUSION

Research on broadcasting the results of the CNN classification using telegram bots which aims to make it easier for users (farmers) in terms of determining disease in rice leaves produces a system that is in accordance with the initial objectives of the research. The CNN classification model that was trained is used as the basis for determining the classification planted on the website and then broadcast using the Telegram application. The final conclusions of the research are as follows:

1. The broadcasting system of the classification results on the image of rice plant leaves is running as expected because it is able to convey the predicted results to the telegram application according to the CNN model.
2. The prediction results in the telegram application are not completely the same as the real conditions due to losses during the training of the CNN model.

The speed of time needed to predict until results are received in the telegram application is still in the best time range, that is 30-60 seconds so users (farmers) don't have to wait too long to find out the predicted image results. n this section, each researcher is expected to be able to make the most recent contribution related to the solution to the existing problems. Researchers can also use images, diagrams, and flowcharts to explain the solutions to these problems.

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