Early Detection of Casava Plant Leaf Diseases using EfficientNet-B0

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***Abstract*— Image recognition plays a major role in everyday life applications like medical image analysis, gaming, surveillance and security, industrial automation, and more recently it has gained massive backing in the agricultural industry to identify plant diseases in crops. Plant diseases are a huge problem in agriculture and incorporating machine learning algorithms for their early detection will help better yields and save the farmers from loses. This paper entails the use of such machine learning algorithms to detect leaf diseases in the cassava plant. Cassava is one of the largest sources of carbohydrates for the continent of Africa. It is also very vulnerable to several plant diseases; this in turn threatens the food security of the continent. The present study is based on four of such diseases that affect the cassava yield namely, Cassava Bacterial Blight (CBB), Cassava Brown Streak Disease (CBSD), Cassava Mosaic Disease (CMD), and Cassava Green Mottle (CGM). In this research work, EfficientNet-B0 is proposed for the early detection of these diseases. The EfficientNet-B0 models outperform existing CNNs in terms of accuracy and efficiency while reducing parameter size and FLOPS by an order of magnitude. It is easier to detect disease at an early stage without the assistance of professionals, saving farmers both time and money. And our proposed model gave an accuracy of 92.6%.**

Keywords- plant diseases, image recognition, Deep- learning, EfficientNet-B0, agriculture.

I. INTRODUCTION

Cassava is the fourth most important food crop in developing countries, trailing only rice, maize, and wheat [1],[2]. Its leaves are quite high in protein content and they can also be stored over a long period, and hence serve as reserve food [1],[3].

Africa accounts for more than 60% of worldwide cassava production (182 of 298 million tons) [1]. It is the most widely cultivated crop in the country's southern regions, contributing significantly to the country's Gross Domestic Product (GDP) and providing a significant source of income for rural farmers. The majority of global cassava yield is also consumed by Africa is a staple for about 500 million people [4]. The domestic consumption of cassava in the continent is expected to rise, which in turn has created a greater demand for the crop.

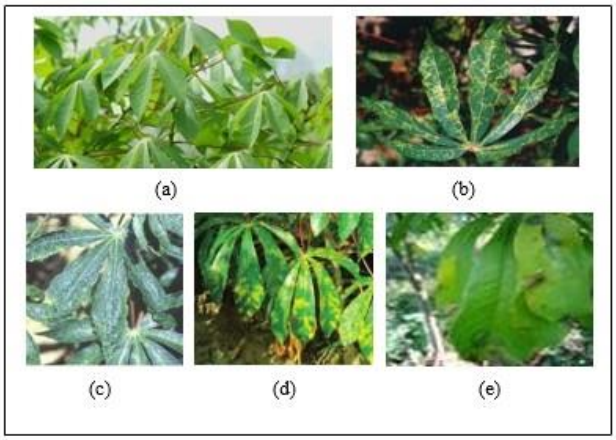

Fig. 1. (a) Healthy, (b) CMD, (c) CGM, (d)CBSD, (e) CBB

However, in 2020, cassava production had dropped by 6.7%. This was mainly due to an outbreak of Cassava Mosaic Disease(CMD). According to scientists, CMD is estimated to cause 15– 24% (equivalent to 12–23 million tons) of crop loss in Africa each year, which would equate to a loss of $1.2 to 2.3 billion USD [5]. Fig. 1, shows healthy and affected Casava leaves.

Cassava is drought tolerant, it can be grown on marginal land where other cereals fail, and requires minimal inputs, however, it happens to be very vulnerable to various viruses and other plant diseases [6]. CMD and Cassava brown streak disease (CBSD) is the most widespread viral disease, affecting at least half of Africa's cassava crops [7], [8]. These plant diseases cause significant reductions in the plant yield, resulting in significant economic losses.

II. LITERATURE STUDY

In the age of climate change and globalization, accurate identification and diagnosis of plant diseases are critical for

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