Chapter 5
Coffee Leaf Diseases Classification Using Deep Learning Approach

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ABSTRACT

Agricultural production is among the key techniques for alleviating extreme poverty, boosting economic stability, and feeding the 9.7 billion people expected to live by 2050. However, crop diseases are major obstacles to agriculture production. The most prevalent diseases that reduce production are late diseases which attack the leaves, which are particularly prevalent in coffee crops. To solve the issue, a suitable approach for identifying and categorizing these illnesses in this crop's leaf is required. Particularly in coffee crops, rust, coffee wilt, and brown spot are the most common diseases. Therefore, automatic identifying of these diseases through the system is critical. Thus, the main objective of this study is to design an automated system that can recognize and classify coffee leaf diseases' severity levels. Design science research methodology will follow. Accordingly, the required images have been collected from the SNNP.

1. INTRODUCTION

Agriculture is one of the diverse and the backbone sources of income for the national economy, and which further plays a critical role in feeding the world's population.. Hence, agricultural researchers and experts are strongly doing their research to obtain maximum yield without affecting the environment (Bashir & Sharma, 2012). Because of this, emerging nations like Ethiopia prioritize the effective execution of agriculture initiatives in order to improve the quality of life for their citizens (Varshney & Dalal, 2016).

The Ethiopian government Agricultural Development Led Industrialization (ADLI) is a central pillar of economic policy in the recently completed plan for accelerated and sustained development to end poverty (Welteji, 2018). More than one-third of the world's population currently consumes coffee as a soft drink. Coffee is additionally one of the most traded commodities nationally and internationally, making it a major commodity on the market and a source of income for millions of people involved in its production. marketing, and processing of the crop. (Pinto et al., 2017). Surprisingly, over 50 developing economies are involved in the manufacture of coffee, while the majority of its consumers are in far-off industrialized nations (Varshney & Dalal, 2016).

The agricultural sector is very important to Ethiopia's economy. The sub-sector of coffee agriculture-based production contributes significantly to the nation's economy. It is the largest source of foreign exchange earnings and significantly boosts the GDP. The usage of coffee as an ingredient in some food processing industries is growing in recent years. For example, it is used as a flavour to various pastries, ice creams, and chocolate, making it not only one of the most popular international beverages but also one of the most important trading commodities in the world after petroleum, candie (Mengistu et al., 2016).

In the cultivation of plant crops, there are many risks. Diseases are one of the risks that attack leaves. In plant science, several diseases attack a crop (Yadessa, Burkhardt, Bekele, Hundera, & Goldbach, 2020). Likewise, in the cultivation of coffee crops, several diseases include rust, brown leaf spot, leaf miner, and Cercospora. If one of the diseases once appear on one leaf, it expands to normal leaves per night and destroys the farm within a few periods (Yadessa, Burkhardt, Bekele, Hundera, & Goldbach, 2020).

Nowadays, the development of soft-computing technologies provided a platform for plant pathologists to use more intelligent tools to diagnose and give appropriate treatment for recognized diseases of plant leaves and make it possible to detect and classify plant leaf diseases (Yadessa, Burkhardt, Bekele, Hundera, & Goldbach, 2020). Nowadays, the development of soft-computing technologies provided a platform for plant pathologists to use more intelligent tools to diagnose and give appropriate treatment for recognized diseases of plant leaves and make it possible to detect and classify plant leaf diseases (Prakash et al., 2017). In contrast with the above idea, the technological advancement in this digital is incomplete if it is not combined with artificial intelligence (Prakash et al., 2017).

The Artificial Intelligence (AI) method is especially helping several sectors to increase productivity and efficiency. The obstacles in any and every sector are being addressed with the assistance of Technologies such as Artificial intelligence. Similar to how it helps other industries, AI in agribusiness is assisting farmers in increasing their productivity and reducing adverse ecological effects. In order to improve the efficiency of agricultural production, the majority of startups in this industry now use AI (Vinuesa et al., 2020).

Image processing helps computer vision to get more meaningful information from the image data. To perform computer vision tasks, machines have to learn from experience (data), so it leads to machine learning, it is a an area of artificial intelligence (AI) that enables systems to automatically learn from experience and improve without explicitly human involvement or with relatively little of it. It focuses

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