# BAB 1 INTRODUCTION

Indonesia, with its tropical climate and fertile soils, is renowned for its agricultural wealth, which plays a crucial role in the nation's economy. In 2020, the agricultural sector contributed significantly to Indonesia's exports, reaching Rp 451.77 trillion, as reported by the Ministry of Administrative and Bureaucratic Reform. Among Indonesia's diverse crops, mangoes (Mangifera indica) stand out as high-value commodities, with the country producing over 3.3 million tons in 2022, a substantial increase from previous years. This productivity highlights the mango's potential as a key export product, driving economic growth in tropical and subtropical regions [1].

To maintain and enhance this productivity, the quality of mango products must be safeguarded, particularly against various diseases that affect plant health and yield. Without early detection and intervention, mango diseases can result in considerable losses, affecting both the quality and quantity of production. The capability to rapidly and accurately diagnose mango leaf diseases is thus essential for effective disease management and prevention, allowing farmers to act before issues escalate.

The latest advancements in artificial intelligence (AI), especially in machine learning and deep learning, present powerful tools for leaf image classification [2]. More specifically, in the context of plant disease detection and classification, previous studies on mango disease classification have demonstrated the potential of deep learning models, such as DeepCNN and DVPSO-Net, which achieved accuracies of 89% and 94.72%, respectively [3], [4]. However, these models often require substantial computational resources, limiting their practicality for widespread agricultural deployment.

To address this gap, efficient architectures are necessary. ConvNeXt, a deep learning model based on a modernized ResNet architecture, has shown great

promise in balancing performance with computational efficiency. ConvNeXt achieved 87.8% top-1 accuracy on the ImageNet dataset [5] and demonstrated its effectiveness in rice leaf disease classification, achieving 94.31% accuracy across six classes [6]. Variants like Sim-ConvNeXt have further pushed this performance, achieving 95.2% accuracy [7], making ConvNeXt a viable candidate for real-world agricultural applications.

In this study, we propose an optimized version of ConvNeXt for mango leaf disease classification. Our modifications include reducing the number of computational blocks in each stage to achieve greater efficiency without compromising accuracy, alongside additional adaptations for enhanced model applicability. Unlike the standard ConvNeXt configuration of 3,3,9,3 blocks per stage, inspired by the SwinTransformer's 1:1:3:1 block ratio, we adopted a 2,2,6,2 configuration [8]. This adjustment reduces model parameters, enabling faster inference while maintaining strong classification accuracy.

The primary objective of this research is to develop a model that balances accuracy and efficiency, making it practical for real-world agricultural use. By providing a model capable of rapidly and accurately classifying mango leaf diseases, this work aims to empower farmers to make timely interventions, reducing crop losses and ensuring product quality for both domestic and export markets.