CHAPTER I
INTRODUCTION

1.1 Background

Skin diseases are one of the health problems with a very large number of patients in the world and in Indonesia. Skin diseases ranked sixth in 2021, ranked fourth in 2010 and 2013 in terms of the number of cases that occurred in Indonesia. Skin diseases have a bad impact on quality of life, psychological conditions, and even some cases of skin diseases can be life-threatening such as skin cancer. In a country with a tropical climate such as Indonesia, it has humidity levels and is exposed to sunlight all year round, which causes a very high incidence of skin diseases caused by fungi and bacteria because these conditions are ideal for fungi and bacteria to develop, such as [1] [2] *tinea* (ringworm) caused by *dermatophyte* fungi and *verruca* caused by HPV (*Human Papillomavirus*)) . Ultraviolet rays emitted by the sun trigger the growth of cancer cells (carcinogenic) for humans so that they can cause [3] *melanoma* cancer cells to grow. Skin diseases have a wide scope, some types of diseases that represent the scope of this skin disease problem are [4] *Melanoma* (cancer), *Verruca* (virus), *Tinea* (fungus), and *Acne* (hormonal). *Melanoma* is the deadliest skin cancer due to its ability to spread (metastasize) quickly to other organs so it requires early detection to improve survival, [5] *Verruca* and *Tinea* are diseases that can be transmitted by direct or indirect physical contact such as skin contact with the sufferer, touching infected objects, can even be transmitted from infected animals, therefore *Verruca* and *Tinea* must be quickly treated so that they do not spread more widely and there is no mistreatment, while [6], [7] *Acne*, although not deadly, has the highest prevalence with severe psychological impact if not treated appropriately [8].

The main challenge in the treatment of these diseases lies in the accuracy of visual diagnosis and the accessibility of health services. Clinically, early skin lesions often have a confounding physical resemblance to the naked eye, even to non-specialist medical personnel. For example, early-stage [9] *melanoma* can resemble a regular *nevus* (mole) or other pigmentation lesions such as *Seborrheic Verruca* so special training is needed for medical personnel to improve the ability

to diagnose skin diseases. Misdiagnosis at this stage is fatal, considering [10] *Melanoma* as a common wart can delay treatment by a cancer specialist (oncology) and worsen the condition as cancer cells will continue to grow. On the other hand, the ratio of dermatologists and gynecologists (Sp.KK) in Indonesia that is uneven and concentrated in big cities causes people in remote areas to have difficulty getting accurate diagnoses [11]. As a result, the phenomenon of incorrect self-medication often occurs, such as the use of steroid creams on fungal infections (*Tinea*) that actually aggravate the condition (*Tinea* incognito) [12].

The gap between the need for diagnosis and the availability of experts creates an urgency for an intelligent system that is not only capable of recognizing different types of diseases, but also providing guidance for further action [13]. An integrated system is needed that is able to utilize collaboration between humans and artificial intelligence, in this study with the context of a system that is able to provide recommendations for appropriate first aid actions based on the Clinical Practice Guidelines published by PERDOSKI (Indonesian Association of Dermatologists and Venereologists). Providing recommendations after identifying this type of disease is crucial to prevent self-harm and guide patients to the correct treatment path [14].

The use of *Deep learning technology*, particularly *Convolutional Neural Network* (CNN), has been commonly used in the automatic diagnosis of skin images. CNN has limitations in looking at the relationships between parts of the image as a whole, so important information on complex skin cases is often missed. Vision [15] *Transformer* (ViT) architecture is here as a solution because of its ability to analyze images as a whole. However, the main drawback of ViT is its very heavy workload when processing high-resolution images, whereas high resolution is required to see the details of skin texture. The use of standard ViT becomes inefficient for practical, lightweight applications that demand fast results [16].

To overcome these computational load constraints, this study proposes the use of *the Swin Transformer* architecture. This method offers a more efficient approach by limiting the analysis to small areas and still connecting the

information between those areas through a *shifted windows* mechanism [17] . This approach makes the computational process much lighter while being able to recognize image patterns in stages. This characteristic is ideal for analyzing skin diseases that vary in size, ranging from small spots like *Melanoma* to large areas of infection like *Tinea*. The main objective of this study is to prove the accuracy of *Swin Transformer* in classifying different types of diseases, which will then be integrated with medical data to provide safe treatment recommendations for users.

1.2 Problem Formulation

Based on the background that has been described, the formulation of the problem in this study is:

1. How to design and implement *the Swin Transformer* architecture to classify multi-class skin disease images?
2. How to build an effective recommendation system to map the predicted results of class labels into valid initial treatment recommendations based on PERDOSKI?
3. How is the performance of the developed model measured based on the parameters of accuracy, precision, *recall*, and F1-score?

1.3 Research Objectives

The purpose of this research is to develop a *Swin Transformer* model that can classify skin diseases in humans and a *Knowledge-based recommendation system website.*

1.4 Research Benefits

This research is expected to add insight into the performance of *the Swin Transformer architecture* to properly classify skin diseases and a knowledge-based recommendation system that is able to map the results of skin disease classification with treatment recommendations in accordance with the recommendations of clinical practice guidelines published by the Indonesian Association of Dermatologists and Venereologists (PERDOSKI).

1.5 Problem Limitations

In order for this research to be more directed and focus on the goals to be achieved, the author sets the limits of the problem as follows:

a. The system is only focused on classifying four classes of skin diseases, namely *Acne*, *Melanoma*, *Tinea*, and *Verruca*/Warts. Skin diseases outside the four classes were not included in the scope of the study.
b. The dataset used is secondary data obtained from the Kaggle platform with https://www.kaggle.com/datasets/pacificrm/skindiseasedataset link. Although the dataset consisted of twenty-two categories of skin diseases, the study used only four classes, namely *Acne*, *Melanoma*, *Tinea*, and *Verruca*/Warts. The data processed is in the form of static digital images in RGB format. The study did not consider other clinical data such as patient age, gender, disease history, lesion location, perceived symptoms, or other medical examination results.
c. The classification method used is limited to the *Swin Transformer* architecture with *a Transfer learning* approach using pre-trained *weights from* the ImageNet *dataset*. The research did not make comparisons with other *deep learning* architectures.
d. The classification system implements a *confidence threshold* mechanism to determine the feasibility of predicted results before recommendations are shown to users. Predictions with *confidence scores* below the specified threshold will not be used as the basis for making recommendations.
e. The system developed uses *a closed-set classification approach*, so that the model can only recognize the classes of diseases that have been studied during the training process. If a user uploads an image of a skin disease outside of the four available classes, the system will still provide a prediction to one of the classes that has the highest visual characteristics.
f. The treatment recommendation feature uses *a knowledge-based approach* sourced from the Clinical Practice Guide published by PERDOSKI. The recommendations given are static based on the results of the classification and do not take into account the individual clinical condition of the user.
g. The final results of the research are in the form of a prototype *of a* web-based application that functions to receive image *input*, classify skin

diseases, and display the results of predictions and treatment recommendations.

h. The system developed is not intended to replace diagnosis, consultation, or medical procedures performed by health professionals. The results provided are only preliminary information and support for decision-making.