Chapter I

Introduction

1.1 Background

Skin cancer is one of the most common types of cancer in the world, especially in white populations (Rarasmaya Indraswaria,2021). The world health organization (WHO) reports that cancer is one of the worlds leading causes of death globally and is responsible for about 10 million deaths annually. Globally, about 1 in 6 deaths is due to cancer. Global cancer deaths are projected to increase by 45% between 2008 and 2030. Skin cancer is ranked fifth among the most common forms of cancer. Abnormal growth of skin cells leads to skin cancer, which is one of the most widespread types of cancer in the world (Duggani Keerthana,2023). Skin cancer is classified into Melanoma, Basal Cell Carcinoma (BCC) and Squamous Cell Carcinoma (SCC). Melanoma is the most dangerous type of cancer which leads to death that usually appears on the moles and the areas on the skin which is exposed to sunlight as well as not exposed to sunlight. The affected part of the skin contains melanocytes that spread to other parts of the body. BCC is the most laggard growing and never be large in size. It appears on the skin exposed areas such as hand, face, leg, ears and scalp. It usually matures as an ulcer and does not improve (S. Sasikalaand Priyadharshini,2020).

It is effective if the lesion is detected early before it spread to other organs. However, if the lesion already spreads to other organs, it will be more difficult to treat, leading to high mortality rates. Therefore, early detection of malignant melanoma lesions is important to increase the chance of recovery (Rarasmaya Indraswaria,2021). But, its identification is challenging to the naked eye and is subjective. The accuracy obtained for detecting melanoma using the clinical diagnosis approach is 65–80% (Duggani Keerthana, 2023). Self examination is so vital even if you have carefully protected your skin from ultraviolet radiations. Thus, people should examine their skins head to toe regularly, looking for any lesions that might be turned into melanoma . Self-exams can help you identify skin cancers in an early stage, when the odds of curing them are completely high. Yet, physicians encourage people to routinely do self-examination (Jinen Daghrir,2020).

The performance of transfer learning feature extraction algorithms in detecting melanoma and basal cell carcinoma (BCC) remains a significant challenge due to their inability to consistently produce high accuracy. For example Rarasmaya Indraswaria (2021) produce 68% of accuracy for using VGG16 feature extraction in classifiying melanoma images. Then Ahmet DEMİR (2019) also classifiying skin cancer using ResNet-101 feature extraction architecture with 84,09% accuracy Despite the advancements in deep learning and the success of transfer learning in various image classification tasks, these algorithms often struggle when applied to medical images, especially skin lesions.

Despite the high accuracy achieved in recent studies on melanoma and BCC classification using advanced machine learning techniques, there is a noticeable gap in the development of practical prototypes based on these models. For example, M. Roshni Thanka (2023) reported an impressive 99.1% accuracy using a hybrid approach combining VGG16 and XGBoost, and Rehan Ashraf (2017) achieved 97.9% accuracy with a CNN model augmented with additional data. However, these studies primarily focus on the theoretical aspects of classification without extending their research into building fully functional prototypes. The absence of prototypes limits the ability to evaluate the real-world performance of these models, particularly in clinical settings. Without a practical prototype, it becomes challenging to assess key metrics like usability, computational efficiency, and real-time application in diagnosing skin cancers, making it difficult to bridge the gap between research and real-world medical applications.

1.2 Problem Formulation

Based on the above background, the problem formulation of this final project is as follows:

1. How to determine the best transfer learning feature extraction algorithm from MobileNetV2, VGG16 and DenseNet201 to detect melanoma, basal cell carcinoma and normal skin?
2. How to develop a prototype web application for skin cancer detection of melanoma, basal cell carcinoma and normal skin based on the best deep learning Feature Extraction algorithm?
3. How to perform performance analysis *prototype* developed?

1.3 Problem Statement

Based on the above background, it can be concluded that there are problems with existing feature extraction and detection algorithms as follows:

1. Existing feature extraction and classification algorithms still produce low detection accuracy.
2. Development of *prototype* detection of melanoma and basal cell carcinoma skin cancer is still rare.
3. Performance of melanoma and basal cell carcinoma cancer detection *prototype* development is still low.

1.4 Objective

1. To study the best transfer learning feature extraction algorithm to improvethe accuracy of melanoma and basal cell carcinoma detection.
2. To develop a *prototype* based on the best feature extraction algorithm.
3. To analize the performance of the developed *prototype*.

1.5 Scope of Research

The following is the scope that exists in the writing of this final project:

1. This research focuses on investigating and comparing the performance of three best transfer learning feature extraction algorithms in early detection of three types of skin cancer, namely melanoma, basal cell carcinoma, and as a comparison normal skin. The algorithms to be evaluated are MobileNetV2, VGG16 and DenseNet.
2. Software prototyping using web application using python and HTML programming language
3. The image dataset in this study was taken from HAM1000
4. This web application is specifically designed to provide early detection of two types of skin cancer, namely melanoma, basal cell carcinoma, and also as a comparison for normal skin.
5. Features of the web app include the ability for users to input the image
6. Ensure that the photos used as test data are clear and not blurry, thus ensuring optimal prediction results from this web app.

1.6 Hypothesis

1. The best transfer learning feature extraction algorithm proposed in this study is combination feature extraction of MobileNetV2, VGG16 and DenseNet201
2. Prototype successfully developed.
3. The algorithm performance of the developed prototype is more accurate than the existing one.

1.7 Systematization of Writing

This Final Project is organized with the following writing systematic:

- **Chapter I Introduction**. This chapter discusses the background, problem formulation, and objectives of this Final Project.
- **Chapter II Literature Review**. This chapter discusses facts and theories related to system design to establish a foundation for thinking. By using the facts and theories presented in this chapter the author analyzes the need for the design of the system architecture being built.
- **Chapter III Methodology and System Design**. This chapter describes the research methods, system design and testing methods carried out in the research.
- **Chapter IV Result and Discussion**. This chapter contains a detailed analysis and interpretation of the research findings. This chapter is crucial as it presents the outcomes of the study and discusses their implications in relation to the research questions, objectives, and existing literature.
- **Chapter V Conclusion and Suggestions.** Provides a comprehensive wrap-up of the study, reinforcing the main findings, discussing their broader significance, and outlining future research opportunities. It serves as a reflection on the entire research process, providing clarity and context for the study's contributions to the field.