Adapting Prompt-Driven Approach for Diabetic Foot Ulcer Segmentation: A Sri Lankan Patient Study

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***Abstract*—Diabetes, a widespread metabolic disorder affecting millions globally, including many in Sri Lanka, often results in diabetic foot ulcers (DFUs). Accurate wound measurement is vital for diagnosing and monitoring DFUs, providing key metrics to track healing and inform treatment decisions. However, manual measurement is both time-consuming and prone to inaccuracies, often leading to misdiagnoses, and flawed documentation. Automated wound segmentation from medical images presents a promising solution by automating wound area assessment and enhancing patient outcomes. This study proposes a prompt-driven segmentation approach to tackle the unique challenges of DFU segmentation, particularly for a limited dataset of Sri Lankan patients. This approach enables the model to use user input like points, regions, or bounding boxes to focus on complex areas, enhancing accuracy in cases with unclear wound boundaries or sparse data. The primary objectives of this research include the creation of a comprehensive dataset reflecting diverse DFU instances in Sri Lanka and the adaptation of the Segment Anything Model (SAM) to accurately segment DFU areas with minimal supervision. The dataset consists of 300 samples from 180 patients at Dambulla Base Hospital, capturing variations in skin tone, ulcer size, shape, and surrounding tissue conditions. The pre-trained SAM was fine-tuned using prompt-driven segmentation techniques to handle the unique characteristics of Sri Lankan patients. The model demonstrated strong performance, achieving a Dice Coefficient of 83.31%, Specificity of 99.73%, and Precision of 90.42%. This approach minimizes the need for large annotated datasets, enhances generalization from limited data, and allows user-guided refinement. The development of population-specific models in this study has the potential to enhance clinical decision-making and significantly improve patient care for DFU management in Sri Lanka.**

Keywords- Diabetic Foot Ulcer, Segment Anything Model, Sri Lankan Patients, Segmentation

I. Introduction

Diabetes is one of the most pressing global health challenges of the 21st century, with the International Diabetes Federation (IDF) (https://idf.org/) projecting that by 2045, 1 in 8 adults worldwide will be affected, predominantly in low- and middle-income countries [1]. In South Asia, including Sri Lanka, the prevalence of diabetes is rising sharply, with over half of the cases undiagnosed, further exacerbating the public health crisis. The estimated prevalence of diabetes in the urban population of Sri Lanka was 27.6%. [2]. Diabetic foot ulcers (DFUs) are a severe complication of diabetes that progress through various stages (Fig. 1), affecting up to 25% of diabetic patients during their lifetime [3], with a global prevalence of around 6.3% [4]. In Sri Lanka, one-third of non-insulin dependent diabetes mellitus (NIDDM) patients are at risk of developing DFUs [5], which can lead to serious outcomes like lower limb amputation. A lower limb is amputated every 30 seconds worldwide due to DFUs, underscoring the condition's severe morbidity and mortality. [4].

Fig. 1: Stages of Diabetic foot ulcers. (https://axiobio.com/).

Various diagnostic methods and treatments may be utilized depending on the type of ulcer and its morphological characteristics [6]. In developing countries like Sri Lanka, the diagnosis and treatment of DFUs largely rely on visual inspection and manual measurement by healthcare professionals, who assess dimensions such as length, width, surface area, and volume. However, these manual methods, including ruler-based and