Chapter 13

Lesion Boundary Segmentation With Artifacts Removal and Melanoma Detection in Skin Lesion Images

Julie Ann Acebuque Salido
De La Salle University, Philippines & Aklan State University, Philippines

Conrado Ruiz Jr.
De La Salle University, Philippines

Nelson Marcos
De La Salle University, Philippines

ABSTRACT

Melanoma is a severe form of skin cancer characterized by the rapid multiplication of pigment-producing cells. A problem on analysis of these images is interesting because of the existence of artifacts that produces noise such as hair, veins, water residue, illuminations, and light reflections. An important step in the diagnosis of melanoma is the removal and reduction of these artifacts that can inhibit the examination to accurately segment the skin lesion from the surrounding skin area. A simple method for artifacts removal is implemented based on image enhancement and morphological operators. This is used for training together with some augmentation techniques on images for melanoma detection. The experimental results show that artifact removal and lesion segmentation in skin lesion images performed a true detection rate of 95.37% for melanoma skin lesion segmentation, and as high as 92.5% accuracy for melanoma detection using both GoogLeNet and Resnet50.

INTRODUCTION

Melanoma is a severe form of skin cancer characterized by the uncontrolled growth of pigment-producing cells. According to the American Cancer Society, there is an estimated 96,480 cases of melanoma of the skin, with about 52,220 in males and 39,260 in females. It is estimated that 7,230 people will die from melanoma in 2019 (Siegel et al., 2019). Melanoma is treatable when detected early, but advanced melanoma can spread to other internal organs, which can result to death. Dermoscopy is used as a non-invasive method (Johr, 2002) that allows an in vivo evaluation of colors and microstructures of the skin specifically the epidermis, dermoeipidermal junction, and papillary dermis. Dermoscopy allows examination of the skin and its patterns. Skin cancers in the study of Papamichail et al. (2008) are categorized into two groups, melanoma and nonmelanoma. Melanoma appears as a painless, firm, non-tender, and ulcerated skin lesion. Highly-trained experts and professional equipment are necessary for accurate and early detection of melanoma. Limited access to expert consultation leads to additional challenges in providing adequate levels of care to the population that are at risk with this disease.

There are dermoscopic criteria developed to distinguish melanomas and moles, such as chaos and clues (Rosendahl et al., 2012), 3-point checklist (Soyer et al., 2004), ABCD rule (Stolz et al., 1994), 7-point checklist (Argenziano et al., 2004), Menzies method (Menzies et al., 1996) and CASH (Argenziano et al., 2004). The ABCDE rule based on the works of Argenziano et al. is used for lesion feature identification: asymmetry, border irregularity, color that is not uniform, dermoscopic attributes, and evolving size, shape or color. Dermoscopic attributes or structures of lesions such as, pigment network, negative network, streaks, melia-like cysts, globules and dots among others.

Recent trends in dermoscopy images since 2016 until 2018 (Berseth, 2017) lead to a newest and better technique in classification. This is because of the challenge of skin lesion analysis towards Melanoma Detection in 2017 International Symposium on Biomedical Imaging (ISBI). For the past years, the International Skin Imaging Collaboration (ISIC): Melanoma Project (Gutman et al., 2016), have been doing a skin lesion boundary segmentation task. Skin lesions digital images can be used to educate clinicians, physicians, professionals and the public in melanoma as well as skin cancer recognition. This will directly aid in the diagnosis of melanoma through teledermatology, clinical decision support, and automated diagnosis. At present, the lack of standards for dermatologic imaging undermines the quality and usefulness of skin lesion imaging. ISIC is developing proposed standards to address the technologies, techniques, and terminology used in skin imaging with special attention to the issues of privacy and interoperability.

Recent advances in diagnostic techniques including confocal scanning laser microscopy, MelaFind, Siascopy, noninvasive genomic detections, among others are used in aid in diagnosing melanoma. Some of these technologies cost as much as US$500 per person for examination (Ferris & Harris, 2012). There are several studies that implement traditional teledmedicine across the world especially in the developing countries, but the efforts have been characterized with challenges such as the high-cost of sustaining teledmedicine solutions and insufficient access to medical expertise when needed. In recent years, there have been high expectations for techniques such as dermoscopy in aiding diagnosis. However, evaluation of pigmented skin lesions is not only expensive to other communities but also complex and highly subjective, thus motivating researches in diagnosis automation. The advances of smartphones and ordinary cameras led to implementation of other applications for skin disease classification.