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Thesis: **"OPTOMECHATRONIC DEVICE TO CLASSIFY MONOCHROME DEMATOLOGICAL IMAGES SUPPORTED BY RGB-STOKES POLARIMETRIC ANALYSIS"**

Summary:

Melanoma, the deadliest skin cancer, demands enhanced diagnosis methods to decrease uncertainty in disease identification. In this regard, an imaging optomechatronic device herein is developed that integrates an automated standard clinical prediction rule (CPR) and polarimetric images with the aim of building a novel database and to assist physicians in diagnosing skin conditions with a broader information base. Through multispectral Stokes imaging polarimetry using a polarized light source (circular/linear polarizations), an image set of polarization features, such as Degree of Linear Polarization (DoLP) and Degree of Circular Polarization (DoCP), are calculated. The implemented CPR is the ABCDE rule, which classifies skin lesions based on Asymmetry, Border, Color, Diameter, and Evolving.

The device uses an addressable RGB LED ring lamp with the appropriate polarization filter to highlight skin lesion features. Diffusely reflected light is collected, passed through a Stokes polarimetric setup, and digitized by a monochromatic CMOS sensor. The system captures images for the ABCDE process and performs the polarimetric process, synchronizing the rotation of the quarter-wave plate with frame acquisition. The resulting images show the degree of polarization for different spectral ranges. By integrating polarimetric imaging and machine learning, this handheld device aims to improve the quality of melanoma diagnosis, offering a user-friendly and portable tool for physicians.