Improving Racial Equity in Skin Cancer Detection: Using Artificial Intelligence Driven Synthetic Image Generation and Cascading Convolutional Neural Networks to Diagnose Cancer in Lesions of Varying Skin Tones

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Massive underrepresentation of non-White skin in dermatology research contributes to significant disparities in skin cancer outcomes. Since artificial intelligence (AI) algorithms are largely trained on research databases containing a disproportionate number of skin lesion images from White patients, the potential for widening this inequality gulf is being realized: underperformance of AI models to detect skin cancer in patients with Black skin has already been demonstrated. To rectify racial disparities in AI-based skin cancer detection, this project introduces a novel AI convolutional neural network (CNN) architecture trained on high-quality synthetically generated dark skin lesion images via an AI-driven style transfer network. The CNN also utilizes a unique Cascading architectural design which has higher accuracy by allowing the model to focus its training on ambiguous lesions. In addition to its 84% accuracy in diagnosing light skin, the model demonstrates an 83% accuracy in diagnosing skin cancer in patients with dark skin, outperforming the best published models for skin cancer detection in dark skin. Given this clinically meaningful level of accuracy, the CNN will next be evaluated on real patient images in a series of clinical trials. Further steps will also include validation of an affordable user-friendly device that uses the CNN model to capture, upload, and diagnose skin lesion images. The 30 dollar device consequently serves impoverished communities across the globe without access to immediate healthcare. Addressing emerging inequities is imperative to prevent the formation of biases in AI and the medical field. Ongoing advancements prompt consideration of the fair and responsible application of these new tools.