University of Basel
Department of
Biomedical Engineering

University of Basel, Department of Biomedical Engineering, Hegenheimermattweg 167c, 4123 Allschwil

Master of Science – Biomedical Engineering
Thesis Proposal

Shades of Equity: Using Generative AI to Reduce Skin Tone Bias in Dermatology Datasets

Artificial Intelligence (AI) holds great promise for scalable diagnostic support, enhancing clinical decision-making, and facilitating access to appropriate medication and treatment. However, a persistent and critical shortcoming lies in the lack of diversity within publicly available dermatological datasets, which are overwhelmingly biased toward lighter skin tones [1]. This imbalance in representation not only limits the generalizability of diagnostic models but also risks perpetuating healthcare disparities, as models trained on such datasets often underperform when applied to patients with darker skin tones [2].

This thesis explores the use of Generative AI, specifically diffusion models [3, 4], to synthesize high-quality dermatological images that reflect a broad spectrum of skin tones. By generating realistic and diverse synthetic images, the aim is to enrich existing dermatology datasets, reduce bias, and improve the fairness and generalizability of machine learning models in medical imaging. The research will evaluate the ability of these generative models to capture and reproduce complex skin characteristics across different tones and will assess the downstream impact of the augmented dataset on diagnostic model performance, particularly in underrepresented populations. Through this approach, the thesis contributes to the broader goal of developing more inclusive and ethically responsible AI systems in healthcare.

Nature of the Thesis
Programming: 80%, Documentation: 20%

Specific Requirements
Experience in deep learning with Python and PyTorch, along with a strong interest in Generative AI and fairness.

Group Leader / Supervisor
Alvaro Gonzalez-Jimenez, University Hospital of Basel, Digital Dermatology.
Prof. Dr. Alexander Navarini, University of Basel & University Hospital of Basel, Digital Dermatology.

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References
[1] Daneshjou, R., et al Disparities in dermatology ai performance on a diverse, curated clinical image set. Science Advances (2022)
[2] Gottfrois, P. et al. PASSION for Dermatology: Bridging the Diversity Gap with Pigmented Skin Images from Sub-Saharan Africa. MICCAI 2024
[3] Song, J. et al.. Denoising Diffusion Implicit Models. In International Conference on Learning Representations.ICLR 2020.
[4] Song, Y. et al. Consistency models. In International Conference on Machine Learning. ICML 2023.

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