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

Developing and Evaluating Vision-Language Models for Pediatric Dermatology

The **PASSION project** addresses a critical gap in dermatologic care in Sub-Saharan Africa, where there are fewer than one dermatologist per million people. This shortage disproportionately affects the pediatric population, with up to 80% suffering from untreated skin conditions. To help bridge this gap, PASSION has developed the first-of-its-kind **open-source dermatology dataset** focused on richly pigmented pediatric skin. The dataset includes 4,901 images from 1,653 patients, covering common conditions such as eczema, fungal infections, scabies, and impetigo. It was publicly released at **MICCAI 2024**.
This thesis focuses on the **alignment between dermatological images and human-generated captions**, rather than traditional classification. Multiple medical students annotated each image with clinical captions, forming a high-quality paired dataset suitable for training and evaluating image–captioning and image–text retrieval models.
The objectives of this thesis are to:

1. Evaluate existing image-to-text models on the PASSION dataset.
2. Fine-tune vision-language models using PASSION data and assess their performance.
3. Analyze fairness and model behavior across different skin tones by comparing results with public datasets that include a range of pigmentation.

By emphasizing fairness and the quality of image–caption alignment in underrepresented populations, this research aims to contribute to the development of **equitable and inclusive AI tools for global health**.
Citations:
PASSION Project. https://passionderm.github.io

Nature of the Thesis
Experimental: 40%
Programming: 60%
Documentation: 20%

Specific Requirements
- Strong programming skills in Python
- Experience with deep learning frameworks (PyTorch, TensorFlow)
- Optional: Familiarity with vision-language models (e.g., CLIP, BLIP, ViLT), knowledge of medical image datasets or NLP
- Interest in fairness, bias mitigation, and global health AI:

Group Leader / Supervisor
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