Assessing the Performance of a Deep Learning Model Used on High Resolution Endomicroscopic Images for the Detection of Cervical Precancer

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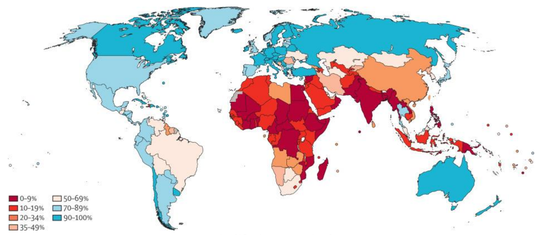
Cervical Cancer Around the World

Fewer than 5% of women in low- and middle-income countries are ever screened for cervical cancer

Barriers to screening include lack of trained clinicians and the need for expensive devices



Ever in lifetime cervical cancer screening coverage in women aged 30–49 years, 2019

Clinical Data

Study 1: Hospital Geral de Mavalane, Maputo, Mozambique	Study 2: Hospital Central de Maputo, Maputo, Mozambique
20 patients	11 patients
42 biopsies	21 biopsies

Methods

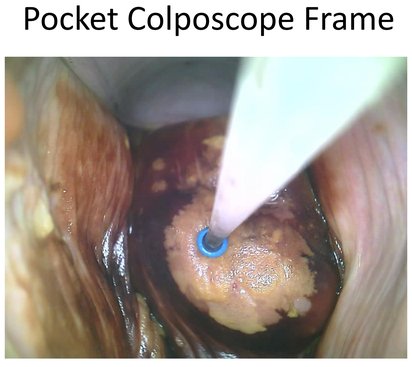
1. Conduct manual widefield translations to identify biopsy-correlated frames
2. Run HRME model to generate probabilities
3. Use biopsy summary videos to conduct manual quality control
4. Calculate the maximum of the moving average (MoMA) of probabilities per biopsy site

Purpose

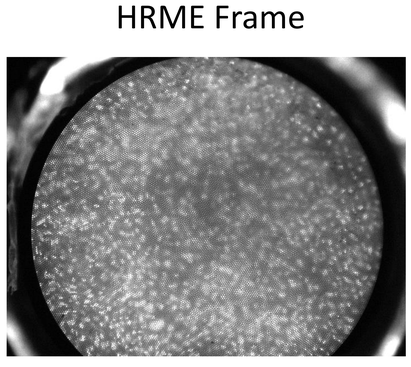
I aim to determine the accuracy of a multitask neural network used on HRME images captured by a multimodal colposcope to detect cases of cervical intraepithelial neoplasia (CIN) 2+ among women in two different low-resource clinical sites

Multi-Modal Colposcope

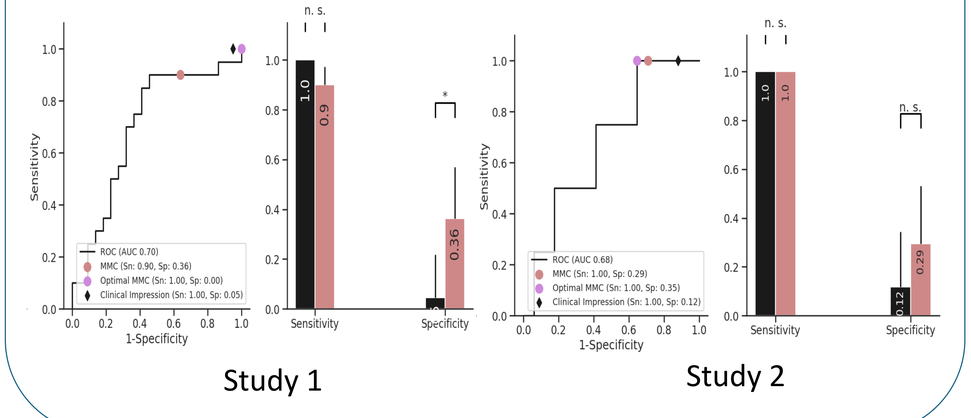
Pocket Colposcope Frame



HRME Frame



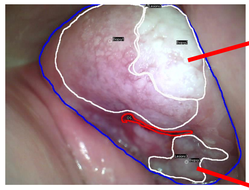
Model Results

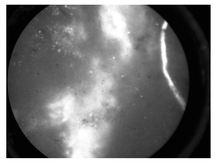


Study 1 Study 2

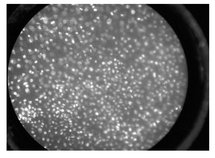
Model Issues

Pathology	Number of Biopsies (% of Total Biopsies)	False Positives (% of Pathology Count)
Condyloma, Condyloma/CIN 1	17 (27.0%)	8 (41.1%)
Cervicitis	6 (9.5%)	6 (100%)
No significant diagnoses/changes	3 (4.8%)	1 (33.3%)





MoMA = 0.411304



MoMA = .736362

Conclusion and Future Outlook

- The multi-task model performed consistent across two different sites, achieving sensitivities comparable to the clinician and outperforming specificity at both
- The HRME seems to have trouble obtaining quality nuclei images on condyloma cases that are heavily keratinized and larger in size
- The model appears to perform less accurately on milder and/or flat condyloma cases, where nuclei are still somewhat visible though with significant debris
- Given the large prevalence of condyloma in this patient population, the model may need to be tuned to improve diagnosis on these images

Acknowledgements

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References

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