

Artificial Intelligence-assisted Diagnosis of Early Syphilis Infection based on Radiomics: A Feasibility Study

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Background:

The aim of this study was to evaluate the feasibility of using radiomics and artificial intelligence for the early detection of syphilis lesions.

Methods:

A total of 335 high-resolution images of sexually transmitted infections, including 81 primary syphilis images, 56 secondary syphilis images, and 198 images of other common STIs were collected from publicly available online sources. Using the Pyradiomics Python package, 102 radiomics features were extracted from each lesion's region-of-interest. A prediction model was constructed based on the extracted radiomics features to distinguish early syphilis from other STIs.

Results:

During the model training process, 52 radiomics features with stronger correlations were excluded, resulting in the use of only 50 features as input for constructing the prediction model. Four best-performing models were identified, with the wavelet filter and Gaussian Process Classifier model exhibiting the best performance (mean AUC of 0.808 ± 0.04 ; median, 0.805; interquartile range, 0.764 - 0.843) and an AUC of 0.8639 on the test dataset. The Ridge Classifier model utilizing the wavelet filter exhibited the second-best performance, with a mean AUC of 0.805 ± 0.07 (median, 0.787; IQR, 0.754 - 0.854) and an AUC of 0.8065 on the test dataset. The SVM model, also utilizing the wavelet filter, ranked third in performance, with a mean AUC of 0.8 ± 0.04 (median, 0.79; IQR, 0.758 - 0.824) and an AUC of 0.8222 on the test dataset. Finally, the Ridge Classifier model utilizing the gradient filter exhibited the fourth-best performance, with a mean AUC of 0.786 ± 0.05 (median, 0.757; IQR, 0.745 - 0.812) and an AUC of 0.8065 on the test dataset.

Conclusion:

The results suggest that radiomics-based diagnostic tools may accurately diagnose early syphilis infection lesions by distinguishing them from other commonly presented STIs.

Disclosure of Interest Statement:

None declared