AI Applications in Medical Diagnostics

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Abstract

Machine learning applications pair well with many medical diagnostics, elevating their general performance. In this presentation we will discuss a handful of exemplary cases for possible applications. One case is the management of polygenic data. In a study at Massachusetts general hospital women who gave birth and were enrolled in their genetic biobanking program were reviewed for risks of pre-eclapmsia. Polygenic risk score was able to predict blood pressure but did not add to predictive model including clinical variables in later pregnancy with AUC of 0.91.

There is a lot of visual data contained in pathologic slides. Whole slide imaging for salivary gland tumors using convolutional neural networks was performed on 41 pleomorphic adenoma and 42 carcinoma ex-pleomorphic adenoma. Patches of pixel data were used for analysis. Area under the ROC curve of 0.97.

Similarly radiographs are rich in data that can take effort to review. Automation can serve a role in the evaluation of the trauma patient. In maxillofacial CT scans mandible fractures were able to be identified using deep learning nnU-Net segmentation framework. Beyond just identifying a fracture, the lesions were able to be classified based on severity with mean AUC 0.86, which helps weight the clinical relevance of the finding.

Much of medicine requires visual diagnosis, which remains imperfect. In a series trained on greater than 4000 intraoral images YOLOv8 computer vision model was used. There was variable performance across different lesion types, with F1 score at 0.8 for HPV related lesions, and less specific appearing keratosis was significantly lower. This model was seen to perform on par with oral surgeons, and significantly better than general dentists.

Spectroscopic data for biologic samples can have subtle findings best managed with a machine learning approach. In a pilot study of 10 cervical cancer patients, using optimized wavelength, CARS spectroscopy was used to obtain images of both normal and cancer bearing areas. The spectrographic images were able to demonstrate both morphologic and molecular composition of the tissues. ConvNeXt was used to extract imaging features and was able to obtain high accuracy predictions in this small dataset.