Summer intern project
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Investigation of Diagnostic, Predictive and Prognostic Values in Clinical H&E images Using Deep Learning

Clinical H&E Whole Slide Images of histological tumor specimens have been scanned, represented and archived for every patient for all oncology trials. These images present unique and detailed information of tumor cell micro-environments, and have been playing key roles in pathological analysis and diagnostic medicine for over a century. However, the extra-high-dimension and high-correlation natures of those images impose many technical hurdles for conventional human interpretation, thus limit powerful, cost-effective, and adaptable applications to study sophisticated interacting immune and oncology pathways.

Recently, the development of Deep Learning, especially convolution neural networks (CNNs) for analyzing and classifying image patterns have led to tremendous success in medical imaging. By deconstructing H&E images into high-dimensional arrays and sequentially and automatically learning to aggregate them to relevant shapes and features that represent distinct spatial and morphological patterns of tumor micro-environments, CNNs are poised to revolutionize H&E image analysis and classification a new source of large biological data sets for precision oncology.

The tremendous success in oncology treatments, the ready availability of H&E Images and recent rapid advancement in CNNs provide a unique opportunity for Merck Scientists to build a state-of-arts, end-to-end, and CNN-based analytical pipelines to investigate the diagnostic, predictive and prognostic values in clinical H&E images. The intern, ideally a Ph.D. candidate with solid training in Statistical Learning and extensive experience in scientific programming, will join and contribute to the on-going multi-departmental pilot studies to build the state-of-art analytical pipeline of H&E images, including using CNNs for preprocessing, automated feature-extraction and outcome prediction. Some of the methods developed in this project may be also leveraged for prediction tasks in oncology using CT imaging.