# A Deep Learning Approach to Detection of Metastasis in H&E-Stained Lymph Node Sections

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The presence of metastatic tissue in lymph nodes is critical for oncologists and cancer treatment, as it is a central part of the TNM cancer staging process and other cancer-related diagnostic information. The advent of AI and deep learning in histopathology is important, since such tools allow for more efficient and swift disease detection and classification. By expediting this process, more time is left to administering treatments and care, which can potentially save a patient's life. Transfer learning, a branch of deep learning, utilizes pre-trained models that have already proven to be very efficient and effective in tasks such as image classification. The purpose of this experiment is to apply various popular transfer learning models in an effort to evaluate where they stand in terms of detecting metastatic tissue in digital scans of lymph node sections. First, I loaded and preprocessed the 327,680 lymph node tissue patches from the patch_camelyon dataset. The three transfer learning architectures used were Inceptionv3, VGG16, and Xception. Using each architecture for feature extraction, I built my own classifier to output a prediction (0 or 1). After training each model, I took the mean of their best performances on the testing dataset. Inceptionv3 had the best net performance, with an accuracy of 0.8328, and AUROC of 0.9106, and an AUPRC of 0.9028. An AUROC greater than 0.9 indicates an excellent classifier, and while still not at ideal medical standards, this shows that the Inceptionv3, VGG16, and Xception model architectures are still very viable in detecting metastatic tissue in lymph node patches. Not only can they be used to help expedite the detection process, but the findings here also further our understanding of deep learning in histopathology.

**Awards Won:**