

# **Automatic Quantification of Lymphocytes as a Prognostic Marker in Cancer Tissue**

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Tumor-infiltrating lymphocytes (TILs) move from the blood into a tumor to attack the cancer. Their accumulation count is associated with how much disease has progressed. Quantifying TILs is very important for cancer research. This is done manually by pathologists by inspecting slides under the microscope, and is time consuming.

A deep learning based convolutional neural network model was developed and trained with data obtained from Lymphocyte Assessment Dataset, containing 20,000 patches from whole-slide images of breast, colon and prostate cancer of human specimens. Using ResNet-50, a neural network that is trained on more than million images and is 50 layers deep, a technique known as transfer learning is employed to train the neural network. Images were classified into three categories, 0, 1-10 and more than 10 based on lymphocyte counts. The model was trained on google cloud for 20 epochs. 70% of data is used for training, 20% for validation and 10% for testing. The model achieved an accuracy of 86.7%, precision of 83%, recall of 86%, F1 score of 80% with test data. This model can be used to automate the process of lymphocyte quantification and can be adopted in routine diagnostics for cancer in the future.