# Histopathology Image Search for Lymphoma Diagnosis Directly from Hematoxylin and Eosin Slides

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**Background:** The microscopic diagnosis of lymphoma remains challenging and complex due to the heterogeneity of its classification. Pathologists usually diagnose lymphoma cases, initially, by observing the morphological features in hematoxylin and eosin (H&E) staining to make an initial decision on a suspected lymphoma case. However, the final decision is made after analyzing immunohistochemistry (IHC) staining, which is a more advanced technique that highlights a specific antigen in tissue. Although IHC is an expensive staining technique, the absence of definitive morphological characteristics on conventional light microscopy makes IHC evaluation essential to specify the lineage of lymphoma cells.

**Methods:** This work utilized previously diagnosed lymphoma cases to develop a diagnostic model that can retrieve histopathology images that had a diagnosis similar to the diagnosis found in the query image. The aim of this work is to investigate the ability of deep learning features to recognize different types of lymphoma from H&E staining without analyzing the IHC slides. The implementation of our model is divided into four main stages: 1) tissue segmentation, 2) mosaic representation (patching) based on color and location clustering, 3) deep feature extraction using KimiaNet, and 4) image matching based on a similar diagnosis.

**Results:** The performance of our model was evaluated using an unbalanced dataset provided by Grand River Hospital which consists of 272 H&E slides from different subtypes of lymphoma from Hodgkin and non-Hodgkin lymphoma. The experiments showed promising results in recognizing different types of lymphoma from H&E slides. Furthermore, the results are comparable with the diagnosis accuracy of pathologists using both H&E and IHC stains. For instance, we achieved an accuracy of 71.07% by using only H&E slides to predict B-cell lymphoma (see Figure 1), while the overall accuracy achieved by pathologists, in using both H&E and IHC stains was 70.17%. For Hodgkin lymphoma, we obtained 75.90% compared with 78.05% by pathologists.

**Conclusion:** Our model helps pathologists to take advantage of similar lymphoma cases that have already been studied and analyzed to have a better understanding of lymphoma patterns using inexpensive H&E staining as part of the routine diagnostic process.
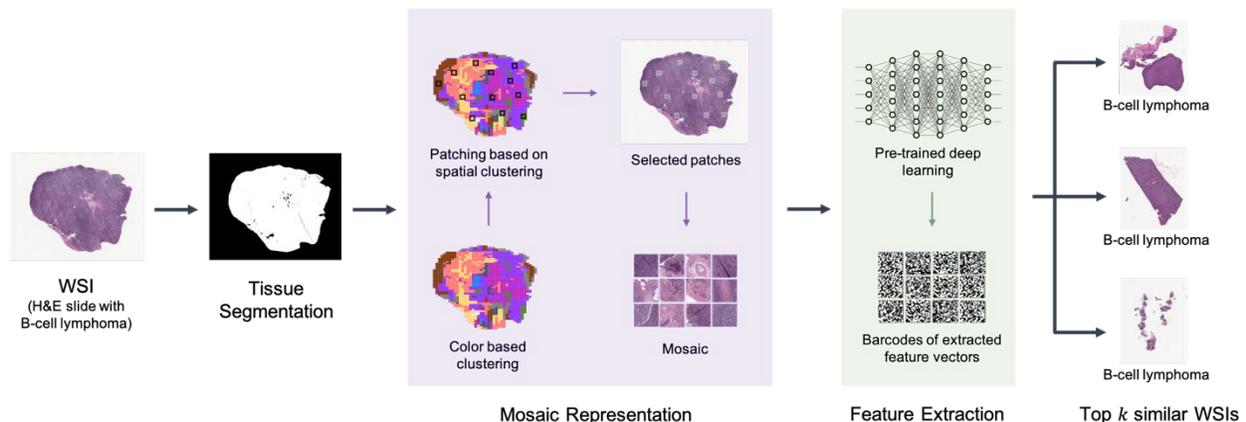
*Figure 1: Retrieve similar images to a query image of H&E slide with B-cell lymphoma*