

Type: Bachelor / Master Thesis
Title: AI for Fixation Type Classification in Digital Pathology
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Keywords: digital pathology, FS, Frozen Section, FFPE, Formalin Fixed Paraffin Embedded, Deep Learning

Objective: To write an AI tool for the automatic classification of the fixation type of a slide prior scan.

Problem: Artificial intelligence (AI) is widely used in digital pathology for quality control of digital scans. Deep learning has shown high potential in numerous studies to e.g., detect scanning artifacts such as blurred slides, or processing artifacts such as tissue folds, air bubbles or pen marks. However, little work has been done to detect the correct fixation type of a slide. Two major types are commonly used: formalin fixed, paraffin embedded (FFPE) as the standard type, and frozen section (FS) as a fixation type for rapid pathology review. Usually, the fixation type is known, but in pathology archives, a minor portion of glass slides are mislabeled due to sloppiness or errors (see Figure 1). This can be problematic when scanning retrospective data sets of one fixation type. The fixation type can very well be classified and verified after scanning(1), but to exclude non-relevant slides from scanning in the first place, a pre-scan classifier is required.

Goal: In this project, a deep learning algorithm shall be developed to differentiate FS slides from FFPE slides using a pre-scan overview image (thumbnail image) of the slide. This thumbnail is of maximal size 1024x1024 px.

The programming language can be chosen. However, Python is preferred for compatibility.

Data: >3'000 whole slide images (WSI) for training and testing, and >300 external WSI (Augsburg, Regensburg) for testing.

Computing: The student will use the LRZ high performance computing cluster for AI (GPU-based), and/or the group's computing infrastructure and/or a workstation.

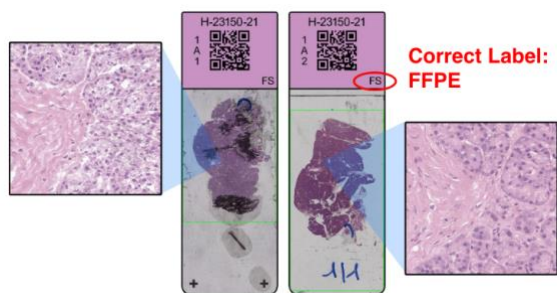


Figure 1: Example of wrongly labeled WSI: Both WSI share the same barcode and label, but indeed, the left is FS and the right is FFPE. From (1).

Requirements

Knowledge in or interest in learning of: Python programming, deep learning, machine learning, Linux cluster usage, GPU programming, image processing, pathology, debugging, visualizations, analytical thinking.

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References

1. J. Israel, L. Dan, S. R. Sarker, F. Stögbauer, W. Weichert, K. Steiger, P. Schüffler, A machine learning approach to classify whole slide images by formalin-fixed, paraffin-embedded or frozen section origin (2022).

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