

Lymph Nodes Metastasis Detection

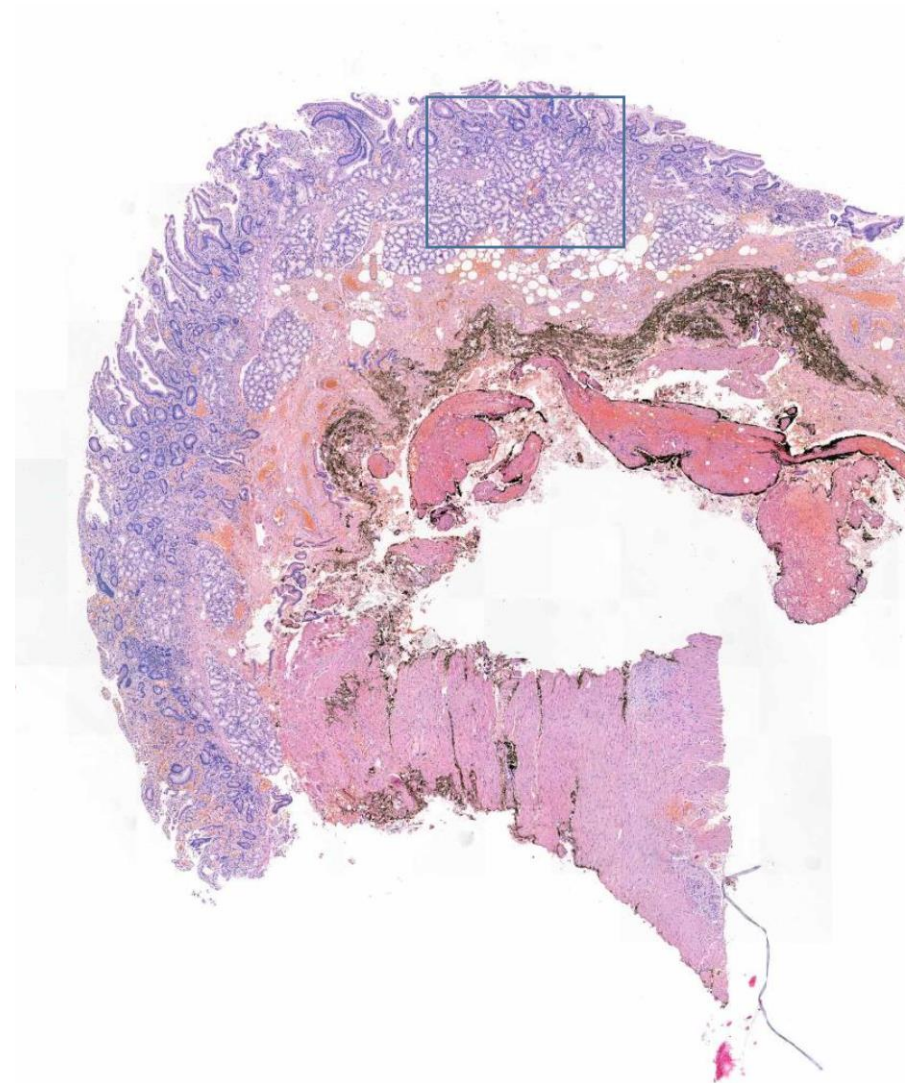
Jakub Pekár

Brief Introduction

Histology and Digital Pathology

Data Acquisition and Preparation

- 4 steps
 - Tissue Acquisition
 - Tissue fixation
 - Cutting
 - Staining
- Evaluation
 - With microscope
 - Digital scans of the tissue

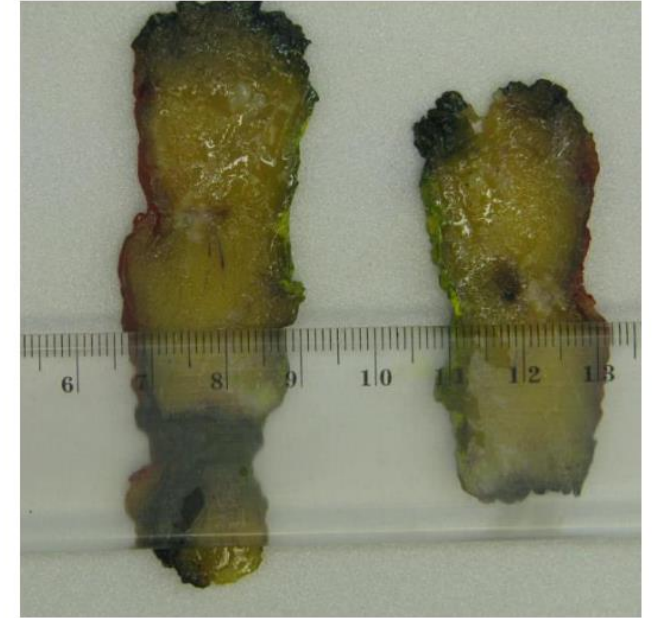


Tissue Acquisition



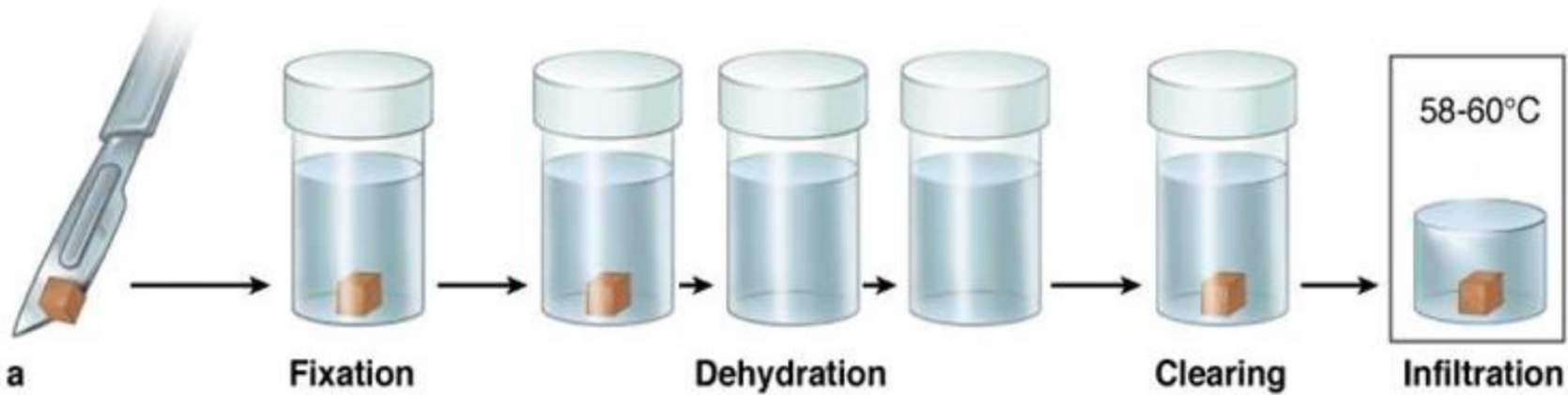
Tissue Fixation

- Water
- Etanol
- Xylene
- Paraffin wax

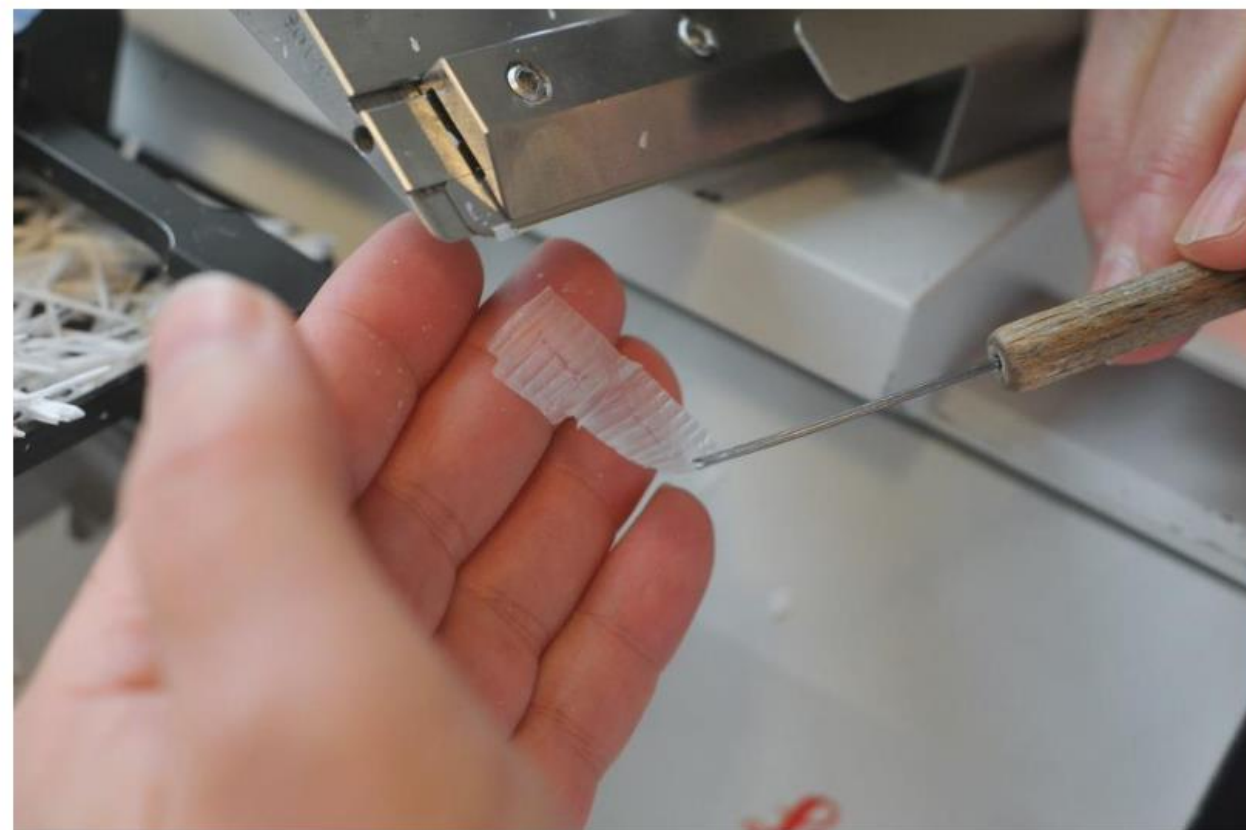
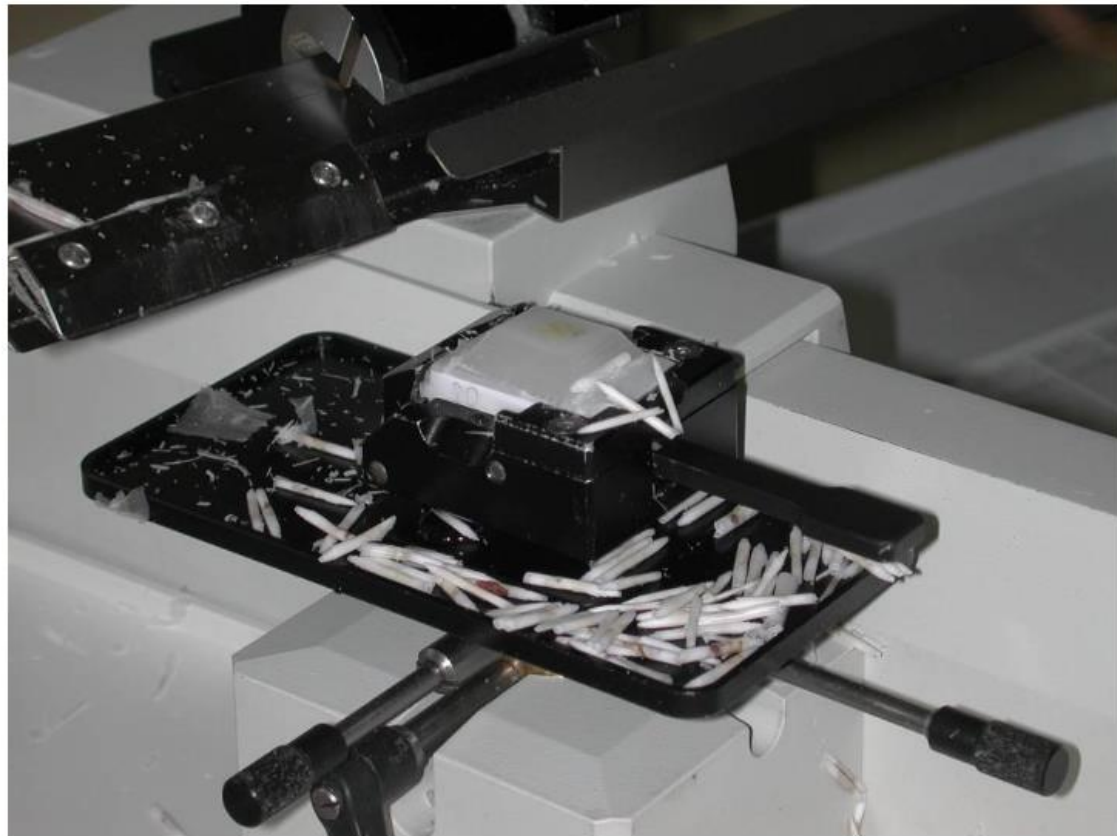


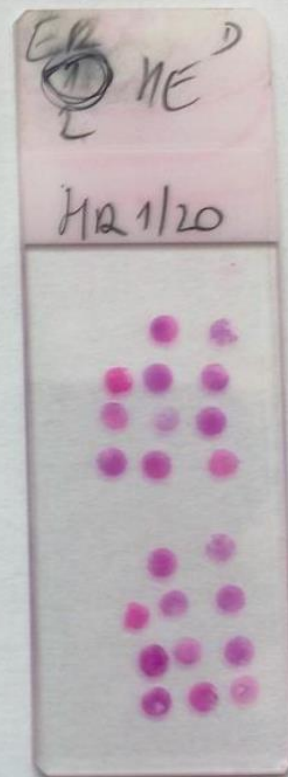
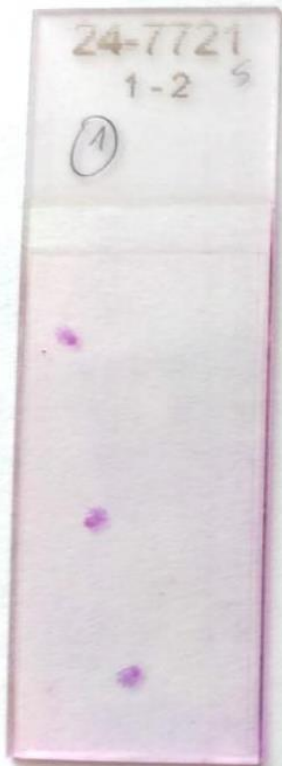
Native tissue

Fixed tissue

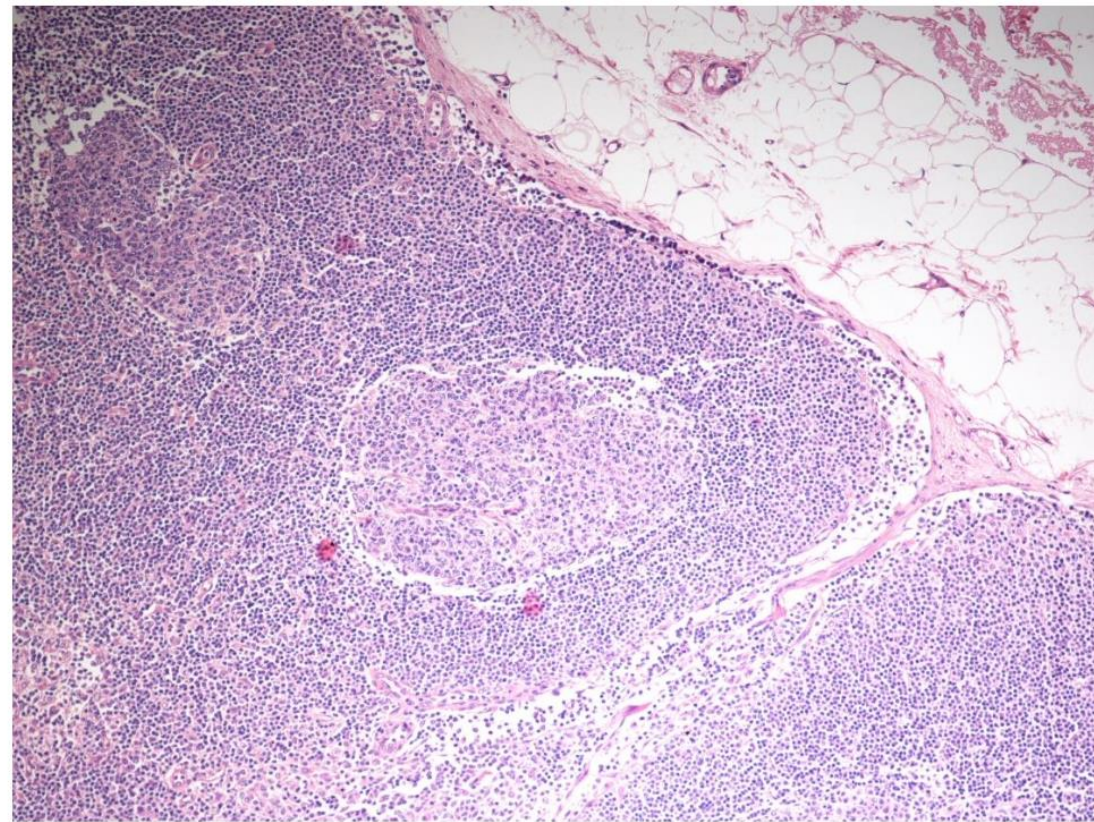
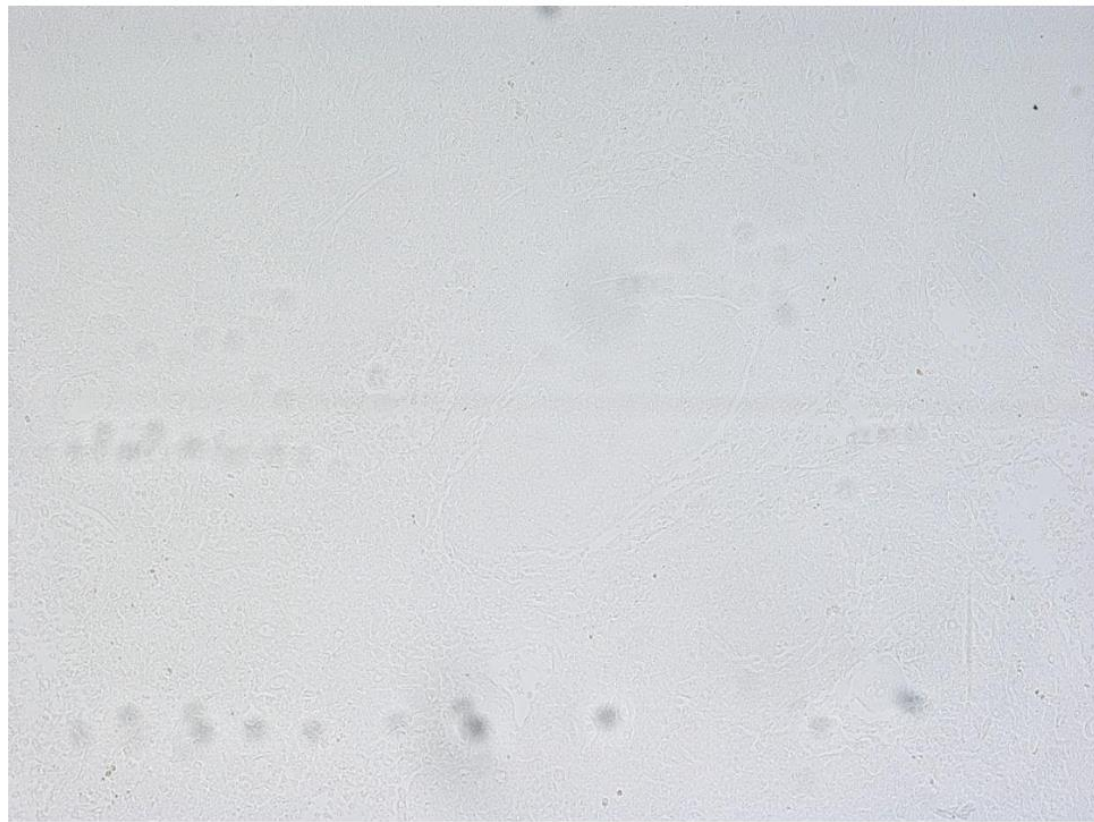


Tissue Cutting



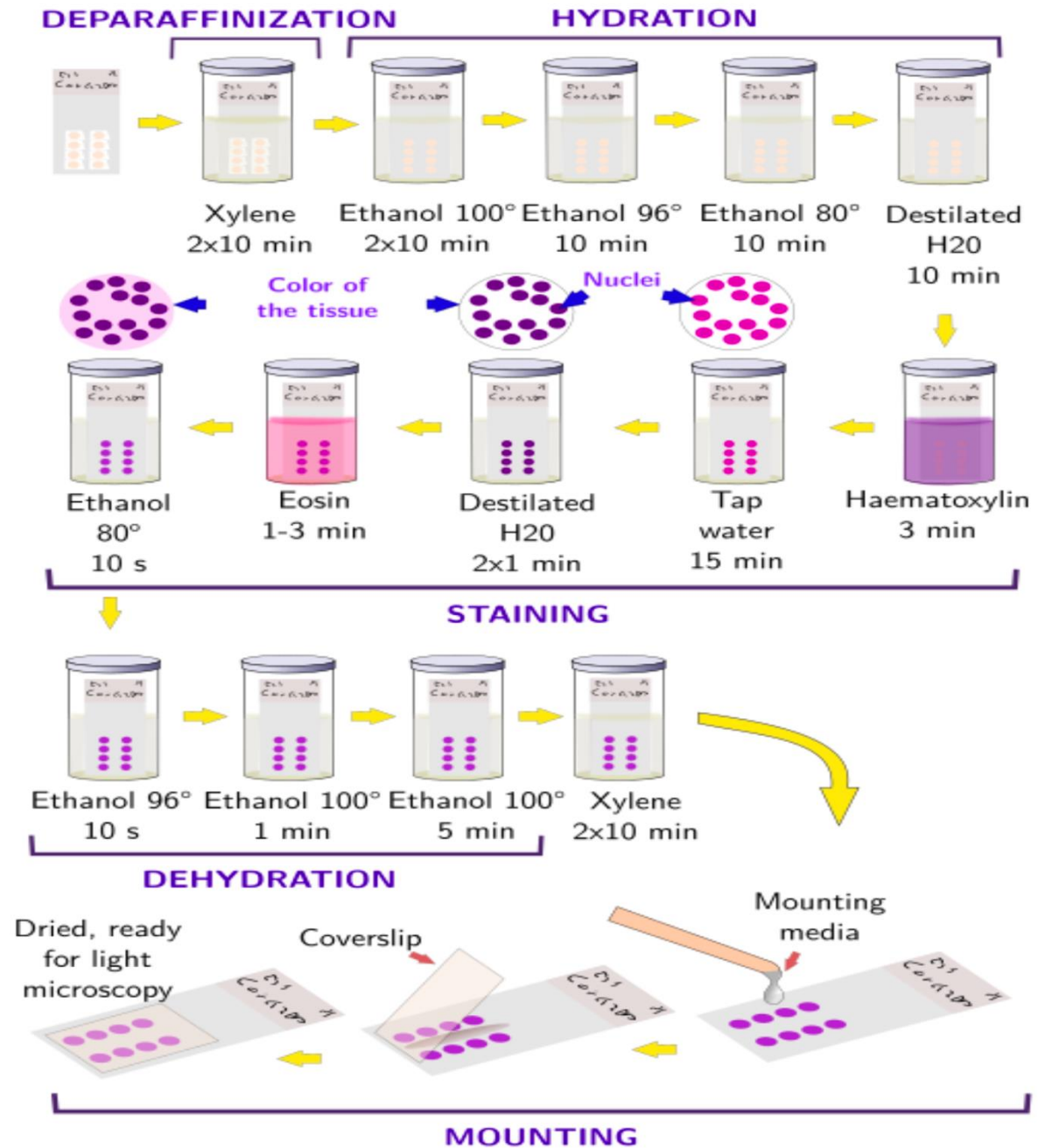


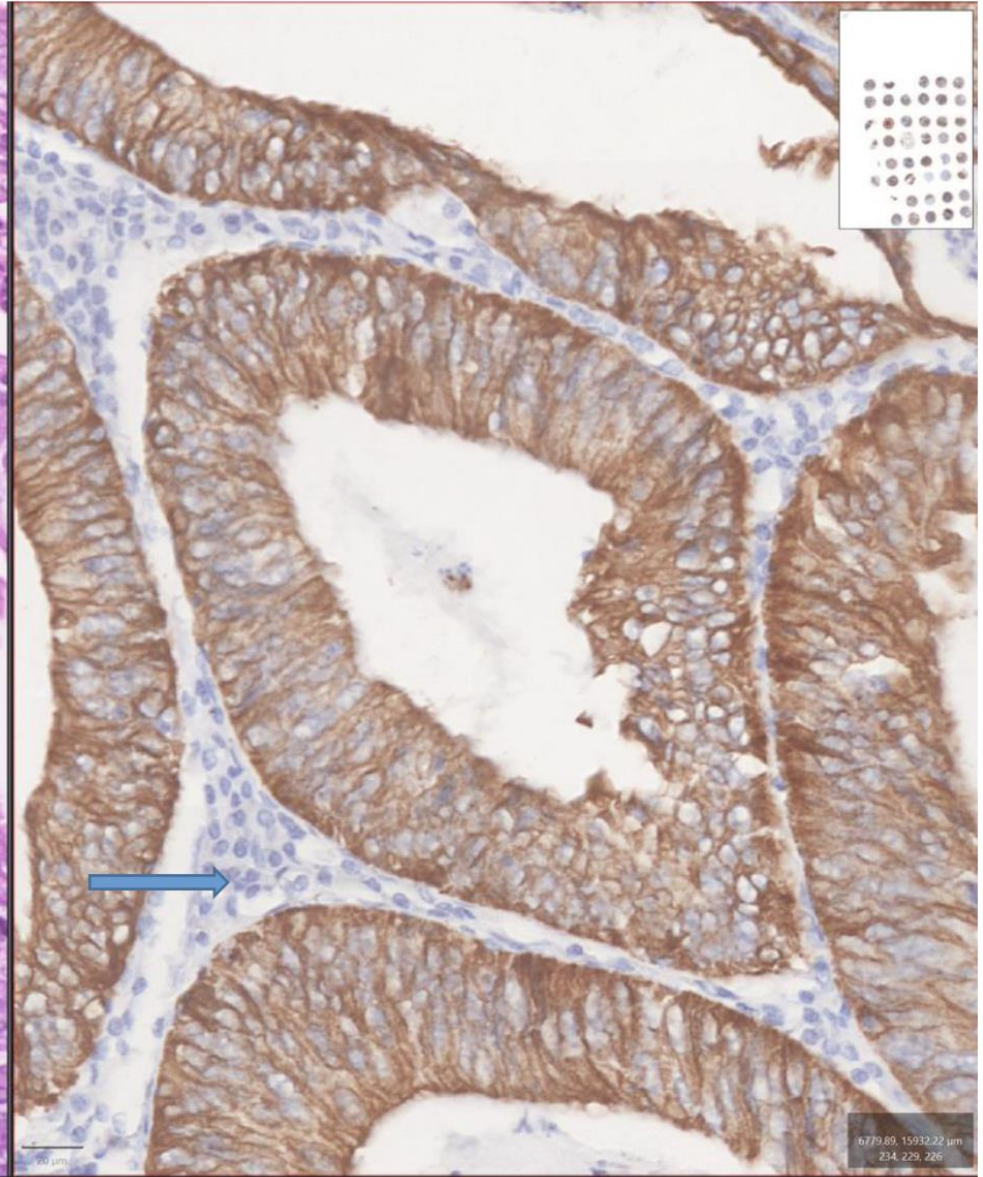
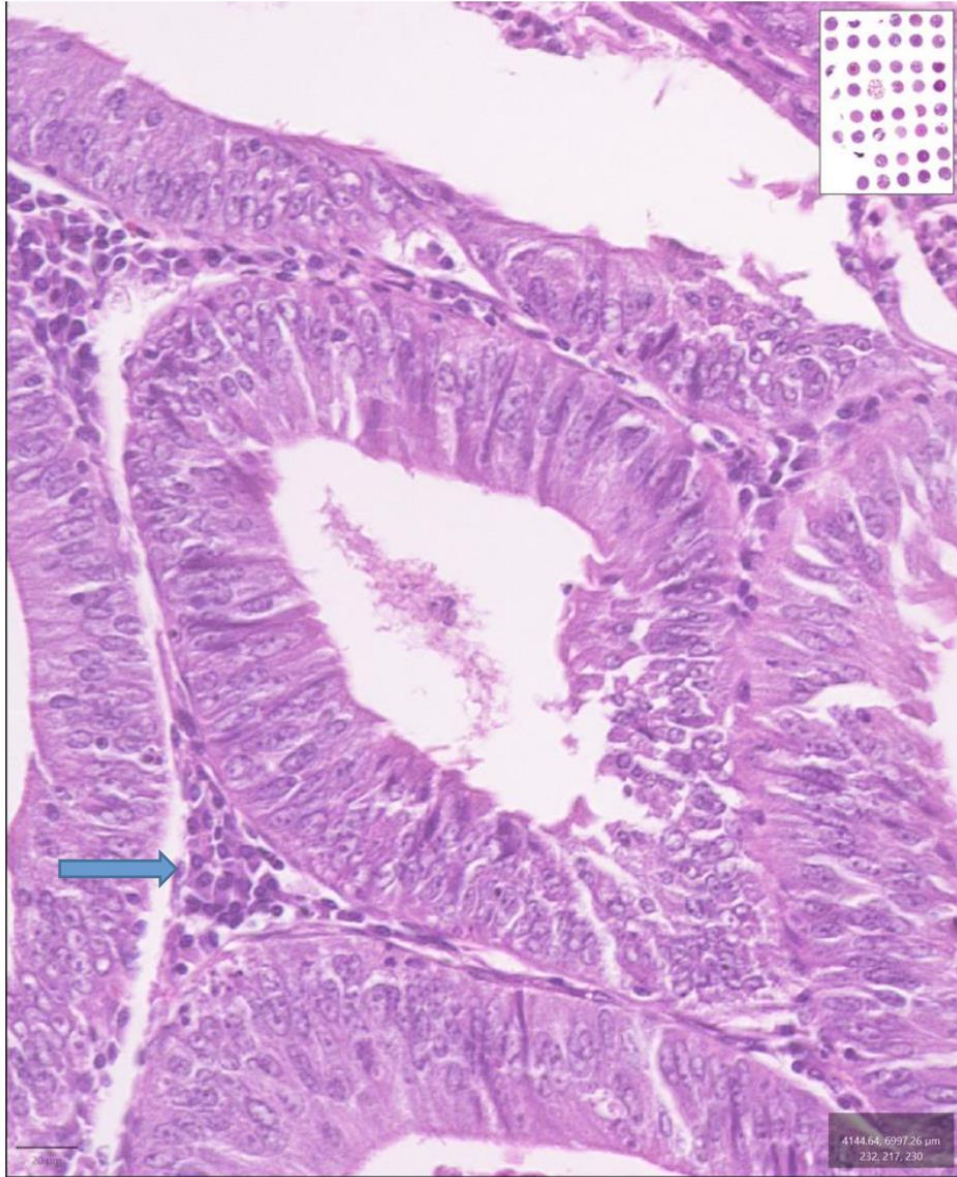
Tissue Staining



Staining Process

- Steps
 - Stain
 - Scan
 - Rehydrate
 - Destain
 - Stain
 - Scan
 - ...
- Stains
 - Hematoxilin & Eosin (H&E)
 - DAB (Imunohistochemistry)





Lymph Nodes Metastasis Detection

H&E Stained Tissue

Why H&E

- Is the most common
- Cheap
- Good staining quality
 - Staining consistency

Demo image

The catch

**We have no annotations hence
almost impossible...**

Lymph Nodes Metastasis Detection

DAB Stained Tissue

DAB Staining (Immunohistochemistry)

- Advantages
 - Metastazing cells are visually distinguishable
- Disadvantages
 - Tissue preparation (staining process)
 - More expensive
 - Poor staining quality

Methodology

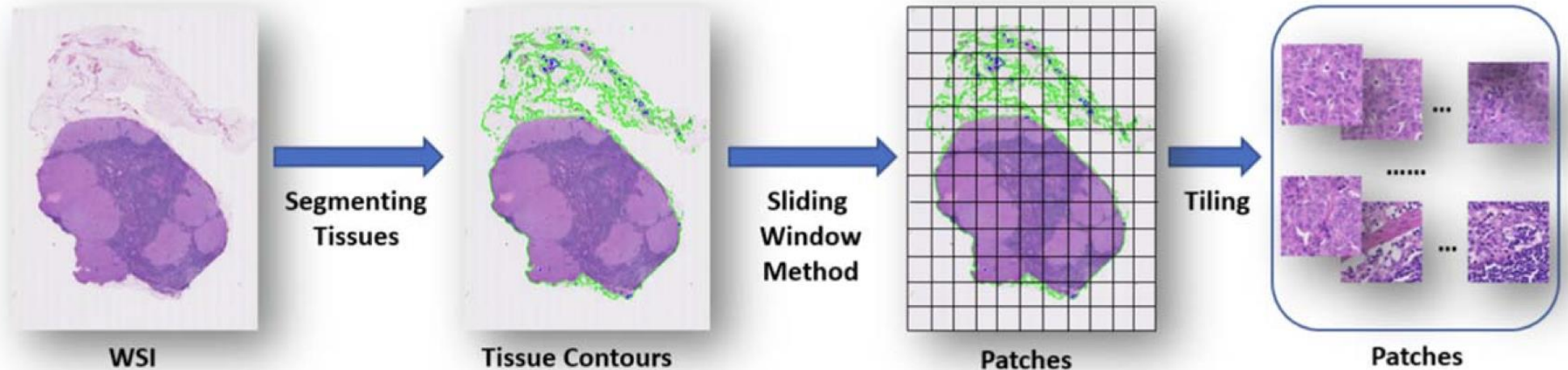
- DAB detector
- DAB annotations
- Image registration
- Use DAB annotations with H&E stained tissue
- H&E detector

Data

- Sparse annotations
 - Positive / Negative slides
- Different tissue, similiary looking metastazis?

Whole Slide Images (WSIs)

- Scans of tissue
- Large in size
- Data Preprocessing
 - Background & artifact removal
 - Tiling
 - Patches of size 512 x 512
 - Overlap 256



Data Overview

- 297 negative lymph nodes WSIs
- 10 WSIs of colorectal or breast cancer DAB stained TMAs
- 4 annotated positive WSIs of lymph nodes
- Training set
 - 7.8 million tiles (patches)
 - 234 thousand of positive patches

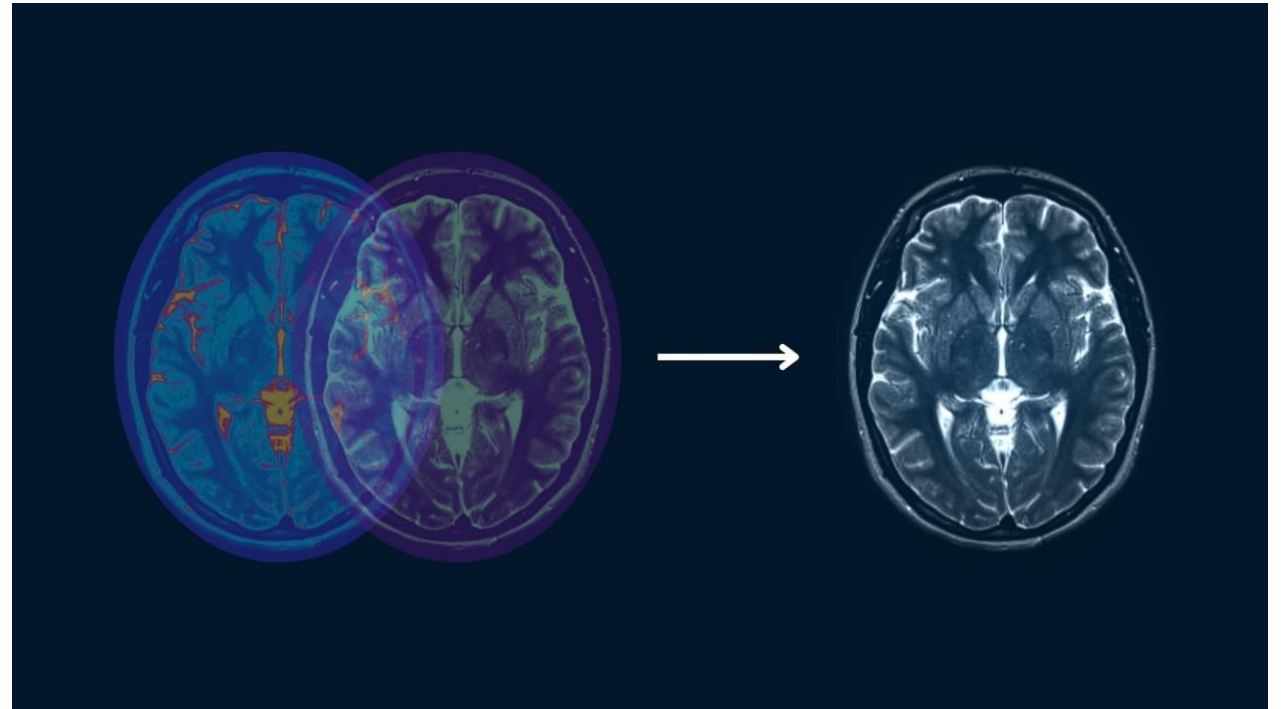
DAB Tissue Model

- VGG16 backbone
- 1 epoch
 - Subset of all training samples
 - Batch balancer

- First results under examination

Image Registration

- Mapping of the same tissue in different staining
- Tissue deformation during staining



H&E model

- Future work
- Publicly available datasets

References

- <https://youtrack.rationali.cloud.e-infra.cz/api/files/225-259?sign=MTczNDIyMDgwMDAwMHwxLTQ1fDIyNS0yNTl8d2lCWm5idnVxQWRoSU1PRHQzTnVSV1VBU0J2UVY4M2E2NGp3Um0yOEJBTQ0K&updated=1728375459401&forceDownload=true>
- <https://iopscience.iop.org/article/10.1088/1361-6560/acde3f>