



Automated Pathology Image Analysis: Enhancing Digital Pathology With a Yolo-Based Object Detection Extension For QuPath

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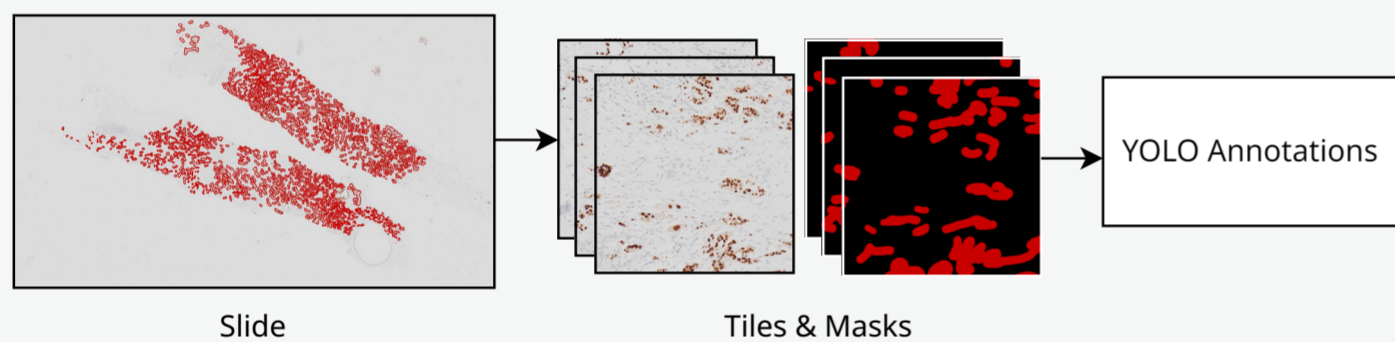
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AIN491 - AIN492 Project

Introduction

- Pathology diagnosis and analysis are time-consuming and error-prone.
- Our aim is to enhance digital pathology analysis tool, **QuPath**, with machine learning methods to assist pathologists by automating tissue annotations, thereby accelerating workflow.
- We developed a YOLOv8-seg-based tumor segmentation model and an extension for QuPath to quickly annotate tumor areas.

Dataset



- Breast cancer **histopathology whole-image slides (WSI)**
 - Consist of different IHC stains
 - 10 slides
- Provided by Hacettepe University Pathology Department
- Annotations made by pathologists using QuPath
- Slides divided into smaller tile-mask pairs, using scripting tool within QuPath

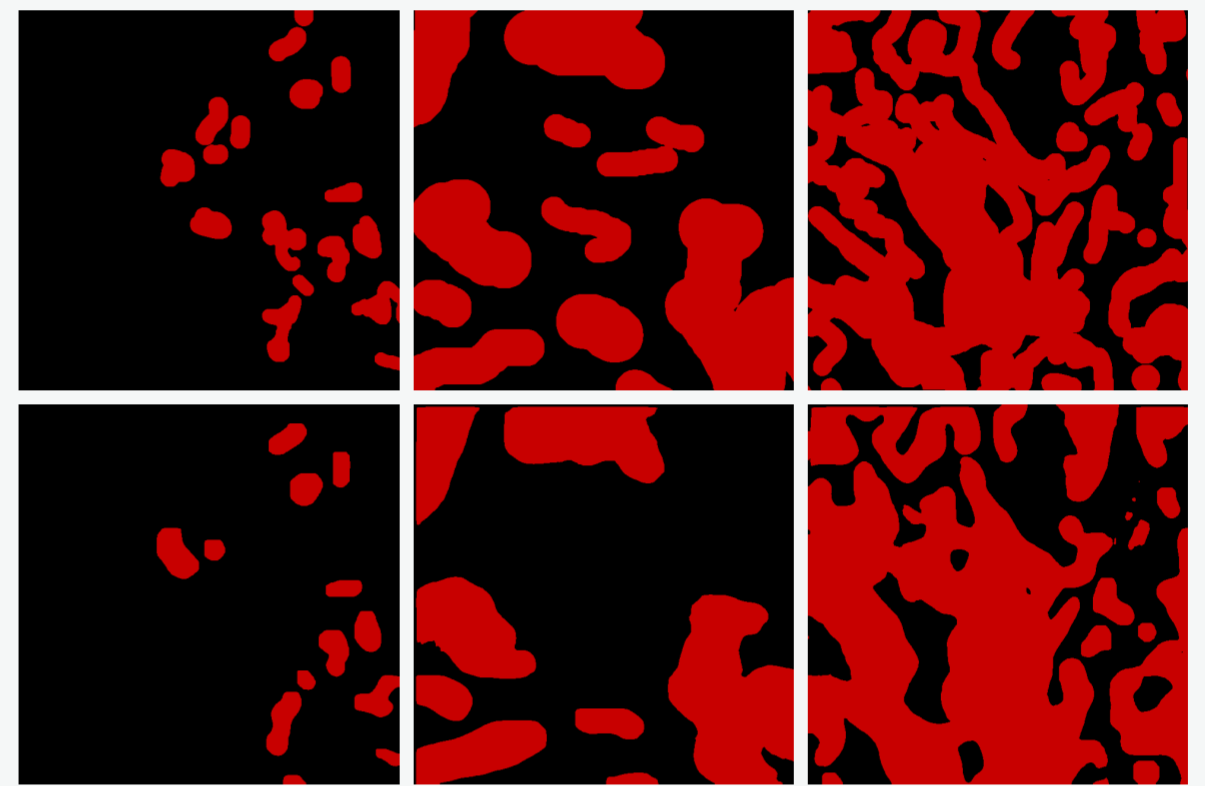
Methodology

- Focused on Convolutional Neural Network (CNN) architectures
- Utilized YOLO (You Only Look Once) model family
 - Efficient and lightweight compared to transformer-based models
 - Provides flexibility
- Worked on various sizes of **YOLOv8-seg** models
- Uses a weighted sum of losses for loss calculation
 - Regression (bounding box, segmentation, DFL)
 - Classification (class)
- Used **mean average precision (mAP)** and **recall** as evaluation metric

Results

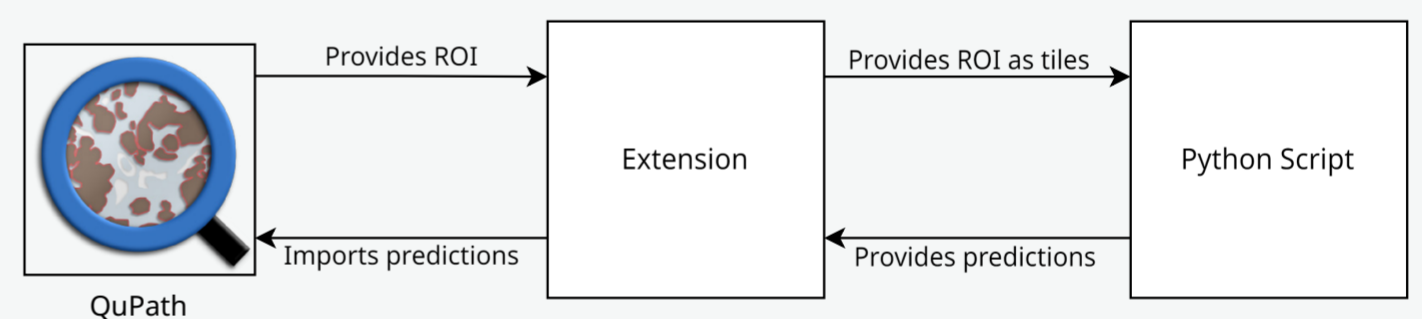
- The obtained results of the model are **promising**
- It is expected that model will perform better, by continuing training the model with more diverse data

Results

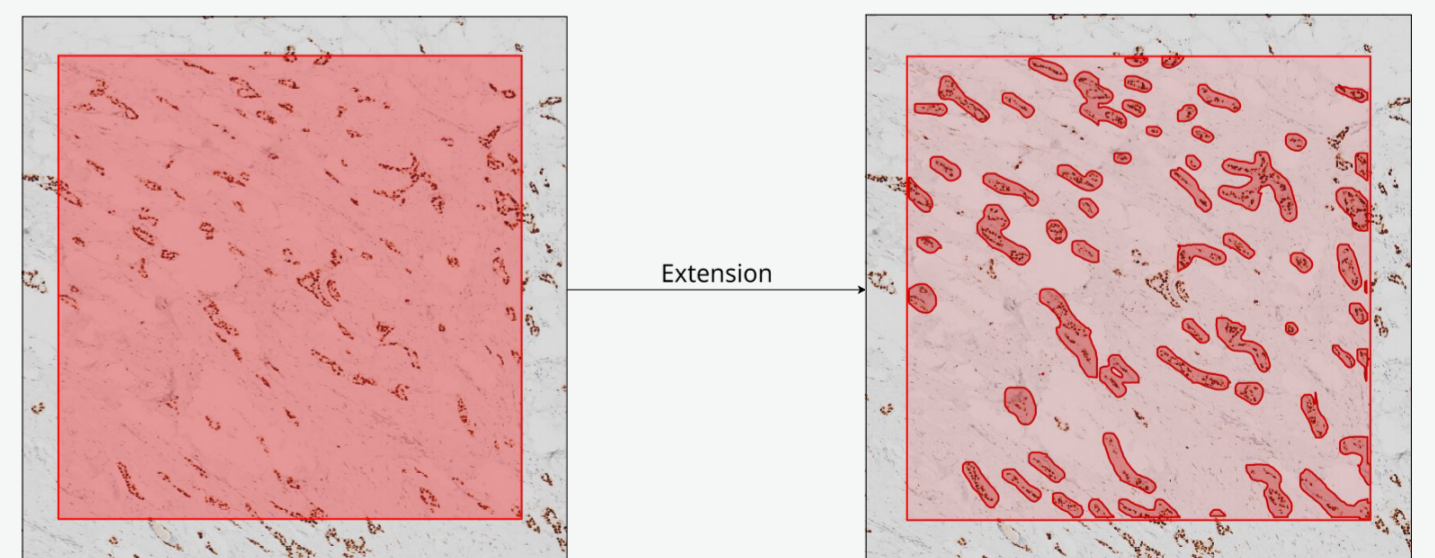


Ground truths are shown above in the figure, predictions are shown below.

Extension



- Allows used model to interact with QuPath
- Invokes Python script for model inference and post-processing internally
- Allows users to set model confidence and IoU parameters for more precise inference
- Handles internal QuPath input/output operations



Future Work

- Further train the model with diverse data, including different stainings and hard-to-capture areas, to enhance its performance
- Expand the extension to support various deployments
- Implement general enhancements by improving the GUI and increasing processing speed