WEB APPLICATION FOR AUTOMATIC NUCLEUS COUNTING IMMUNOFLUORESCENCE TISSUE BIOPSIES

NO.10

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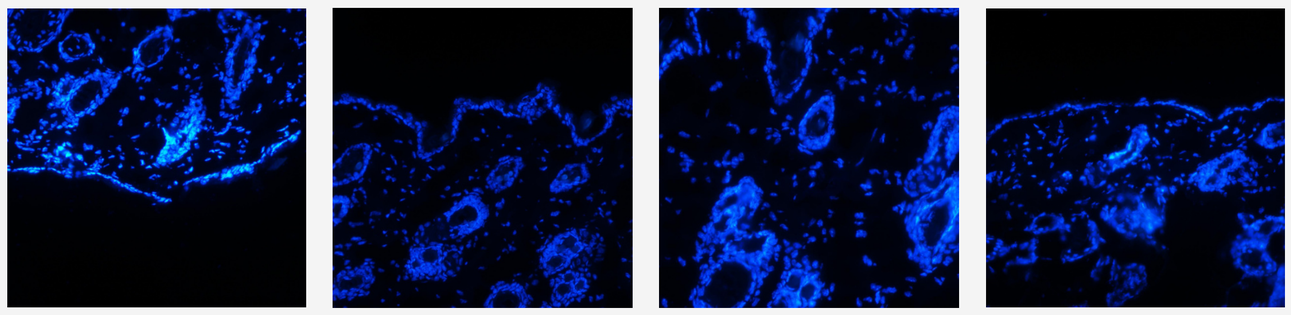
ABSTRACT

Accurate nucleus counting is vital in pathology for disease diagnosis and treatment advancement. Pathologists typically employ Fluorescence Microscopy machines to image DAPI-stained tissue and rely on the Columbus platform for automated nucleus counting. However, the platform struggles to accurately count and locate nuclei in cases of overlapping, clustered, or indistinct shapes caused by overlapping fluorescent dyes. Consequently, pathologists are compelled to manually count nuclei, resulting in time-consuming processes prone to errors.

DATASET

Immunofluorescence Tissue with 4′,6-diamidino-2-phenylindole (DAPI), to precisely identify the locations of nuclei.



OBJECTIVE

1. To develop a model for counting nuclei from histological images stained with a fluorescent dye.
2. To develop a web application that can perform nucleus counting from histological images stained with a fluorescent dye.

Target Users is

" Pathologist "

METHODOLOGY

1. **Data Preparation**
   - Labelling
   - Image Augmentation
2. **Algorithm/Modelling**
   - Deep Learning
     - Mask R-CNN
     - YOLO
     - U-Net
   - Image Processing
     - Thresholding
     - Split Touching
     - Counting
3. **Evaluation** • $F1 = \frac{2 \times Precision \times Recall}{Precision + Recall}$
4. **Web Application**

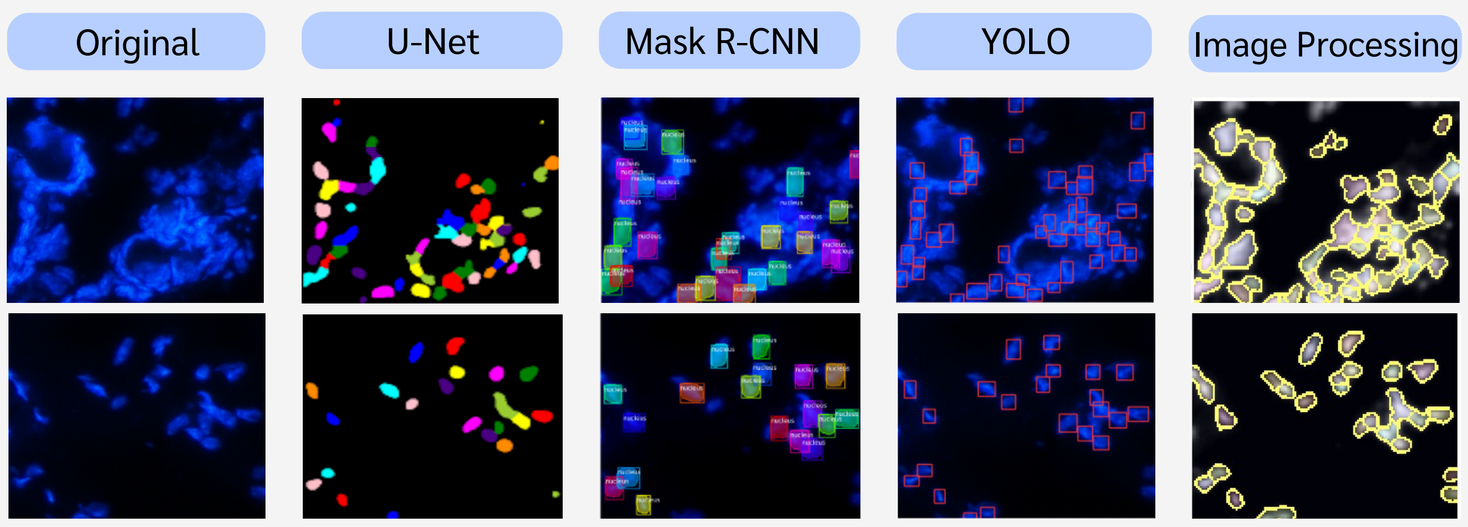
EVALUATION with F1-score

Mask R-CNN	YOLO	U-Net	Image Processing
69.3%	90.2%	88.1%	77.8%

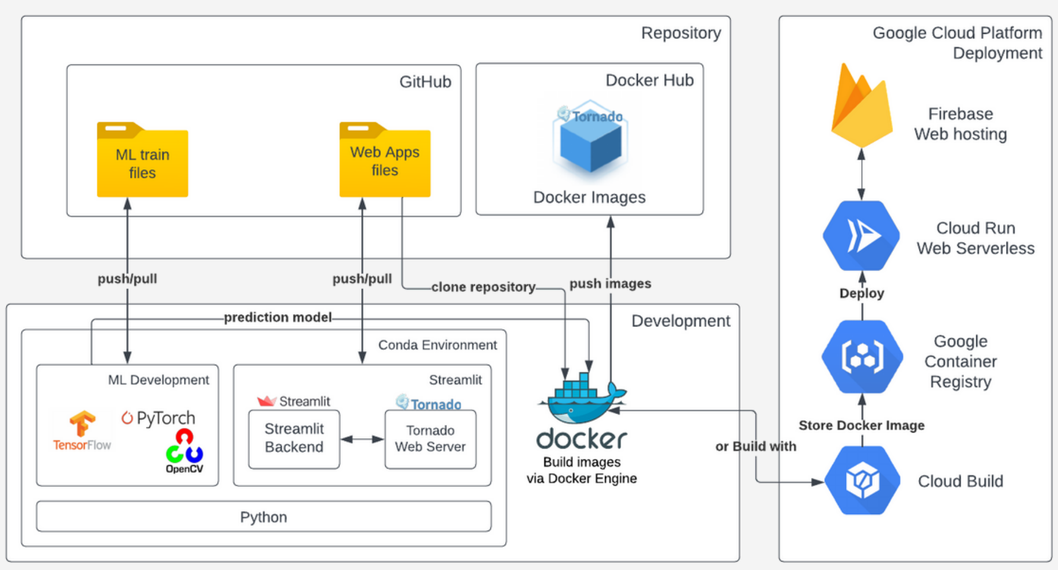
RESULT

Based on the results obtained from comparing all the models, it was found that the YOLO model can accurately identify the positions of nuclei the best, with adjustments made to six parameters: Dropout, Leaky, Hardswish, momentum, scale image, and object loss.

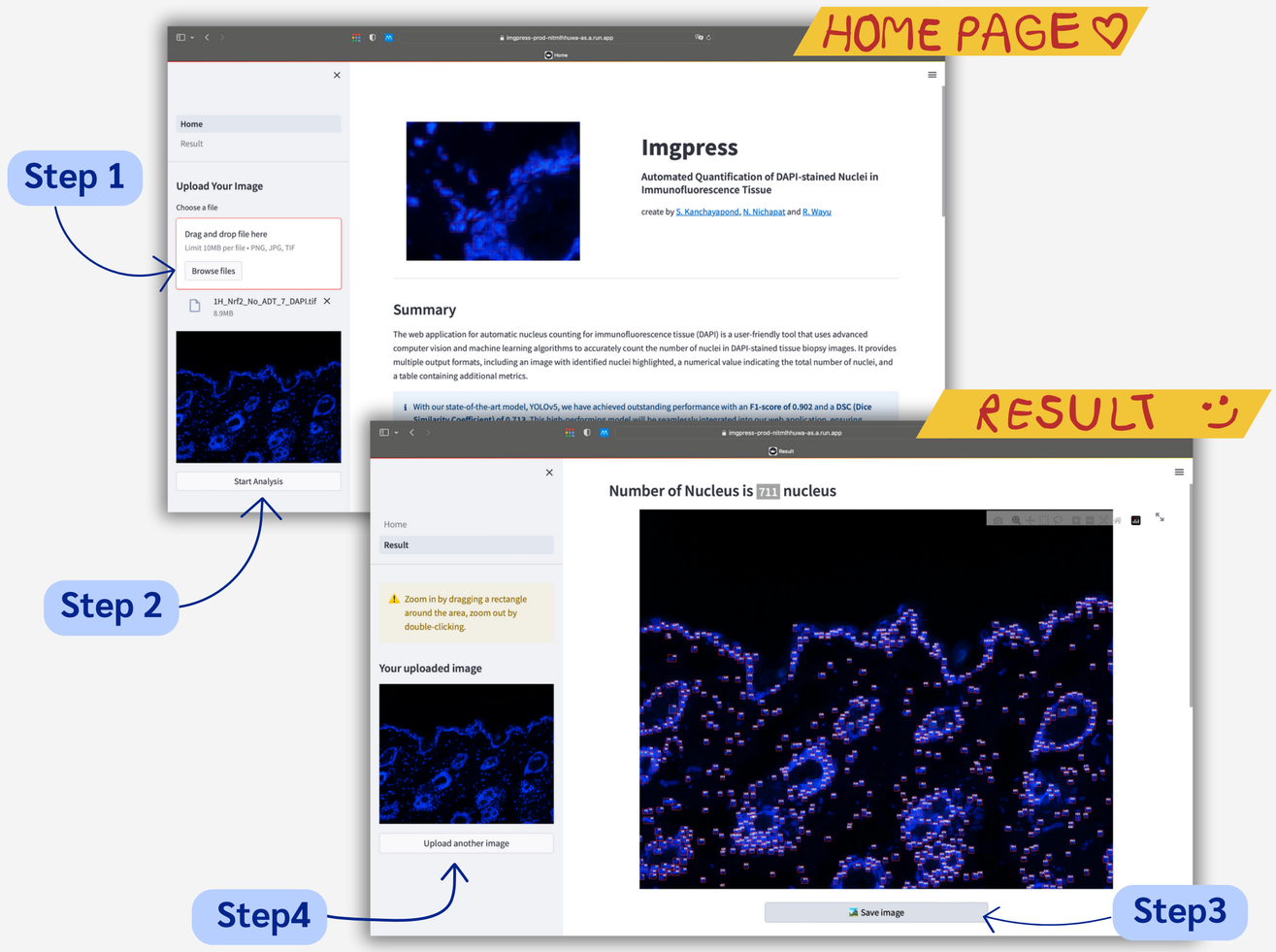
Algorithm/Model	Precision	Recall	F1 Score	ENr	DSC
Mask R-CNN	0.857	0.581	0.693	0.659	0.509
YOLO	**0.896**	0.908	**0.902**	0.823	0.713
U-Net	0.840	0.926	0.881	0.908	**0.740**
Image Processing	0.657	**0.953**	0.778	**1.083**	0.670



SYSTEM ARCHITECTURE



WEB APPLICATION



USER SATISFACTION

Design	★★★★☆
Clarify	★★★★☆
User friendly	★★★★★

Best Performance

YOLO

with F1-score

90.2%