

Classifying Breast Histopathology Images with a Ductal Instance-Oriented Pipeline

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December 2020

Ductal Instance in Breast Cancer

- Ducts
 - Important Region for Breast Cancer Diagnosis
 - Provide Interpretable Machine Learning Decisions

- Challenges
 - Hard to Split Ductal Instances
 - Scarcity of Labelled Data

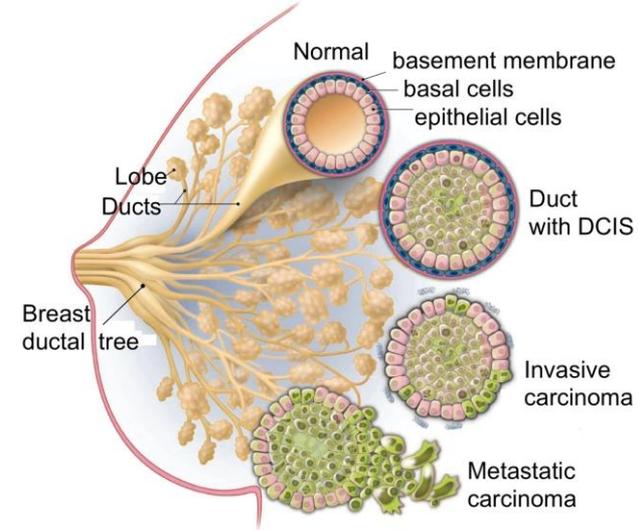
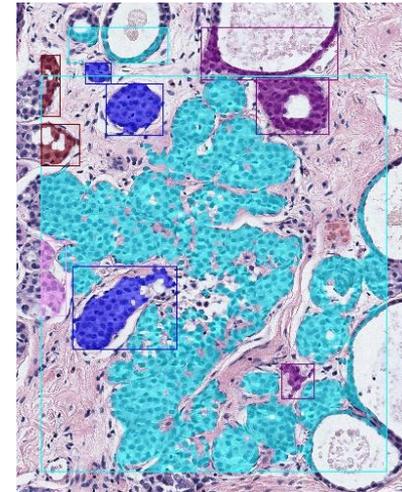
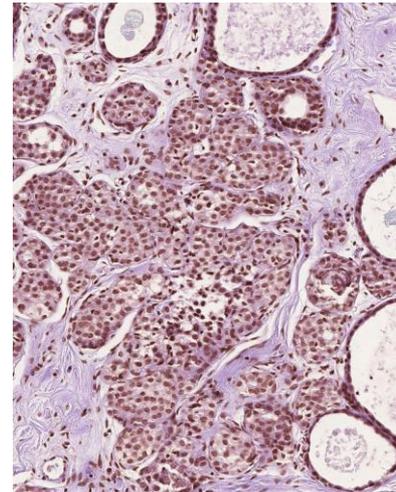


Image Source: <https://bit.ly/33Ua7OP>

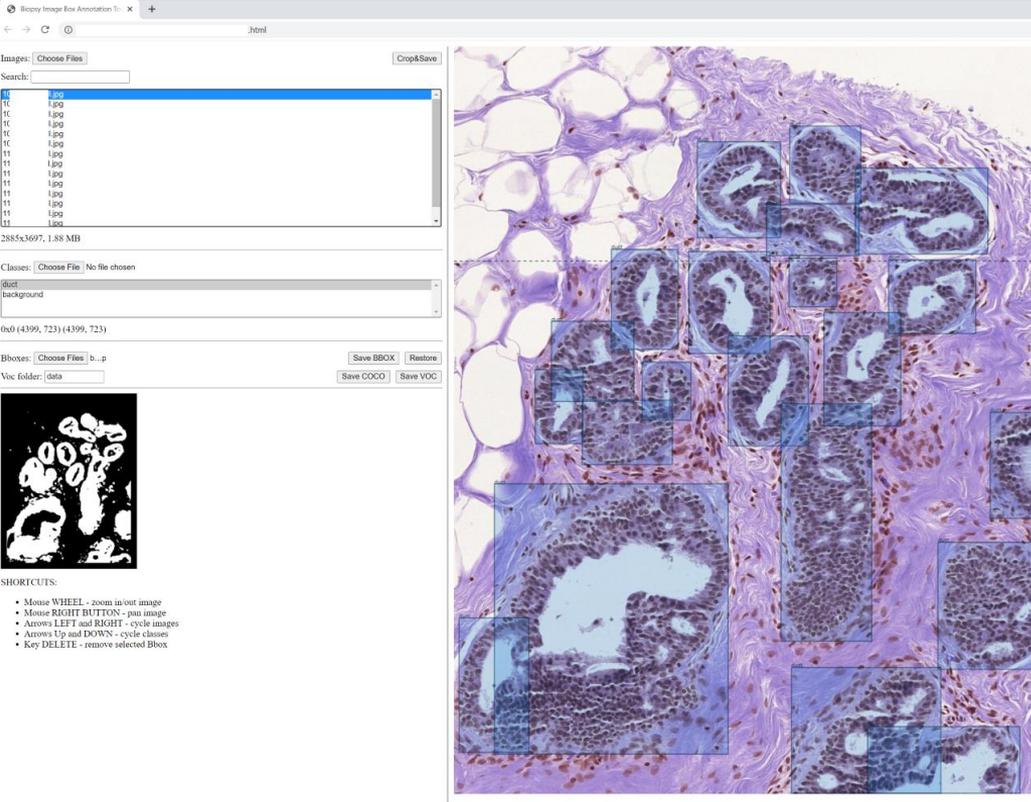


Weakly Supervised Annotation

Human-AI Collaboration for Labelling

Semi-Supervised Pixel-Level Instance Segmentation Labels

Silver Standard



Biopy Image Box Annotation Tool interface showing a list of images, a class selection dropdown, and a large histology image with blue bounding boxes.

Images: Choose Files | Crop/Save

Search:

2885x3697, 1.88 MB

Classes: Choose File | No file chosen

Class: background

0x0 (4399, 723) (4399, 723)

Bboxes: Choose Files | b...p | Save BBOX | Restore

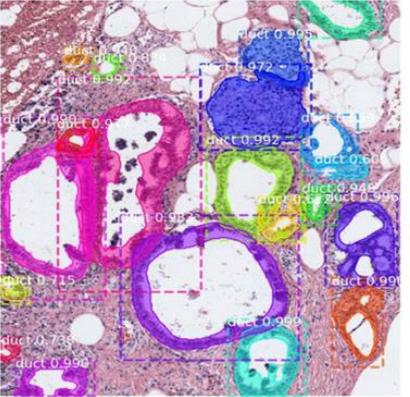
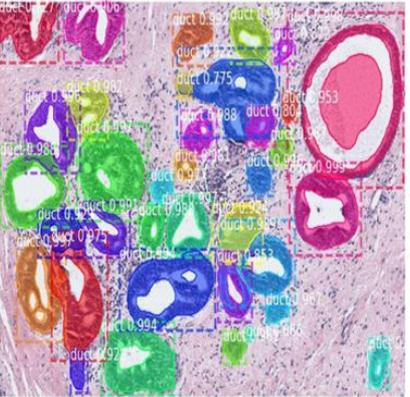
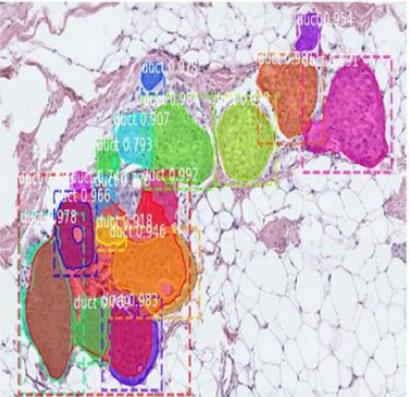
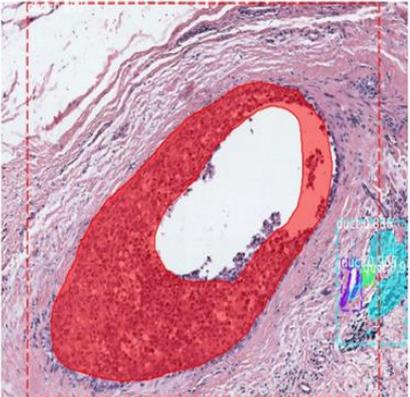
Voc folder: data | Save COCO | Save VOC

SHORTCUTS:

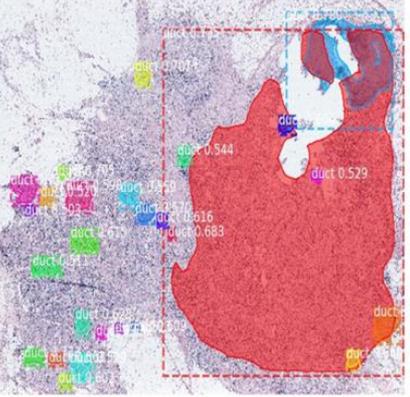
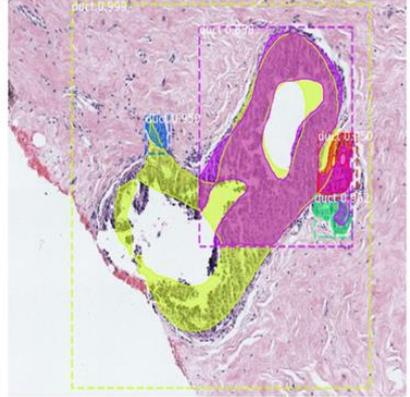
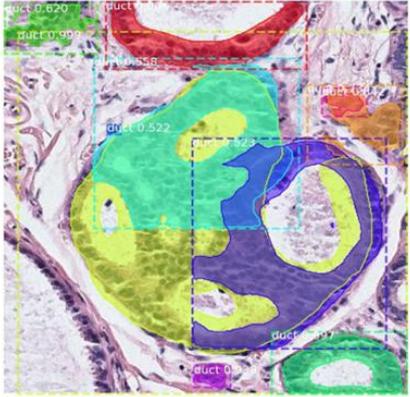
- Mouse WHEEL - zoom in/out image
- Mouse RIGHT BUTTON - pan image
- Arrows LEFT and RIGHT - cycle images
- Arrows Up and DOWN - cycle classes
- Key DELETE - remove selected Bbox

Instance Segmentation Results

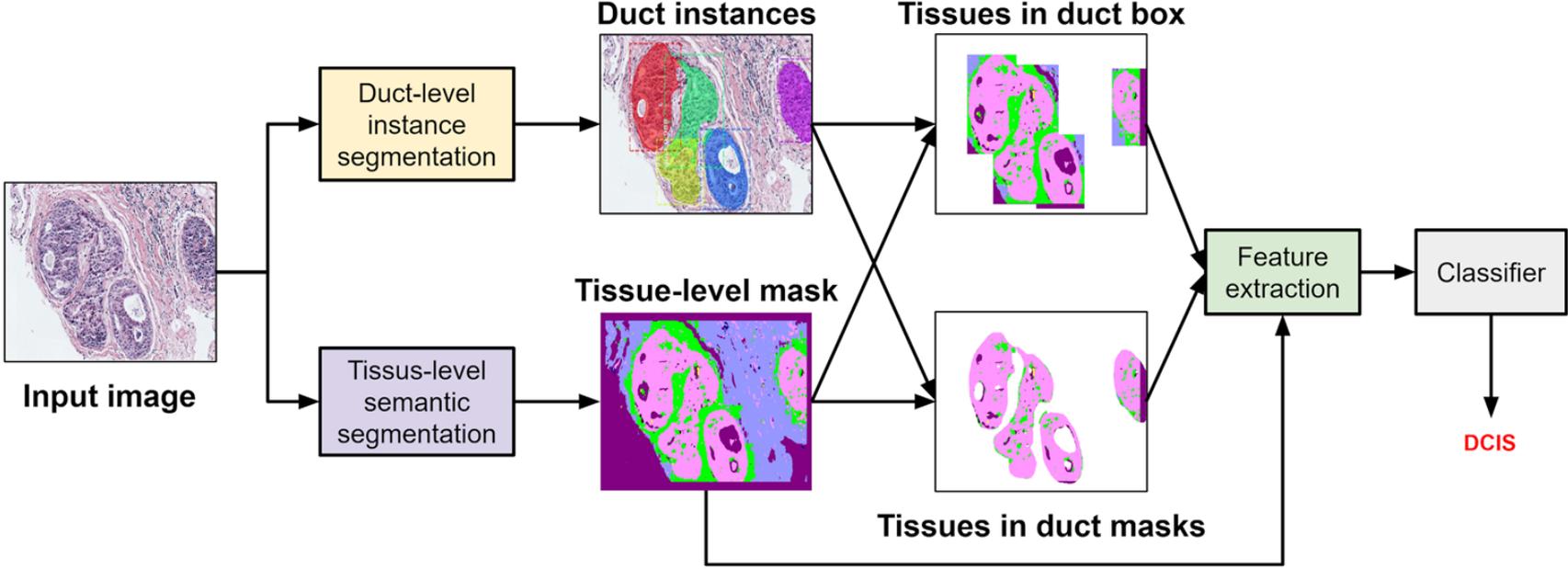
Good



Imperfect



Pipeline



Diagnostic Results

Method	Accuracy
Pathologists	0.70
MIL with max-pooling	0.55
MIL with learned fusion	0.67
Semantic Learning	0.55
Y-Net	0.63
DIOP (Ours)	0.70 \pm 0.02

Method	Accuracy
Tissue in ROI	0.67
Tissue in Duct box	0.66
Tissue in Duct mask	0.69
Tissue in Duct mask + ROI	0.69
Tissue in Duct box + ROI	0.67
Tissue in Duct box + mask	0.69
Tissue (All)	0.70

Rank	DIOP (ours)	Tissue-level model
1	BD & BE in duct mask	ME & NC in ROI
2	ME & NC in duct mask	BG & NC in ROI
3	BD & NC in duct mask	SC freq in ROI
4	BE & NS in bounding box	BE freq in ROI
5	BG & NC in duct mask	BE & SC in ROI
6	BE & SC in ROI	ME & NS in ROI
7	ME & SC in bounding box	BE & NS in ROI
8	NC freq in bounding box	NC freq in ROI
9	BE & SC in bounding box	NS & NC in ROI
10	DS freq in duct mask	SC & NC in ROI

Thank You!



Research reported in this article was supported by grants R01 CA172343, R01 CA140560, U01CA231782, and R01 CA200690 from the National Cancer Institute of the National Institutes of Health.



Music: Once Again (*Benjamin Tissot*) www.bensound.com