

Classifying Breast Histopathology Images with a Ductal Instance-Oriented Pipeline

Beibin Li,

Ezgi Mercan, Sachin Mehta, Stevan Knezevich, Corey W. Arnold,
Donald L. Weaver, Joann G. Elmore, Linda G. Shapiro

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

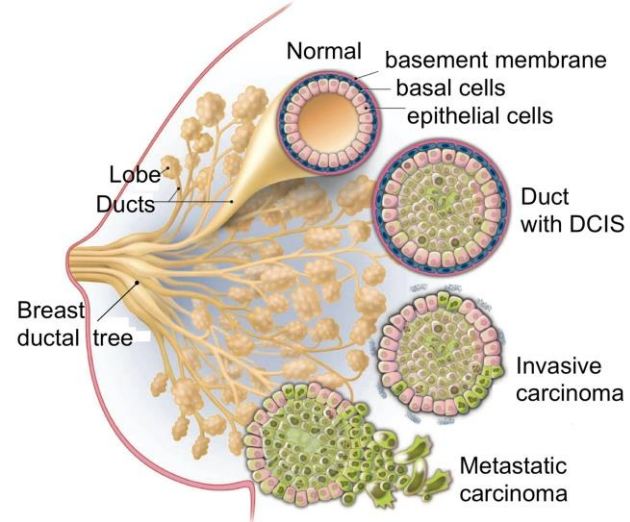
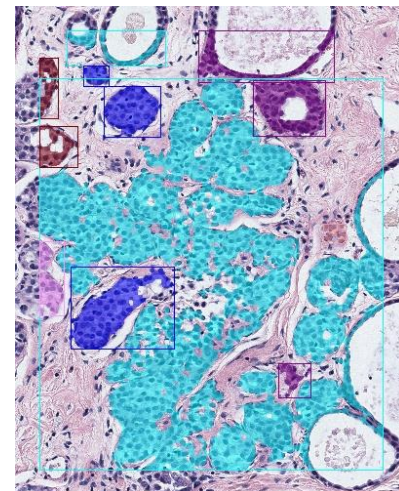
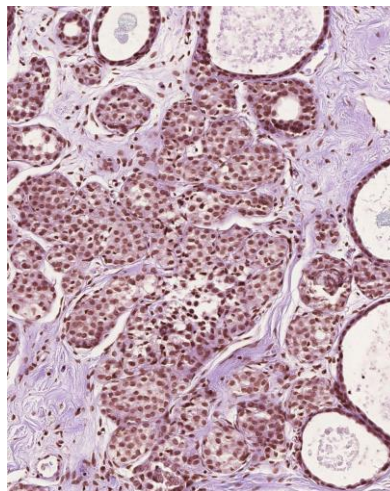


Image Source: <https://bit.ly/33Ua7OP>

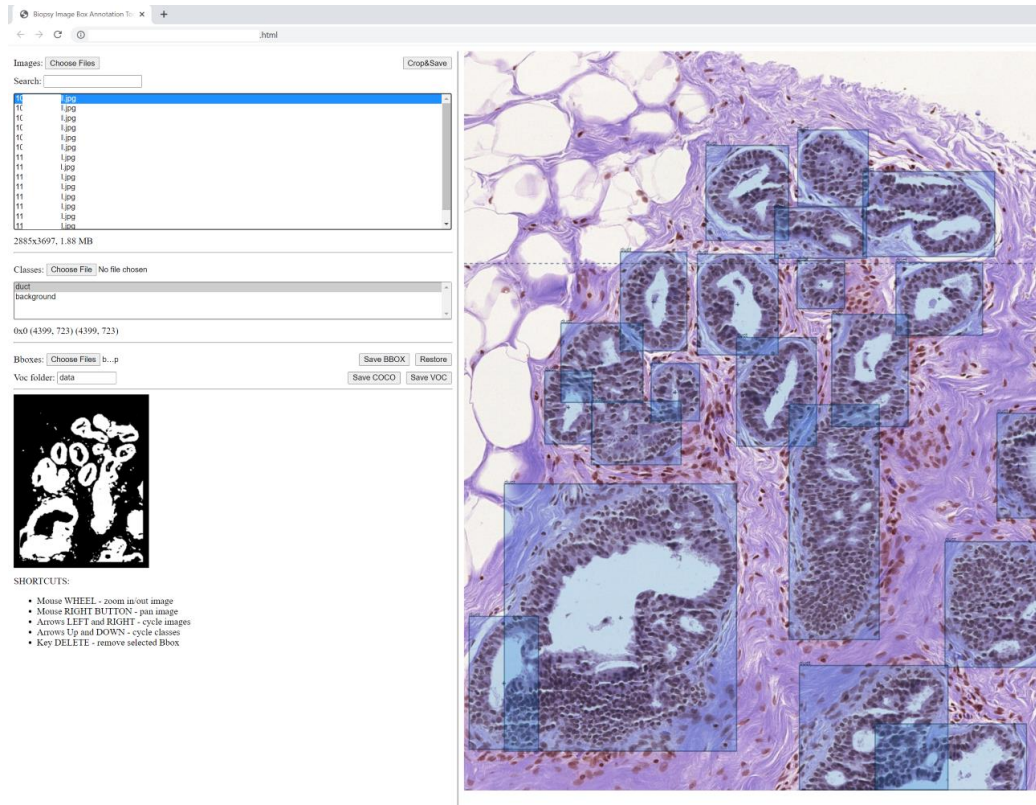


Weakly Supervised Annotation

Human-AI Collaboration for Labelling

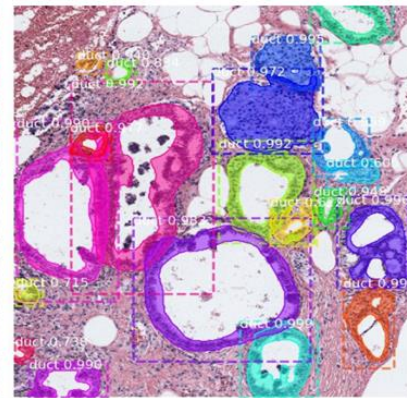
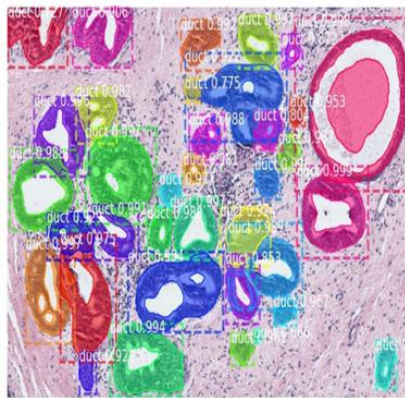
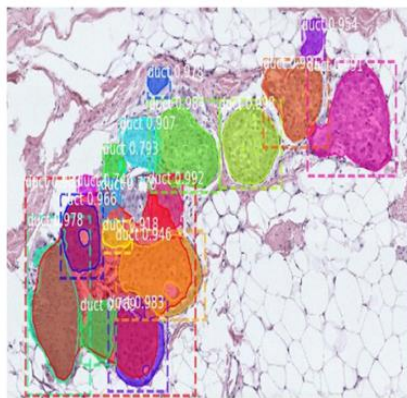
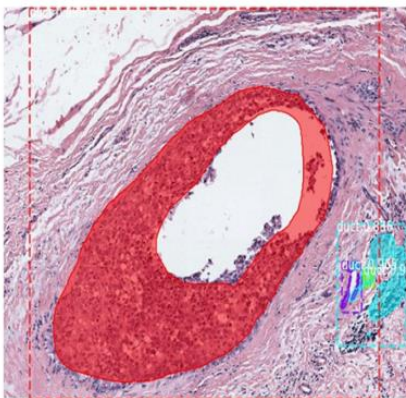
Semi-Supervised Pixel-Level Instance
Segmentation Labels

Silver Standard

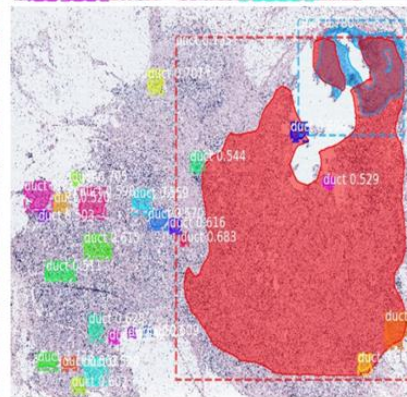
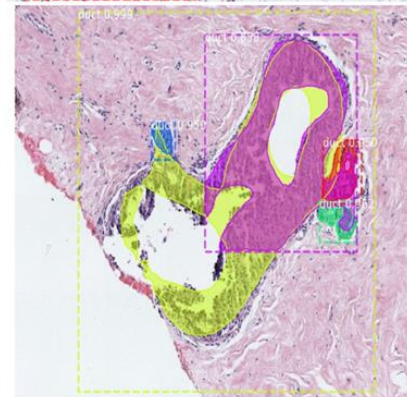
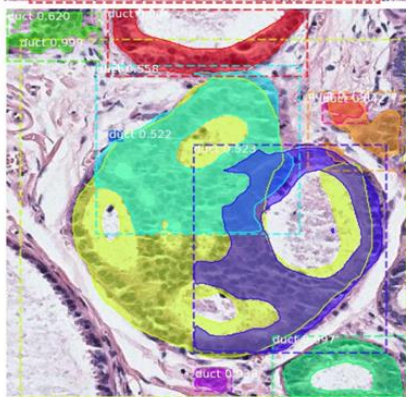


Instance Segmentation Results

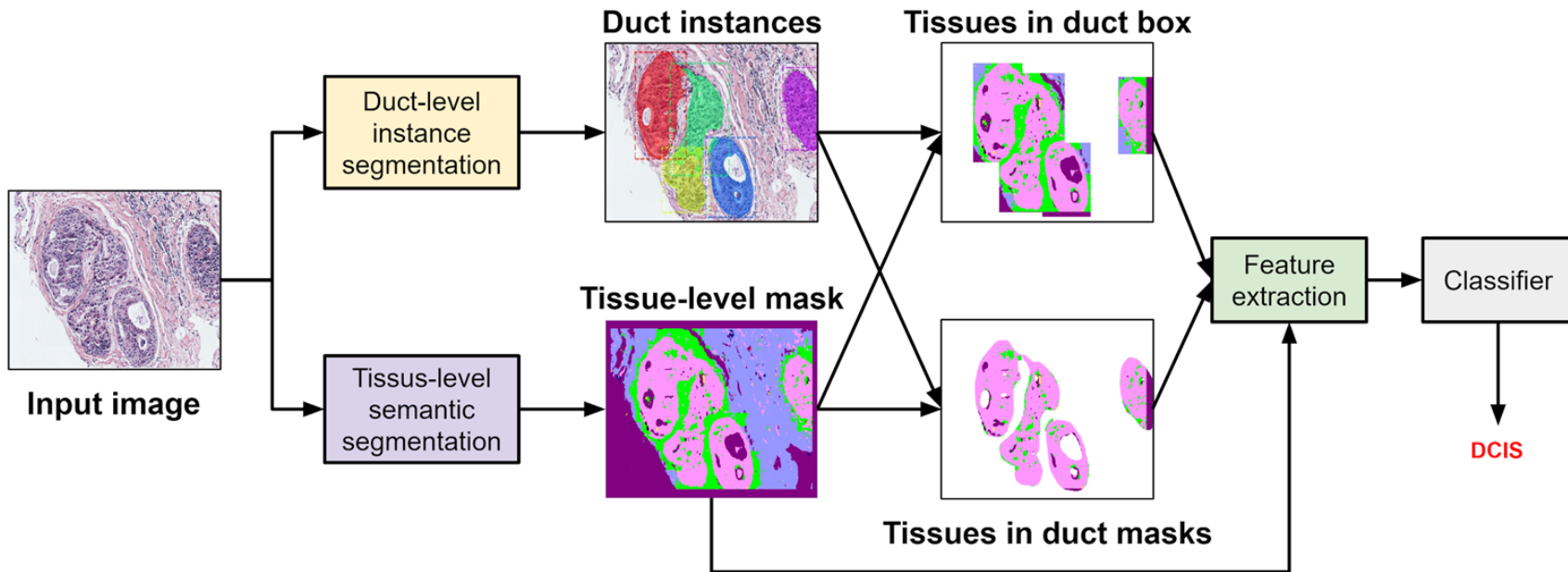
Good



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