



Glandular Structure Segmentation from Colon Histopathology Images

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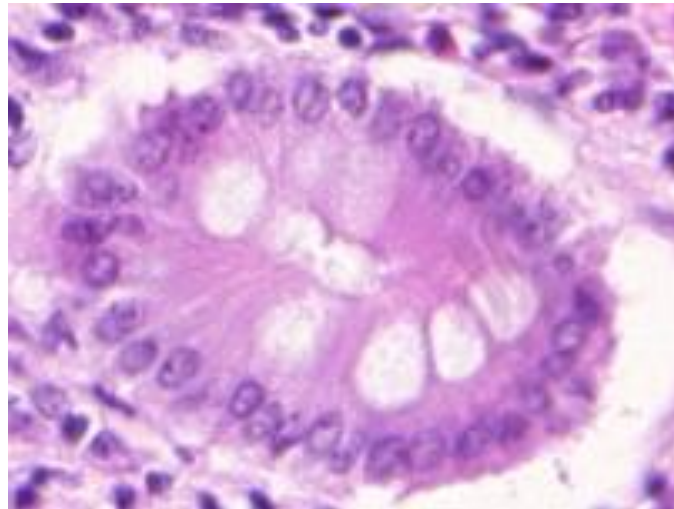
GlaS Contest , September 2015

ABOUT GLANDS

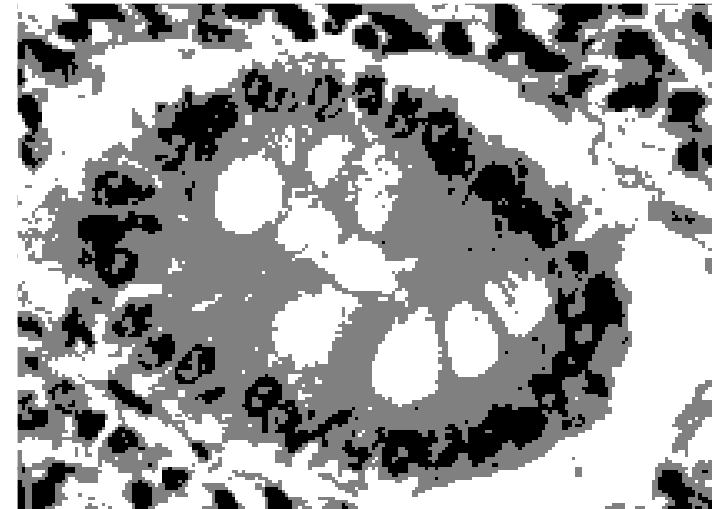


Typically a gland includes three main structures:

- Lumen – Cytoplasm - Cell nuclei



Gland



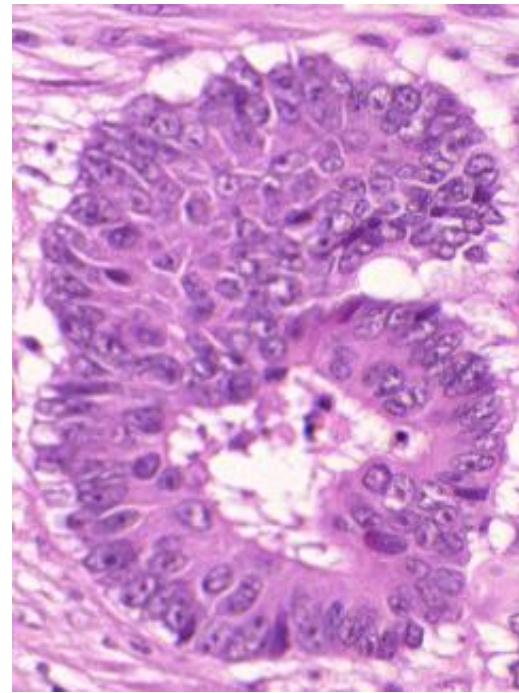
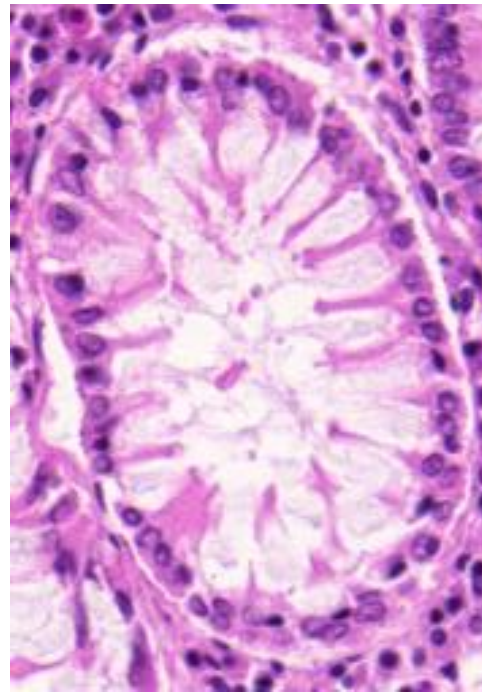
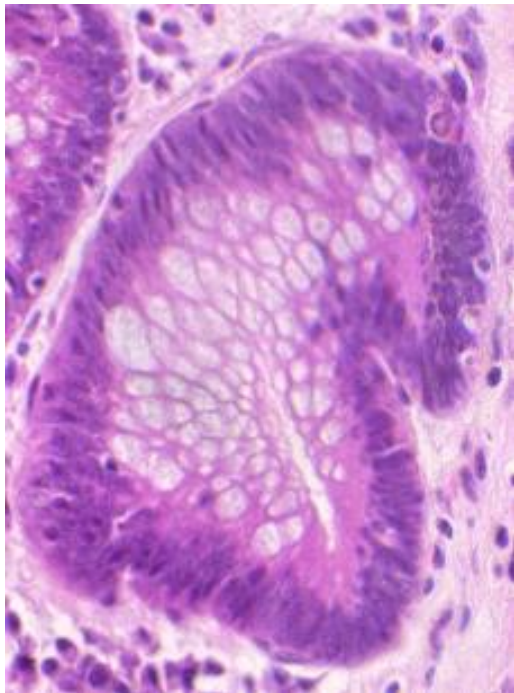
Clustered to 3 cluster by k-means

- Cytoplasm
- Lumen
- Cell Nuclei

ABOUT GLANDS



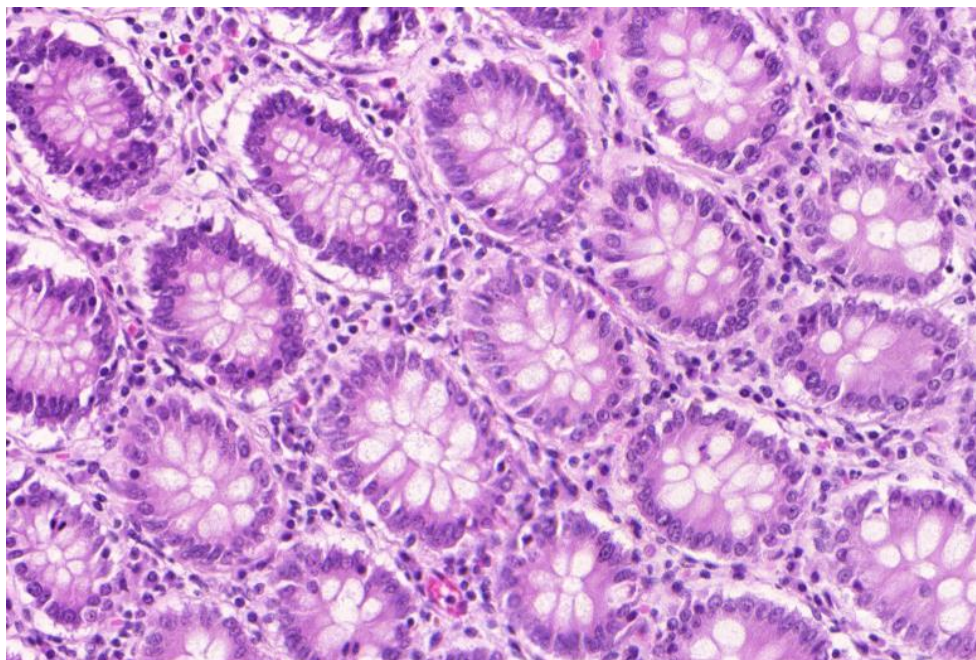
gland can have different sizes and shapes and also nuclei can have very complex shape.



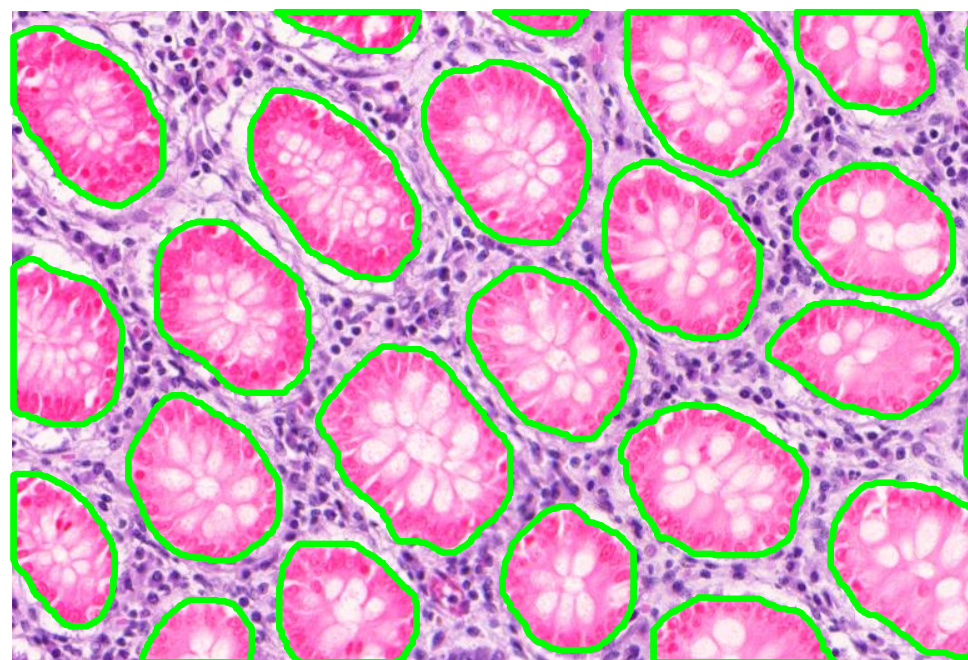
CONTEST CHALLENGE



Challenge: the challenge is to segment glandular structure in colon histopathology images



Typical histopathology image

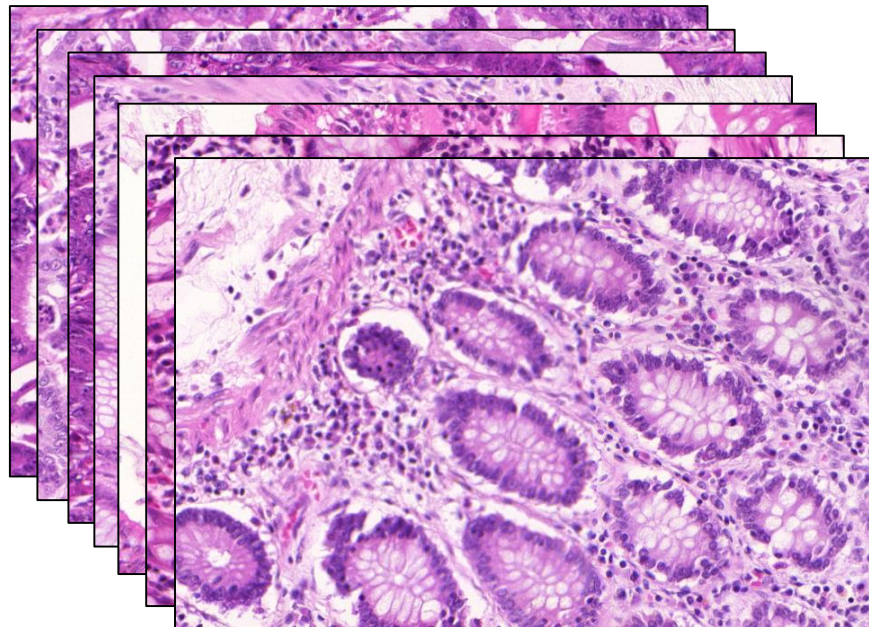


Segmented gland by pathologist

DATABASE



The database of GlaS contest consist of 85 train and 60 test Haematoxylin and Eosin (H&E) stained images, including malignant and benign images.

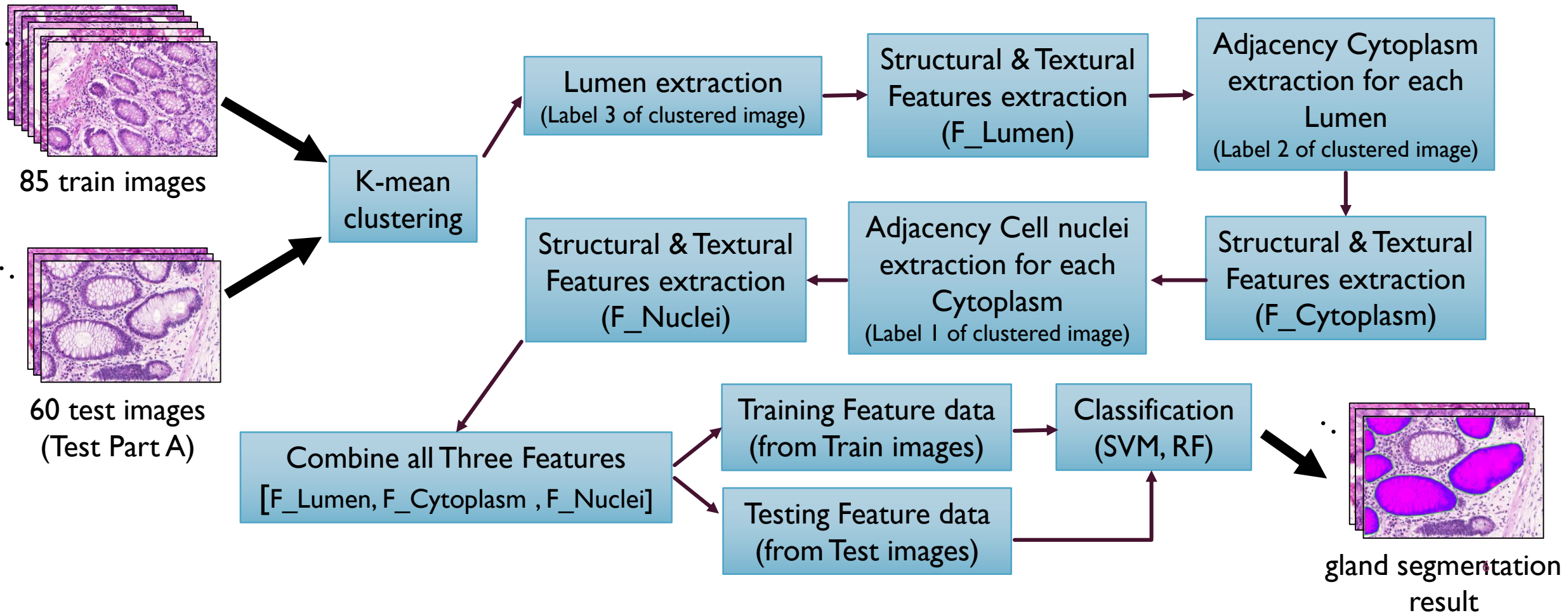


85 train images



60 test images (Test Part A)

PROPOSED GLAND SEGMENTATION SYSTEM



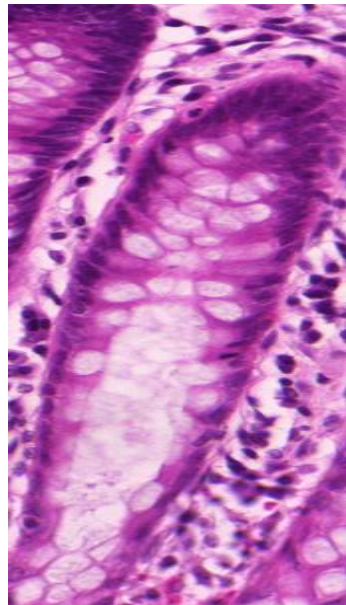
Overview of proposed gland segmentation system (SUTECH team)

PROPOSED GLAND SEGMENTATION SYSTEM



- **Fist step:** K-means clustering

Cluster all images to 3 cluster: Lumen, Cytoplasm, Cell nuclei



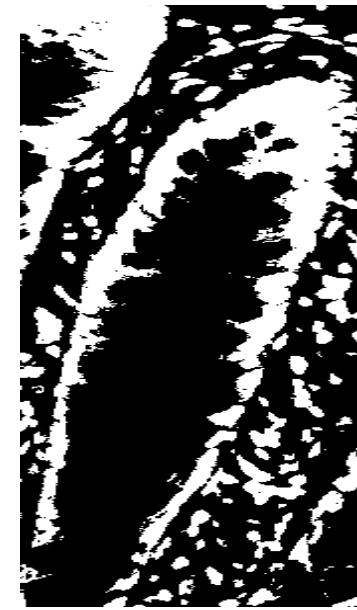
gland



Lumens
(with remove small objects)



Cytoplasm
(with opening with SE disk 2)

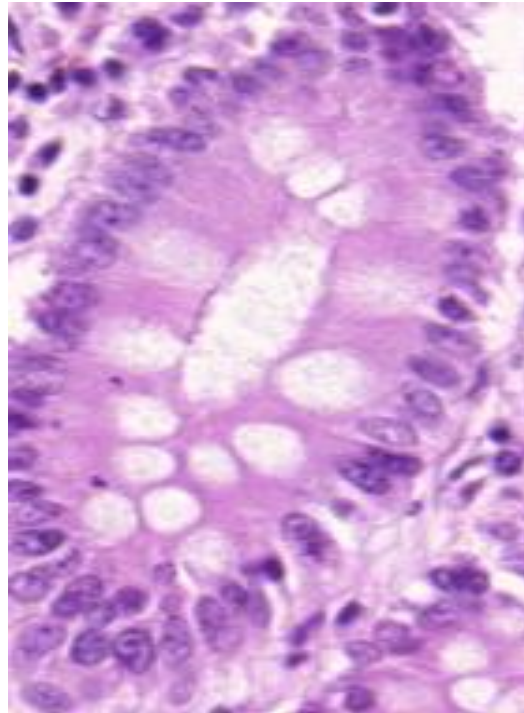


Cell nuclei
(with remove small objects)

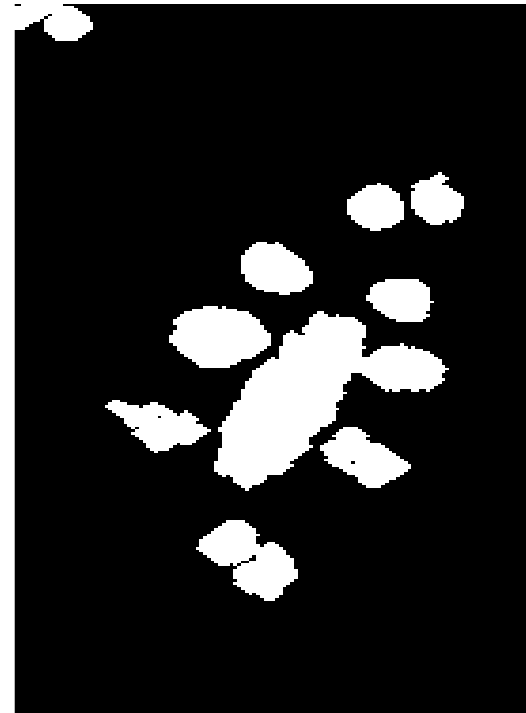
PROPOSED GLAND SEGMENTATION SYSTEM



- **Second step:** Lumen extraction



gland



Lumens
(with remove small objects)

PROPOSED GLAND SEGMENTATION SYSTEM

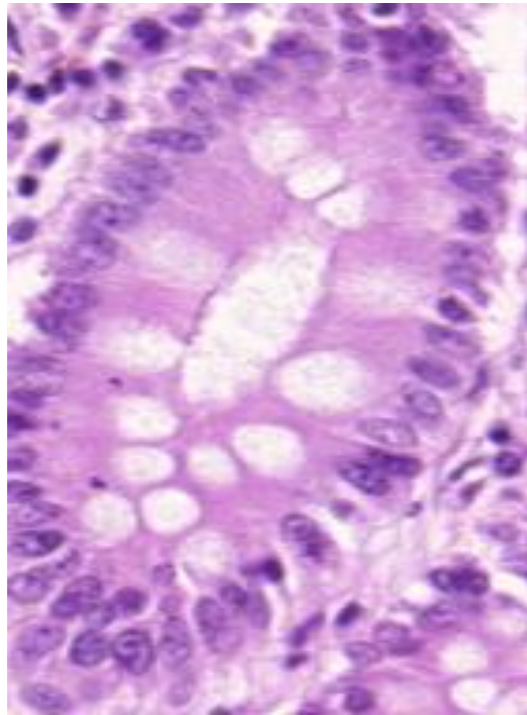


- **Third step:** Textural and structural Feature are extracted from each lumen including :
 - ✓ Textural: GLCM, CLBP, Gabor, gray level moment, ...
 - ✓ Structural : number of nuclei pixels (label 1) in outer border of lumen, number of cytoplasm pixels (label 2) in outer border of lumen, area of all holes in lumen, number of nuclei holes in lumen, area of nuclei holes in lumen, number of cytoplasm holes in lumen, area of cytoplasm holes in lumen, number of other lumen holes in lumen, area of other lumen holes in lumen, Area, Euler Number, Perimeter, Extent, Eccentricity, , ...

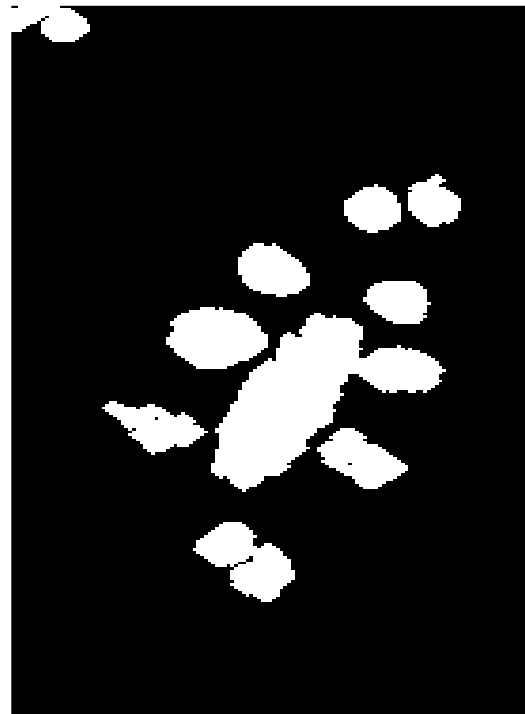
PROPOSED GLAND SEGMENTATION SYSTEM



- **Fourth** step: Adjacency Cytoplasm extraction for each Lumen



gland



Lumens
(with remove small objects)



Adjacency Cytoplasm extraction
for each Lumen
(with opening with SE disk 2)

PROPOSED GLAND SEGMENTATION SYSTEM

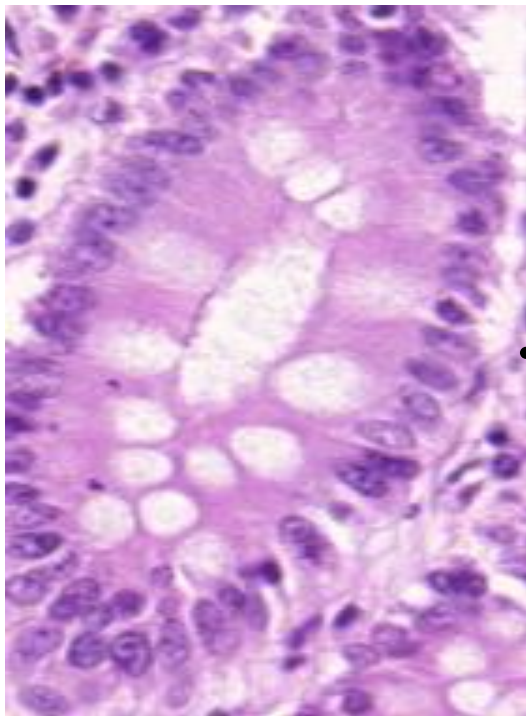


- **Fifth step:** Textural and structural Feature are extracted from each cytoplasm including : (as Lumen Features)
 - ✓ Textural: GLCM, CLBP, Gabor, gray level moment, ...
 - ✓ Structural

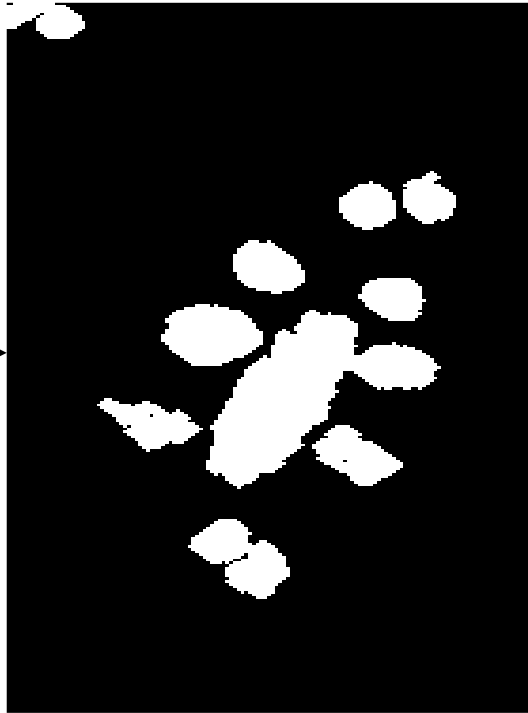
PROPOSED GLAND SEGMENTATION SYSTEM



- **Sixth step:** Adjacency Cell nuclei extraction for each Cytoplasm



gland



Lumens
(with remove small objects)



Adjacency Cytoplasm extraction
for each Lumen
(with opening with SE disk 2)



Adjacency Cell nuclei extraction
for each Cytoplasm
(with remove small objects)

PROPOSED GLAND SEGMENTATION SYSTEM



- **Seventh step:** Textural and structural Feature are extracted from each nuclei ring including :
 - ✓ Textural: GLCM, CLBP, Gabor, gray level moment, ...
 - ✓ Structural
- **Eighth step:** Combine three features that extracted from lumens, corresponded cytoplasms and corresponded nuclei rings.

PROPOSED GLAND SEGMENTATION SYSTEM



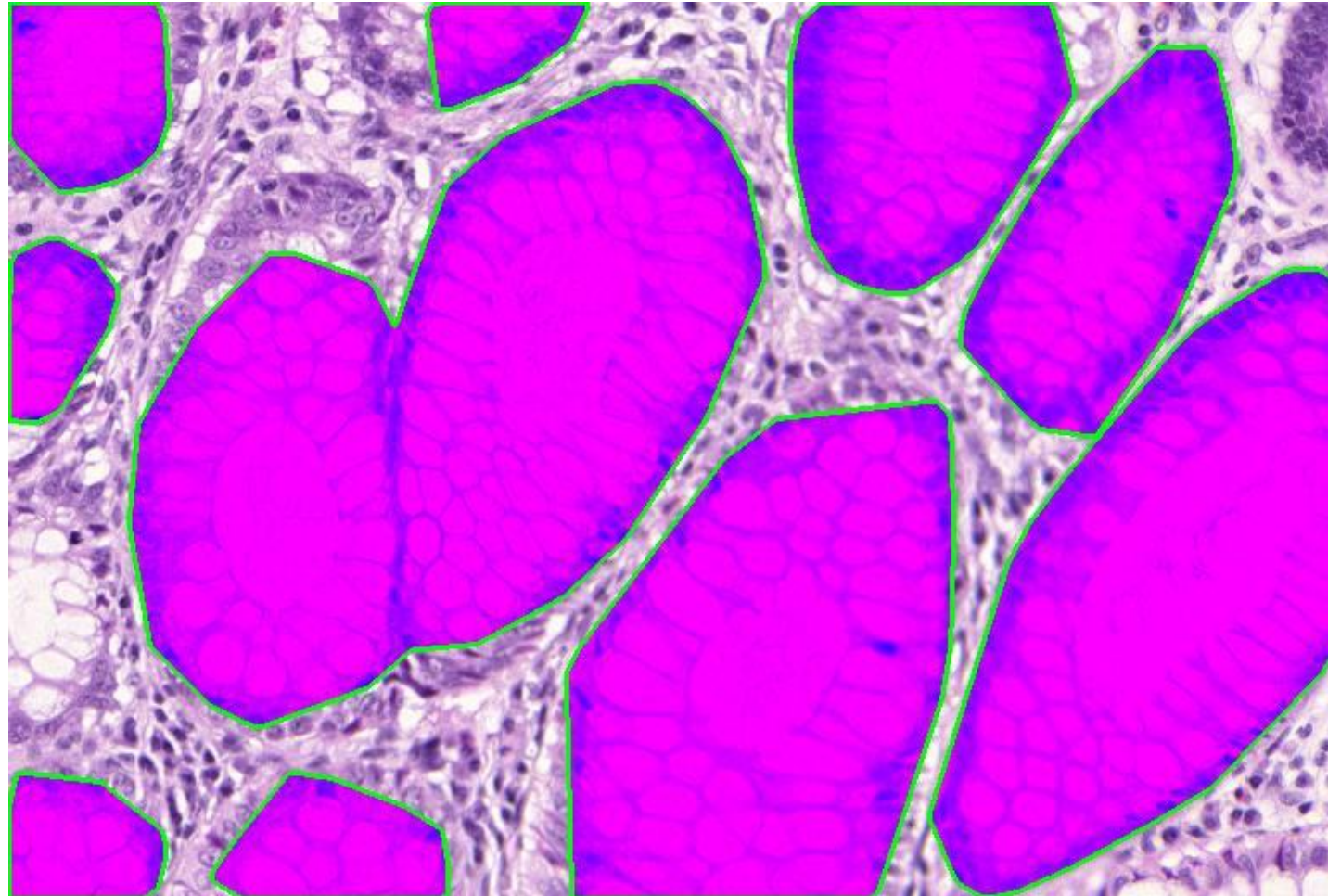
- **Ninth step:** train SVM classifier with kernel RBF by train features and evaluate the test ones with trained classifier.

$$\text{RBF} : K(x_i, x_j) = \exp(-\gamma |x_i - x_j|^2)$$

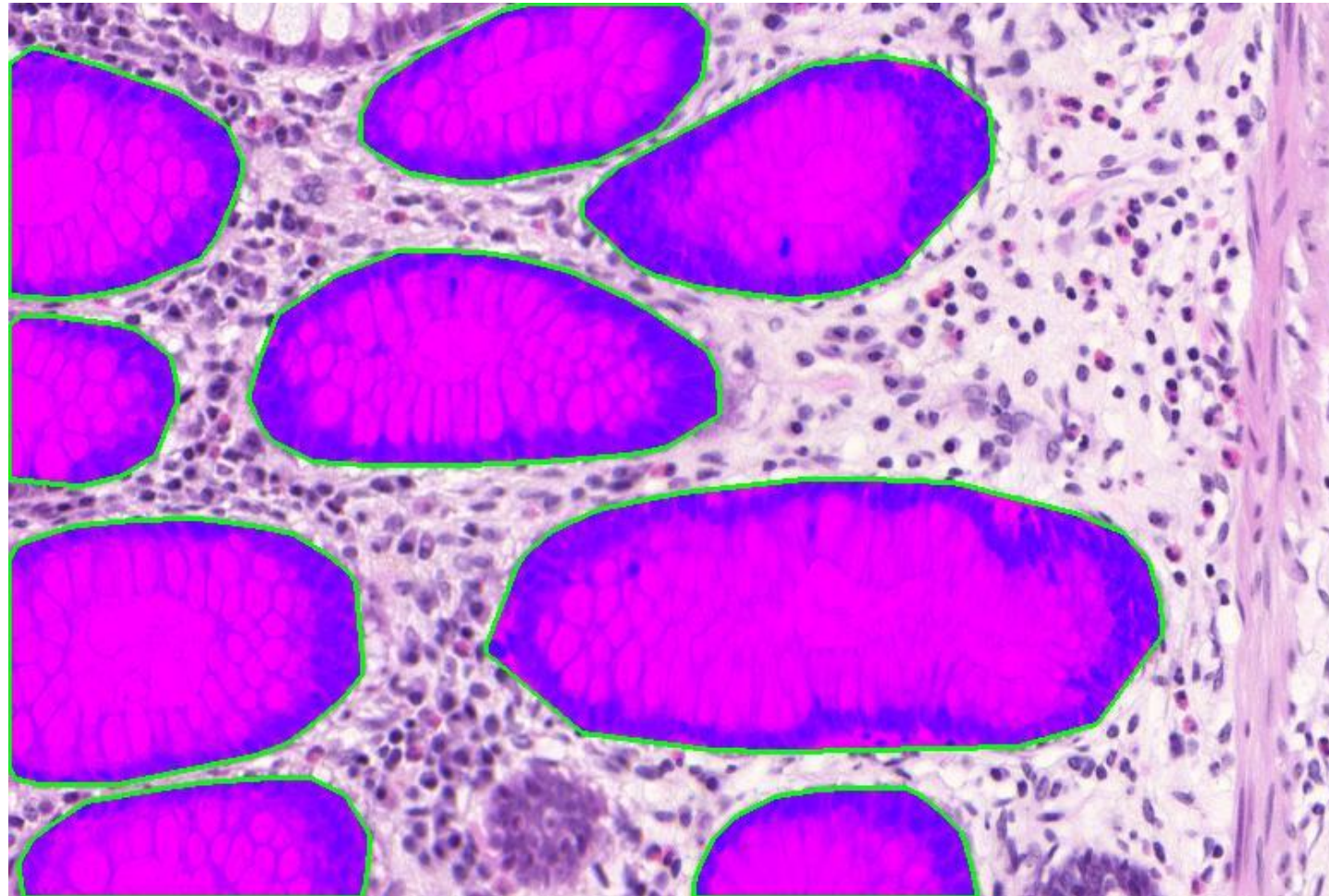
- **Evaluation metric :**

$$F_{\text{measure}} = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

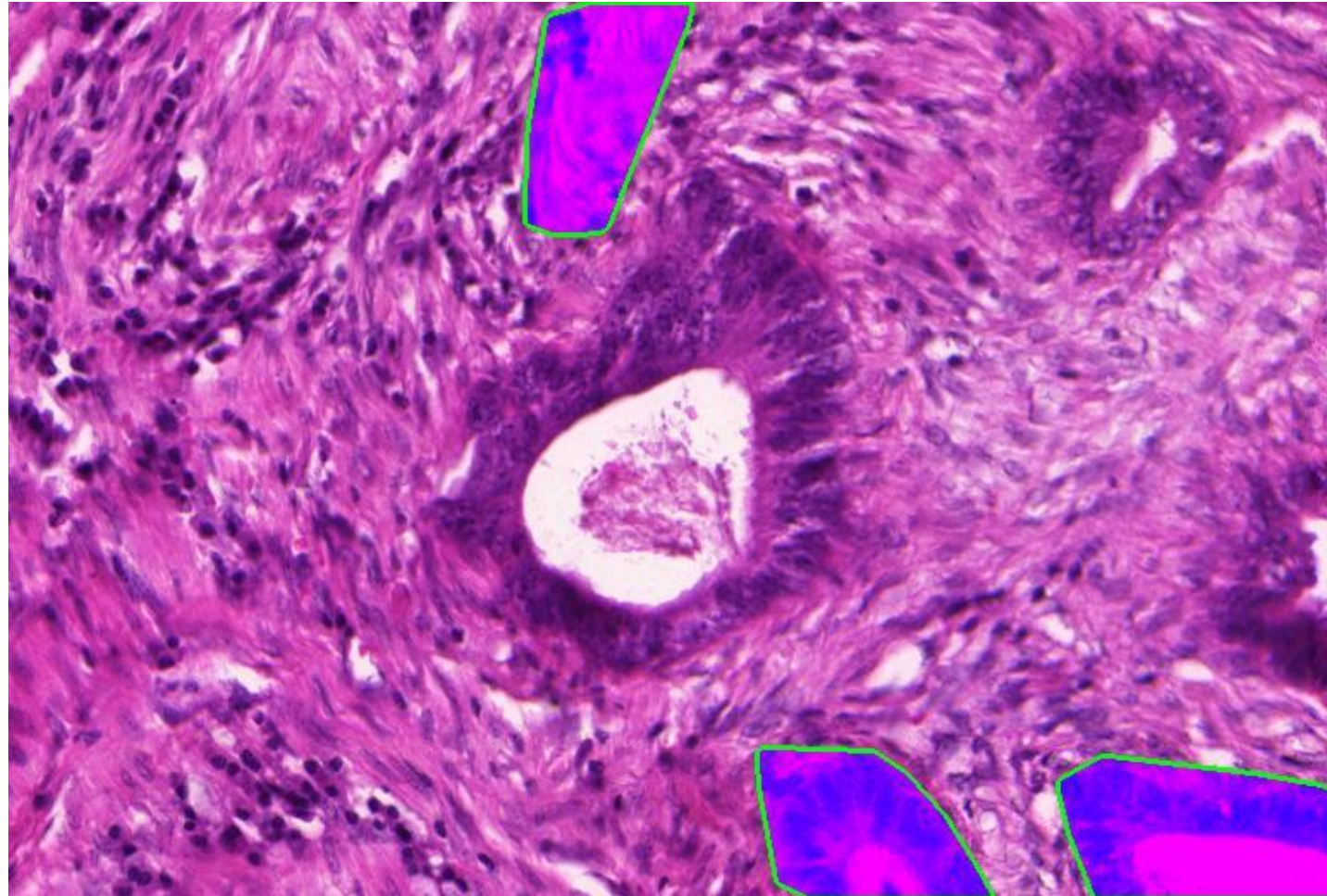
SOME OBTAINED RESULTS



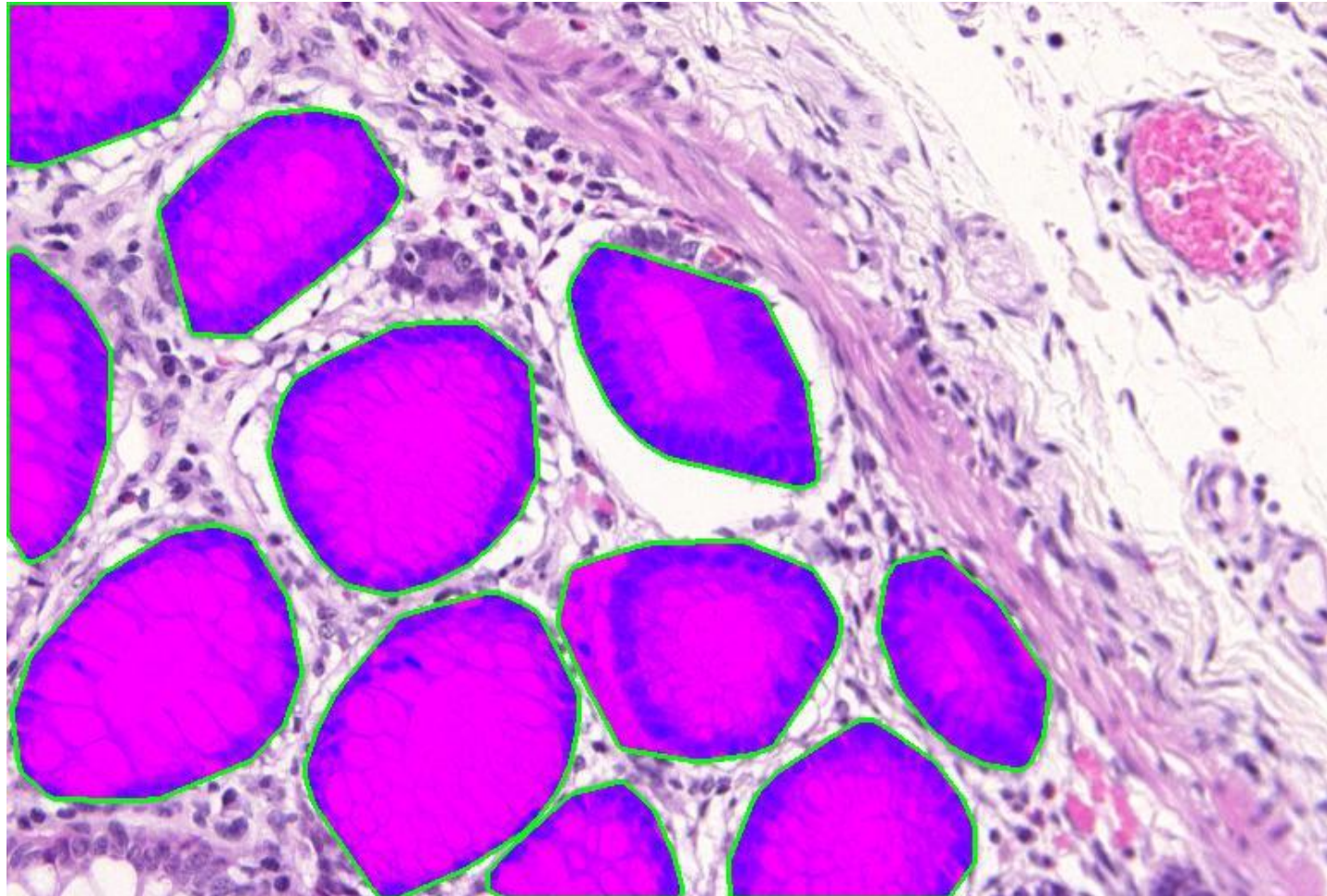
SOME OBTAINED RESULTS



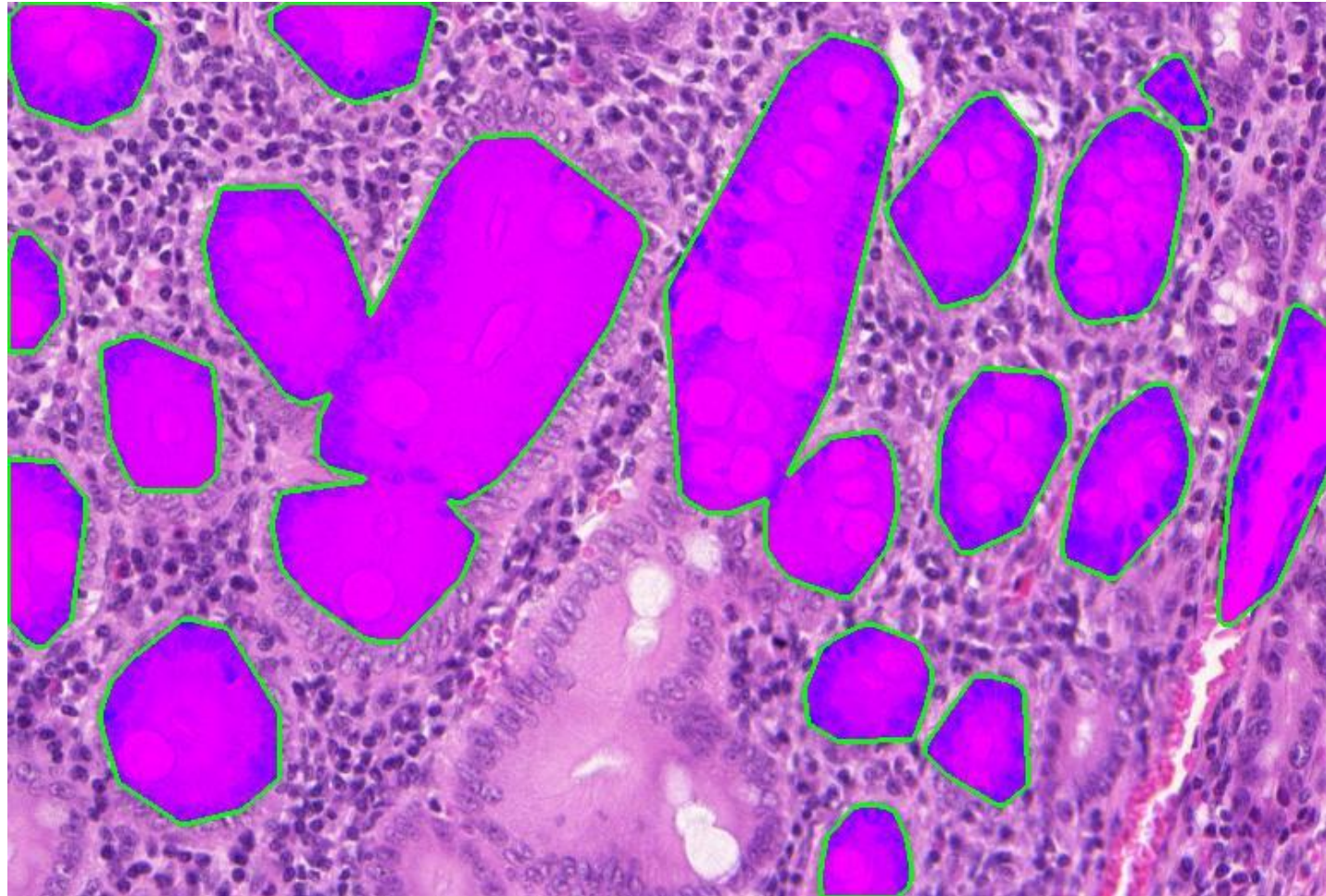
SOME OBTAINED RESULTS



SOME OBTAINED RESULTS



SOME OBTAINED RESULTS



Q & A



SUTECH team presentation
by Ramin Nateghi

Thanks

Q & A