

Development of a Deep Learning Method for Abnormality Detection in the Rat Stomach

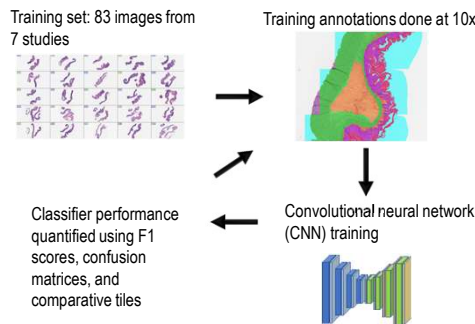
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1 Background

- Stomach evaluation plays an integral role in xenobiotic safety assessment, especially for agents administered orally
- Stomach lesions in the rat are relatively common in nonclinical studies and affect glandular and non-glandular portions
- We hypothesized that a deep learning artificial intelligence (AI) algorithm could be developed to detect common stomach lesions with high sensitivity and specificity, providing decision support for the pathologist and increasing diagnostic quality and efficiency

2 Methods

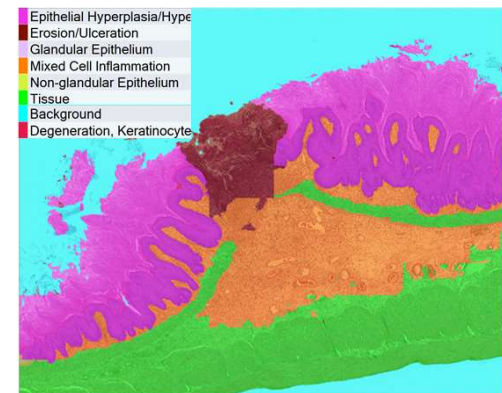
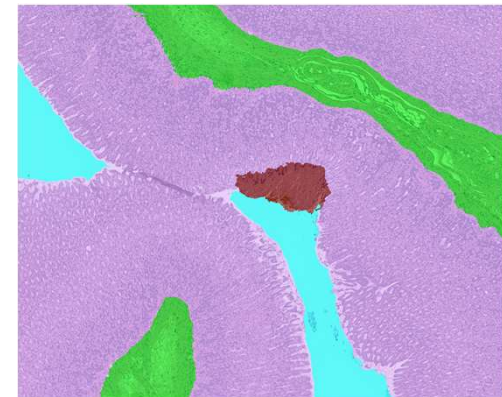
- Whole slide images of H&E stained rat stomachs were scanned at 40x on a Leica AT2 scanner and uploaded to Deciphex' Patholytix Preclinical Study Browser



3 Results

Confusion Matrix

Actual \ Predicted	Background	Tissue	Degeneration, Keratinocyte	Hyperplasia/Hyperkeratosis	Mixed Cell Inflammation	Erosion/Ulceration	Glandular Epithelium	Non-glandular Epithelium
Background	97%	0%	1%	0%	0%	1%	0%	0%
Tissue	0%	97%	0%	0%	2%	0%	0%	0%
Degeneration, Keratinocyte	2%	0%	95%	3%	0%	0%	0%	0%
Hyperplasia/Hyperkeratosis	0%	1%	5%	90%	2%	0%	0%	2%
Mixed Cell Inflammation	0%	8%	0%	1%	89%	2%	0%	0%
Erosion/Ulceration	0%	0%	3%	2%	5%	89%	1%	0%
Glandular Epithelium	0%	0%	0%	0%	0%	0%	99%	0%
Non-glandular Epithelium	4%	3%	0%	6%	0%	0%	1%	86%



4 Discussion

Conclusions

- The CNN algorithm detected stomach pathology successfully for 6 common lesions (2 consolidated lesion classes)
- The heat map provided by the algorithm masks can help the pathologist readily identify "abnormal" areas
- Using a CNN algorithm as a decision support tool for pathologists could facilitate standard stomach evaluation

Challenges & Next Steps

- Using only 2 "normal classes" initially slowed the computer learning process (expanded to 4)
- Despite their apparent differences, 2 separate erosion/ulceration classes, 1 for each type of epithelium, created confusion. 1 consolidated erosion/ulceration class resolved this
- Further validation of the model is required on slides from unseen studies and by evaluating performance compared to pathologists not involved in model development
- Additional studies are required to understand the impact of this type of tool on the pathologist's efficiency and consistency within and across studies

Best Classifier

Class	F1 Score
Background	0.98
Tissue	0.97
Glandular Epithelium	0.97
Epithelial Hyperplasia/Hyperkeratosis	0.91
Degeneration, Keratinocyte	0.9
Mixed Cell Inflammation	0.9
Non-glandular Epithelium	0.9
Erosion/Ulceration	0.83