

Using Artificial Intelligence (AI) to Identify and Categorize Rodent Ovarian Follicles for Reproductive Toxicity Assessment

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Artificial Intelligence Enables Efficient and Reproducible Quantitative Rodent Toxicology Ovarian Follicle Evaluation

INTRODUCTION

- FDA and EPA recommend quantitative evaluation of ovarian primordial follicles as part of reproductive toxicology safety assessment
- Ovarian follicle enumeration w/ hematoxylin and eosin (H&E) is slow/difficult; PCNA staining is done to assist

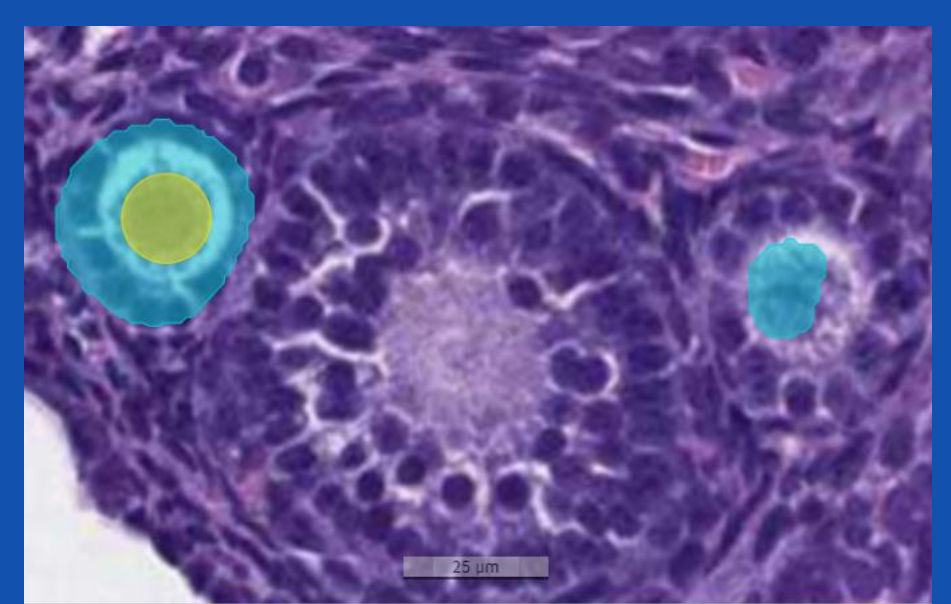
METHODS

- Training & testing sets- 20x whole slide scans (WSS) of serial sectioned H&E stained ovaries
- Supervised training of a convolutional neural network (CNN) used Aiforia® Cloud

RESULTS

CNN model performance against training data

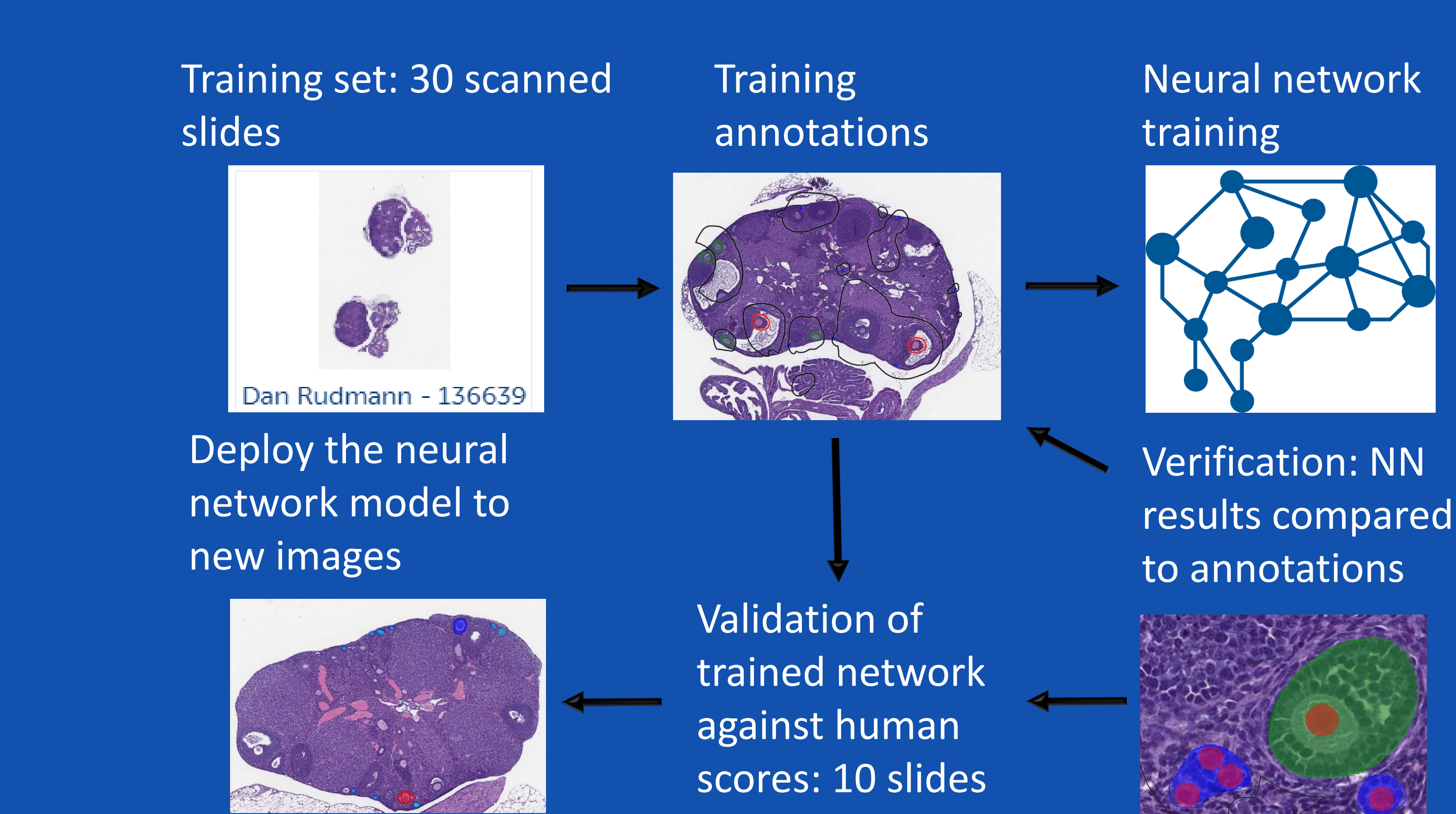
Primordial/primary 98.81% (error 1.19%)
Growing 100.00% (error 0.00%)
Antral 98.46% (error 1.54%)



Concordance: Manual Counting versus AI

DR/CS

96% /94% Primary/Primordial
100% / 97% Secondary
93% /94% Antral



CONCLUSIONS

- The AI algorithm identified follicle types without the need for PCNA staining
- The AI methodology increased the efficiency of follicle counting by 45x versus manual counting
- The reproducibility of AI follicle counting between the training and testing sets was excellent (>98%)
- The concordance of AI counts with manual counting by 2 evaluators was very good (93-100%)

Challenges and Next Steps:

- GLP Validation of the AI algorithm
- Duplicate AI algorithm for rat follicle assessments
- Incorporate the AI methods into the CRL Workflow

RESULTS

- The trained CNN delineated with a high level of concordance the three different follicle classes using ground truth established by DR/CS
- The AI-derived algorithms also processed ovaries much faster than manual counting

Analysis time 45x faster than Manual

- Per whole slide image: ≤8 sec
- Per 10 slide batch (validation): 1 min 25 sec
- Per 30 slide batch (training): 4 min 10 sec
- Manual= Approx 360 sec/slide

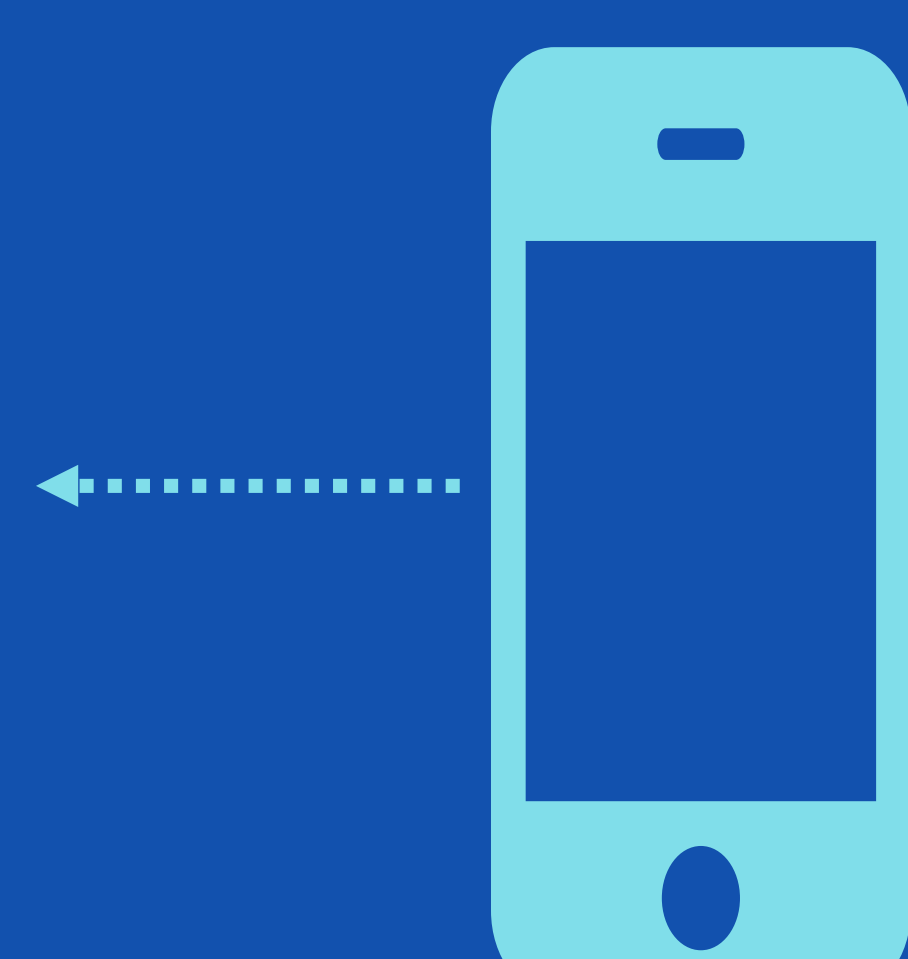


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