UNIVERSITY of GUELPH

COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

PhD Qualifying Examination

Tuesday September 25, 2018 at 10:00AM in Reynolds, Room 2224

Using Deep Learning Computer Vision Methods for
Animal Re-identification from Camera Trap Data

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Chair: Dr. Joseph Sawada
Advisor: Dr. Stefan Kremer
Advisory Committee: Dr. Stefan Linquist [Philosophy]
Non-Advisory Committee: Dr. Mark Wineberg
Non-Advisory Committee: Dr. Karl Cottenie [Integrative Biology]

ABSTRACT:

The ability of a researcher to re-identify (re-ID) an individual animal upon reencounter is fundamental for addressing a broad range of questions in the study of ecosystem function, community and population dynamics, and behavioural ecology. Ecologists use a variety of methods for re-ID including tagging, scarring, DNA analyses, and camera traps. Tagging animals during mark and recapture studies is the most common method for reliable animal re-ID. However, this method can be laborious, intrusive, and expensive. Camera traps and video is a desirable alternative, requiring less labour, much less intrusion, and prolonged and continuous monitoring into an environment. Despite these advantages, the analyses of camera traps and video for re-ID by humans are criticized for their biases related to human judgment and inconsistencies between analyses. For decades ecologists with expertise in computer vision have successfully utilized feature engineering to extract meaningful features from camera trap images to improve the statistical rigor of individual comparisons and remove human bias from their camera trap analyses. Recent years have witnessed the emergence of deep learning systems which learn meaningful features from large data volumes. Current deep learning systems have demonstrated the accurate re-ID of humans based on image and video data with near perfect accuracy. Despite this success, few ecologists have utilized these approaches for animal re-ID. By utilizing novel deep learning methods for object detection and similarity comparisons, ecologists can extract animals from an image/video data and train deep learning classifiers to re-ID animal individuals beyond the capabilities of a human observer. This methodology will allow ecologists with camera/video trap data to re-identify individuals that exit and re-enter the camera frame. Deep learning methods pose as the beginning of a major trend that could revolutionize the analysis of camera trap data and, ultimately, our approach to animal ecology.