Deep Learning-Based Quantification of Pulmonary Hemosiderophages in Cytology Slides

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Exercise-induced pulmonary hemorrhage (EIPH) is a common condition in sport horses with negative impact on performance. Cytology of bronchoalveolar lavage fluid by use of a scoring system is considered the most sensitive diagnostic method. Manual grading of macrophages, depending on the degree of cytoplasmic hemosiderin content, on whole slide images (WSI) is however monotonous and time-consuming. We evaluated state-of-the-art deep learning-based methods for macrophage classification and compared them against the performance of nine cytology experts. Additionally, we evaluated object detection methods on a novel data set of 17 completely annotated cytology WSI containing 78,047 hemosiderophages [1]. Our deep learning-based approach reached a concordance of 0.85, partially exceeding human expert concordance (0.68 to 0.86, mean of 0.73, SD of 0.04). Our object detection approach has a mean average precision of 0.66 over the five classes from the whole slide gigapixel images. To mitigate the high inter- and intra-rater variability, we propose our automated object detection pipeline, enabling accurate and reproducible EIPH scoring in WSI.

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References

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