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Automated Age Prediction of White-tailed Deer via Deep Learning and Computer Vision

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Abstract

Accurate age estimation of white-tailed deer (*Odocoileus virginianus*) is critical for understanding herd dynamics and informing management decisions. This study describes two computer vision models to predict deer age from trail camera imagery and jawbone photographs. Using transfer learning with convolutional neural networks, the trail camera model achieved 78.4% accuracy and the jawbone model achieved $90.7\% \pm 2.6\%$ accuracy on held-out test data. Both models significantly outperformed traditional classifiers (57.3%), human expert assessment (58.6%), morphometric methods (63%), and the 70% accuracy threshold required for professional wildlife management. Attention map analysis confirmed that models identified biologically relevant age-related morphological features rather than spurious correlations. These automated methods provide rapid, objective age determination with immediate practical applications for wildlife agencies, research institutions, and harvest monitoring programs.

1 Introduction

Characterizing white-tailed deer populations is crucial to measuring their impact on ecosystems, human health, and property. Herd health, for instance, informs management decisions like hunting regulations, disease response, and protection against environmental damage from overgrazing. As a result, age-related data is becoming increasingly important since deer age affects body growth, doe fertility, antler quality, and sex ratios of offspring.

State-of-the-art trail cameras enable hunters and professionals to monitor the movement and health of local deer populations, but estimating the age of white-tailed bucks from camera imagery remains challenging. One technique known as "Aging On The Hoof" (AOTH) attempts to determine age by analyzing the location and date of each image as well as the relative body proportions of the buck in the image [5, 4, 1, 6, 3]. When the buck's body measurements are not known, human AOTH estimate averages just 36% – less than half the accuracy required for management-related selective harvest decisions ($\geq 70\%$) or research purposes ($\geq 80\%$) [2].

1.1 Subsection title

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1.1.1 Subsubsection heading

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References

- [1] S. Demarais, D. Stewart, and R. N. Griffin. A hunter's guide to aging and judging live white-tailed deer in the southeast., 1999.

Table 1. Caption text describing the table. Adapt the template table below or replace with a new table. To add more tables, copy and paste the whole `\begin{table}...\end{table}` block.

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Data availability

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