**Abstract** (200-250 words)

* Wildlife management challenge: aging white-tailed deer
* Two ML models addressing different data modalities
* Results from both approaches
* Conservation and ecological implications

**1. Introduction**

* Wildlife population management and sustainable hunting
* Current deer aging methods (labor-intensive, expert-dependent)
* ML opportunity for scalable, accessible tools
* Research objectives: develop and validate two complementary CV models

**2. Related Work**

* Wildlife age estimation using ML
* Computer vision in conservation
* Existing deer aging techniques (tooth wear, body morphology)

**3. Materials and Methods**

*3.1 Data Collection*

* Trail camera dataset characteristics
* Jawbone image dataset characteristics
* Ground truth age determination methods
* Geographic coverage and temporal scope

*3.2 Trail Camera Model*

* Architecture selection and justification
* Feature extraction approach
* Training protocol
* Validation strategy

*3.3 Jawbone Model*

* Architecture selection and justification
* Morphological features targeted
* Training protocol
* Validation strategy

*3.4 Attention Mechanism*

* Heatmap generation methodology
* Interpretability goals
* Comparison between modalities

**4. Results**

*4.1 Trail Camera Model Performance*

* Accuracy metrics
* Age class confusion patterns
* Attention map analysis

*4.2 Jawbone Model Performance*

* Accuracy metrics
* Age class confusion patterns
* Attention map analysis

*4.3 Comparative Analysis*

* When each method excels
* Complementary strengths
* Field application scenarios

**5. Discussion**

* Implications for wildlife management
* Accessibility advantages (trail cameras vs. harvested specimens)
* Model interpretability via attention maps
* Integration potential for dual-method validation
* Limitations and error analysis

**6. Applications and Deployment**

* Web platform development (brief mention)
* Accessibility for hunters and managers
* Cost structure justification

**7. Conclusions**

* Dual-modality approach fills critical gap
* Scalable alternative to expert assessment
* Future work: model refinement, expanded species

**Data/Code Availability Statement**

* Links to datasets and trained models

**Key angles for ML: Earth fit:**

* Biosphere monitoring (wildlife populations)
* Conservation technology
* Earth system sustainability
* Novel ML methodology with ecological applications
* Open-source tools for environmental management

Done.