

Population status of leopard in one of Africa's largest wilderness areas and the challenge of monitoring at scale

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Abstract

Artificial intelligence (AI) has embedded itself into the core of smart healthcare systems, transforming the face of medical diagnosis, especially AI-driven imaging and diagnostic tools. These developments have met the exponentially increasing demand for accuracy, efficiency, and interpretability in healthcare solutions. However, challenges remain regarding optimal performance across diverse datasets and the transparency of AI-driven decision-making. Conventional classification models do not handle the challenge of an imbalanced dataset and generally fail to maintain a balance between precision and recall. Moreover, non-interpretable AI models result in complex deployments in critical applications where decision-making should be transparent. This research article investigates the performance of the SHAP-AI-XNet model, a novel AI-driven imaging and diagnosis tool for smart healthcare systems. This also discussed the evaluation of this model using accuracy, precision, and recall parameters to find their interpretability and suitability to high-stake medical contexts. Overall, 13,244 samples are in the dataset. These are either positive or negative. Below is the description of the performance of a few models that used a confusion matrix and ROC curve; the PR curve also describes it. The results were interpreted using various visual tools, calculating accuracy, precision, recall, and F1-score. The SHAP-AI-XNet model yielded 100% accuracy, precision, recall, and an F1 score of 100%. The ROC curve analysis yielded a perfect AUC of 1.00, indicating a perfect separation between the classes. A similar shape of the PR curve also attested to a high precision value at all recall values, showcasing that the model was reliable and strong. The results stated that the SHAP-AI-XNet model performed very well with a limited number of misclassifications and was highly interpretable. It is an efficient AI-based tool for imaging and diagnostics in smart healthcare systems, ensuring accuracy and reliability for medical decisions. Future work should confirm the scalability and generalizability of the model with more and larger diverse datasets. Besides, enhancing multi-class classification and real-time deployment could strengthen its application in smart healthcare environments.

Keywords

Population density; Biological sciences; Camera traps; *Panthera pardus*; Spatially explicit capture-recapture