Analyzing Global Wildlife Trade Trends for Sustainability and Conservation

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Abstract

Analyzing global wildlife trade to help maintain both sustainable and healthy animal populations is increasingly important as we continue to face difficult challenges in protecting our species. Utilizing predictive modeling through the knowledge learned by studying data science could help to target specific trading practices of species before they can become threatened. By analyzing the 10 most traded species on the CITES Trade Database, I hope to show how historical trading practices can be used to predict future trading, and how these could be unsustainable for the species in the future. Cleaning the processing the CITES dataset and performing EDA has set e up for meaningful features that can be used for predictive modeling. I will utilize different models such as ARIMA or Facebook Prophet for Time series forecasting, Random Forest for classification, and K-means or hierarchal cluster analysis for clustering to help determine which models are the best fit for my project. Through these methods, I hope to show spikes in international trading practices and highlight the need for reducing large scale international wildlife trade of these species.

Introduction

Scientists estimate that extinction rates are at an all time high throughout the 21st century. It is estimated that every hour, 3 species go extinct (Djoghlaf 2007). Throughout the day, that is an estimated dozens of species going extinct. These estimations highlight the need for understanding and educating people on the need for conservation and sustainable trading practices. Every change can cause positive impacts on an environment for animals. What I hope

to show is how utilizing predictive models on the largest international wildlife flora and fauna database could help show some of the future possibilities for animals by identifying unsustainable trading practices through historical data.

Background

International wildlife trade has been a major conservation challenge for decades. The Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) was established in 1973 to help regulated trade and ensure that trading does not threaten a species survival (CITES 2019). As of today, CITES governs trade on over 40,000 species, categorizing them into different Appendices based on both conservation status and trade regulations. One common animal that people may be familiar with that benefitted greatly from conversation tactics is the American Alligator. Due to overhunting, it nearly went extinct during the 1960s but was able to bounce back with help from strong conservation policies and the creation of the ESA. By 1987, it no longer required being labeled as endangered or threatened (Loyack n.d). If we can gather a better understanding of historical trade patterns and apply predictive modeling to them, we can help identify species that may face risks of overexploitation in the future. This could allow for ample time for preemptive conservative action.

Summary of Literature Review

While several researchers have studied the human impacts on wildlife, the introduction of machine learning and big data poses new opportunities for analyzing and improving conservation efforts. Recent articles suggest that machine learning use is growing, and currently maximum entropy and Bayesian ML are currently the most popular methods in species threats due to their

success in decision making and monitoring (Branco et al. 2023). Others have used other forms of Bayesian models in order to help in the reduction of illegal wildlife trade in some international markets (Oyanedel et al. 2021). Systematic review of available literature also shows support in the short term of international trade restrictions, with more a more negative trend towards socioeconomic factors (Hiller & Sas-Rolfes 2024). With that understanding, creating more nuanced approaches and bringing in more features to look at international wildlife trading is needed in order to best support wildlife as well as the communities that benefit from them.

Research Questions

There are a number of questions I hope to answer with this project:

How has the trade volume of the 10 most traded species changed over the past 50 years?

I will establish this by performing EDA on the publicly available CITES datasets.

Which species show signs of unsustainable trade and risk of overexploitation based on forecasting models?

Through the EDA I performed, I will use predictive models to help determine what species are seeing spikes in their trades, and if there is any correlation in other real-world data such as GDP growth in effected countries or increased destruction of habitat.

What factors correlate with increased trade volume?

This will be a question that is answered as I continue EDA and include additional features throughout the process.

How do different predictive models compare in accuracy when forecasting wildlife trade risks?

When establishing which kinds of predictive models I will be using, I will be able to compare themselves to each other to find which ones tend to work the best for the selected datasets.

Preliminary Implications

While there are several cases of researchers looking into human impact on wildlife, I have yet to see much of it focused on wildlife trading. Most common topics look into habitat destruction and illegal poaching of animals. Adding onto these topics with my focus on wildlife trading could help grow and extend how we look into wildlife conservation practices. The more information and factors that are seen to impact wildlife, the more opportunities to help create sustainable policies to protect them.

Conclusion

The goal of this project is to help bridge the gap between wildlife conservation and predictive analysis through machine learning in order to help assess future trade trends. Through my EDA and the use of forecasting, classification, and clustering modeling techniques, I will help to highlight which species may suffer from overexploitation in the future. By combining real world trade data with conservation science, this project can help with the ongoing effort to balance legal wildlife trade and species conversation, allowing trade regulations to evolve as we become better at providing data-driven insights through data science.

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