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Leptospirosis Occurrence in Europe: Understanding Environmental and Socio-Economic Drivers Using Machine Learning

Inhalt

Leptospirosis is a rodent-borne infectious disease posing a growing global health threat. Human infections occur through contact with environments contaminated by host urine. Recent ECDC reports indicate a rising trend in Leptospirosis cases across Europe, highlighting the need for improved public health measures. Understanding the factors driving leptospirosis occurrance can enhance surveillance and preparedness actions. Here, we investigate environmental drivers of leptospirosis in Europe using a predictive modelling framework.

We implemented an XGBoost model to predict the occurrence of at least one leptospirosis case based on temperature, rainfall, environmental, and socio-economic factors, including population density and GDP. We developed the model using the ECDC leptospirosis patient data at the NUTS3 and monthly resolution. The dataset has 3,868 outbreak and non-outbreak records from 2009 to 2021. We also conducted a SHAP analysis to understand the feature importance.

We achieved 75.19% accuracy, 74.18% specificity, and 76.10% sensitivity for the model in prediction, indicating a balanced performance in detecting leptospirosis case occurrences and absences. The SHAP analysis revealed that temperature, livestock population, employment rate, and population density made the most considerable predictive contributions to a case occurrence. Our results contribute to developing spatial risk mapping and prediction to inform healthcare and prevention planning.

Keywords

Leptospirosis, Predictive Modeling, Environmental Drivers, Socio-Economic Factors, Machine Learning

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106

Professional Status of the Speaker

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Junior Scientist Status

Yes, I am a Junior Scientist.

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