Capstone Two Project

Capstone Project Proposal: West Nile Virus Prevention

Problem Statement:

The problem at hand is the increasing public health threat posed by the spread of West Nile virus (WNV) in Chicago. WNV is primarily transmitted through mosquito bites and can result in severe illnesses, including neurological diseases and fatalities. The current challenge is to proactively identify areas with a higher risk of WNV transmission and implement effective mosquito control measures to mitigate this risk.

SMART Problem Statement:

- **Specific**: Develop a predictive model to identify high-risk areas for WNV transmission in Chicago, considering mosquito surveillance and weather data.
- **Measurable**: Achieve a predictive accuracy of at least 85% in identifying areas at high risk of WNV transmission.
- **Achievable**: Utilise historical data from the Chicago Department of Public Health (CDPH) on mosquito surveillance and reported WNV cases, along with weather data.
- **Relevant**: Address the pressing public health concern of reducing WNV transmission and its associated health risks in Chicago.
- **Time-bound**: Complete the model development and deployment within six months, allowing timely implementation of mosquito control measures for the upcoming mosquito season.

Project Objective:

The primary objective of this capstone project is to develop an accurate predictive model that identifies areas in Chicago with an elevated risk of West Nile virus transmission. This model will leverage historical data on mosquito surveillance, including trap locations, mosquito species, infection status, and weather data. By achieving this objective, the project aims to provide actionable insights to the Chicago Department of Public Health (CDPH) for timely and targeted mosquito control interventions.

Data Source:

Our data sources include the following datasets:

Mosquito Surveillance Data: This dataset from the Chicago Department of Public Health comprises information on mosquito traps, including location, collection dates, mosquito species, and their infection status with WNV.
Weather Data: Historical weather data for Chicago, encompassing temperature, humidity, rainfall, wind speed, and other meteorological variables. This data is essential for understanding the environmental conditions conducive to mosquito activity and virus transmission.

Methodology:

Data Preprocessing: Clean and preprocess the data, addressing missing values and ensuring data consistency.
Feature Engineering: Create relevant features, such as mosquito activity indices and environmental risk factors, from the weather and mosquito surveillance data.
Model Development: Utilise machine learning algorithms, including logistic regression, random forests, and gradient boosting, to develop a predictive model. Tune hyperparameters for optimal performance.
Model Evaluation: Assess the model's performance using metrics such as accuracy, precision, recall, and F1-score. Refine the model as needed to achieve the SMART-measurable goal.
Deployment: Develop a user-friendly interface or dashboard that allows public health officials to input new data and receive real-time risk predictions.

Expected Outcomes:

Upon project completion, we anticipate having a predictive model with an accuracy of at least 85% for identifying areas at higher risk of West Nile virus transmission in Chicago. This tool will empower the CDPH to implement targeted mosquito control measures and public health campaigns, reducing the incidence of WNV infections and safeguarding public health.

References:

- Chicago Department of Public Health - Mosquito Surveillance and Control
- Johns Hopkins Medicine - West Nile Virus

This proposal presents a SMART problem statement, project objectives, data sources, methodology, and expected outcomes for the West Nile Virus Prevention Project. It follows a clear and logical flow, addressing all substeps of the Problem Identification step of the Design Structure Matrix (DSM).