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**FROM RAINY ROADS TO RIDER RELIEF**

**Boda-Safe Shield: Dynamic Motorcycle Insurance Pricing Model**

**Project Goal:** To develop a data-driven, dynamic pricing model for motorcycle insurance (specifically targeting Boda Boda riders in Kampala, Uganda) that incorporates real-time weather risk to calculate a variable monthly premium.

The BodaSafe Shield Quote tool is a an actuarial product development project that creates a usage-based auto insurance product policy specifically for motorcycle operators designed to dynamically adjust a rider's estimated premium based on real-time exposure to weather-related risk. The policy predicts the expected accident frequency using a gbm model by combining a rider's daily hours of operation with the forecast for a specific pricing and enable potential claims to be handled automatically through its parametric trigger mechanism.

**Parametric Trigger**

The trigger is the daily total of precipitation exceeding 10 millimeters (mm) derived from the forecast of a public weather API. This specific trigger level is chosen because studies and police reports confirm that precipitation above this threshold significantly increases the probability of skidding and severe motor accidents making it a reliable proxy for high risk days.

**Methodology and Execution:**

1. **Data Acquisition:**
   * **Historical Weather Data (Offline):** Daily precipitation data for Kampala (Latitude 0.3476, Longitude 32.5825) was fetched from the Open-Meteo API for the period 2019−01−01 to 2023−12−31.
   * **Synthetic Claims Data:** Accident frequency and severity data were simulated using a Poisson distribution for frequency and a Gamma distribution for severity. A key feature, risk\_trigger, was engineered: 1 if precipitation >10mm, and 0 otherwise.
   * **Feature Engineering:** The month of the year and the risk\\_trigger were the primary input features for the modeling phase.
2. **Statistical Modeling:**
   * **Frequency Model:** Two models were trained to predict accident *frequency* (Accidents per Exposure Month):
     + **GLM (Poisson Family):** Used for interpretability and establishing a baseline.
     + **GBM (Gradient Boosting Machine):** Selected for its non-linear predictive power, outperforming the GLM based on model fit metrics.
   * **Severity Model:** A **GLM (Gamma Family)** was used to model the average *cost* (severity) of a claim.
3. **Risk Finding:**
   * The synthetic data demonstrated a strong separation in accident frequency: days with the rain risk\\_trigger active had a simulated accident rate (Poisson λ) approximately 66% **higher** than dry days (e.g., λ=0.25 vs. λ=0.15). This justified the use of precipitation as a primary rating factor.
4. **Deployment (Streamlit Application):**
   * The trained GBM model was saved (gbm\\_model.pkl) using joblib.
   * A web application was built using **Streamlit** and Python, enabling users to input location and daily hours.
   * The app performs an **on-demand API call** to Open-Meteo for *tomorrow's* forecast.
   * The final premium is calculated based on the formula:

Premium=Predicted Frequency×Daily Hours×Rate×30 days

The BodaSafe Shield Quote Tool serves as a robust proof-of-concept for a data-driven, weather-contingent insurance pricing strategy.