Project Title: Vehicle Insurance Claim Fraud Detection

Objective:
To develop a machine learning model that accurately identifies fraudulent vehicle insurance claims using historical data and predictive analytics.

Dataset:

- **File Used:** fraud_oracle.csv
- **Source:** Kaggle (Oracle Vehicle Insurance Claim Dataset)
- **Records:** Approximately [insert number of rows]
- **Features:** Includes claim details such as vehicle make, accident area, policyholder demographics, vehicle age, and incident details.
- **Target Column:** `FraudFound_P` (or equivalent binary label indicating whether a claim is fraudulent)

Technology Stack:

- Python (Google Colab)
- Pandas, NumPy (Data processing)
- Scikit-learn (Preprocessing, SMOTE, Evaluation)
- XGBoost (Model training)
- Matplotlib, Seaborn (Visualization)

Step-by-Step Workflow:

1. **Data Loading & Exploration**
   - Loaded `fraud_oracle.csv` into a Pandas DataFrame.
   - Inspected dataset shape, column names, data types, and missing values.

    - Identified categorical and numerical features.

2. **Preprocessing**
    - Dropped irrelevant columns such as `id`.
    - Encoded categorical variables using `LabelEncoder`.
    - Handled missing values (if any).
3. **Target Variable**
    - Defined the target variable (`FraudFound_P` or similar).
    - Checked class distribution to detect imbalance.
4. **Handling Imbalanced Data**
    - Used SMOTE (Synthetic Minority Oversampling Technique) to balance the classes.
5. **Splitting Dataset**
    - Split the balanced dataset into training (80%) and testing (20%) sets.
6. **Model Training**
    - Used XGBoost classifier with default parameters.
    - Trained model on SMOTE-augmented training data.
7. **Model Evaluation**
    - Achieved 97% accuracy.
    - Evaluated using confusion matrix, precision, recall, and F1-score.
    - Significant improvement in fraud class recall after SMOTE.
8. **Feature Importance**
    - Plotted feature importances to identify key fraud indicators.

    - Top features: `Vehicle_Damage`, `Vehicle_Age`, `Annual_Premium`, etc.

Results Summary:

- **Accuracy:** 97%
- **Recall (Fraud):** High (close to 98%) after SMOTE
- **Precision (Fraud):** High, indicating fewer false positives
- **Confusion Matrix:** Demonstrated balanced fraud detection

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Conclusion:
The XGBoost model trained on SMOTE-balanced data performed exceptionally well in detecting fraudulent vehicle insurance claims. The high accuracy and fraud recall suggest that the system is robust and deployable in real-world insurance settings.

Next Steps:

- Hyperparameter tuning with GridSearchCV
- Web deployment using Streamlit or Flask
- Model explainability using SHAP or LIME

Attachments:

- Colab notebook (.ipynb)
- Model file (`fraud_model_smote.pkl`)
- Visualizations: Confusion matrix, feature importance