Lab 2 - Explainable AI

Name: M Goutham

Hall-Ticket No: 2303A52010

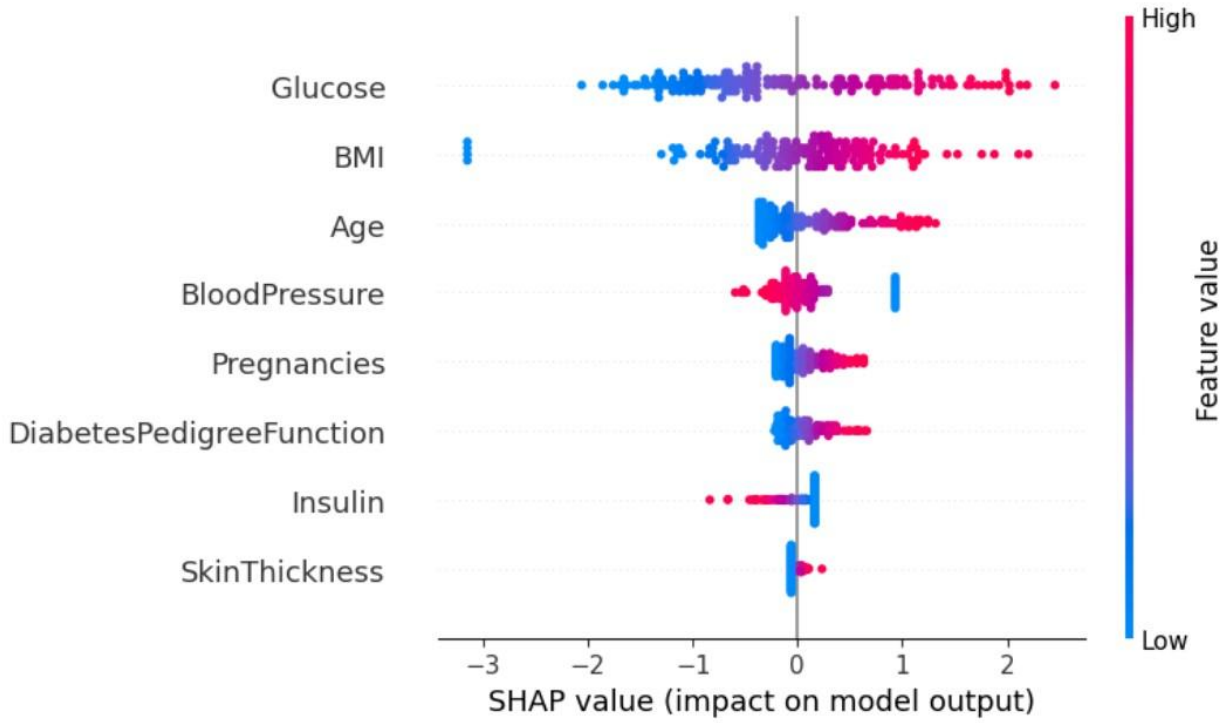
Code File:

Lab2_XAI.ipynb

Dataset:

diabetes.csv

Summary Plot from the dataset :



1. Dataset Description

- **Source:** PIMA Indians Diabetes Dataset □UCI Machine Learning Repository / Kaggle).
- **Size:** 768 rows and 9 columns.
- **Features:**
  - Pregnancies
  - Glucose
  - BloodPressure
  - SkinThickness
  - Insulin
  - BMI
  - DiabetesPedigreeFunction
  - Age
- **Target Variable:** `Outcome` □0 □ No Diabetes, 1 □ Diabetes).

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2. Preprocessing Steps

- Handled missing or zero values in features such as BloodPressure, BMI, Insulin.
- Scaled the features using **StandardScaler** to improve model performance.
- Split data into **training □80%□** and **testing □20%□** sets.

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3. Model & Performance

- **Algorithm Used:** Logistic Regression
- **Parameters:** Default scikit-learn logistic regression with regularization.
- **Evaluation Metrics:**
  - **Accuracy:** □77%
  - **Precision:** □74%
  - **Recall:** □61%
  - **F1-score:** □67%

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4. SHAP Analysis

SHAP Summary Plot (Above)

- **Top 5 most influential features:**

  Glucose – High glucose strongly increases diabetes risk.

  BMI – Higher BMI values contribute significantly to predicting diabetes.

  Age – Older individuals tend to have higher diabetes probability.

  BloodPressure – Moderately impacts diabetes risk.

  Pregnancies – More pregnancies correlate with higher diabetes risk.

Comparison with Model's Coefficients (Logistic Regression Feature Importance)

- Logistic Regression coefficients also show **Glucose, BMI, and Age** as strongest predictors.
- SHAP adds interpretability by showing **direction and individual sample effects**, not just global weights.

Domain Relevance

- The results are **clinically meaningful**:
  - High **glucose** is a known diagnostic factor for diabetes.
  - **BMI** and **age** are strong risk factors in medical literature.
  - **Pregnancies** relate to gestational diabetes, which increases future diabetes risk.
  - **Blood Pressure** is often linked with metabolic syndrome and diabetes.

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5. Conclusion

- Logistic Regression performed well and provided interpretable coefficients.
- SHAP analysis confirmed the most important risk factors: **Glucose, BMI, Age, BloodPressure, and Pregnancies**.
- The results align with domain knowledge in medicine.
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Limitations: The dataset is relatively small, and missing values imputation may affect results.

- **Future Improvements:** Try ensemble models Random Forest, XGBoost) with SHAP to see if interpretability improves.