

**HealthGuard: Diabetes Prediction**

# **HealthGuard: Diabetes Prediction**

A Machine Learning and Expert System Approach

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## HealthGuard: Diabetes Prediction

### 1. Overview

The HealthGuard project is designed to predict the likelihood of diabetes using machine learning and expert system reasoning. This project aims to provide an accessible and user-friendly tool for early diabetes risk assessment.

### 2. Objectives

The primary goal of this project is to assist users in identifying diabetes risk factors based on their personal health data. The project aims to combine predictive capabilities of a machine learning model with reasoning provided by an expert system.

### 3. Dataset Details

The Pima Indians Diabetes dataset contains 768 instances with 8 medical attributes such as glucose level, blood pressure, BMI, and diabetes pedigree function. This dataset is a standard benchmark for diabetes-related studies.

### 4. Machine Learning Model and Evaluation

The Random Forest Classifier was used to predict diabetes outcomes. The dataset was preprocessed with scaling and splitting into training and test sets. The model achieved an accuracy of 78.00%. Below is the classification report:

Precision:0.80

Recall: 0.72

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F1-Score: 0.76

### 5. Expert System Design

The expert system uses rules to provide reasoning for diabetes risk. For example, high glucose levels, BMI above 30, and age over 45 are considered significant factors. The reasoning is displayed to the user along with the prediction.

### 6. GUI Application

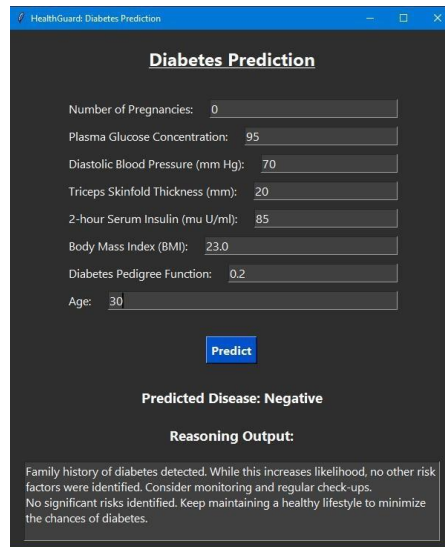
The GUI, built using Tkinter, provides an intuitive interface for users to input their data and receive predictions along with reasoning. Inputs include glucose levels, BMI, age, and more.

### 7. Outputs and Reasoning

Below are example outputs from the application showing predictions for positive and negative cases along with detailed reasoning:

The screenshot displays the 'HealthGuard: Diabetes Prediction' application window. It features a dark-themed interface with a title bar. The main content area is titled 'Diabetes Prediction' and contains several input fields for user data: 'Number of Pregnancies' (2), 'Plasma Glucose Concentration' (180), 'Diastolic Blood Pressure (mm Hg)' (85), 'Triceps Skinfold Thickness (mm)' (35), '2-hour Serum Insulin (mu U/ml)' (200), 'Body Mass Index (BMI)' (33.5), 'Diabetes Pedigree Function' (0.8), and 'Age' (50). Below these fields is a blue 'Predict' button. The output section shows 'Predicted Disease: Positive' and 'Reasoning Output:'. The reasoning text includes: 'Age is a risk factor for diabetes.', 'BMI indicates overweight, increasing diabetes risk.', 'Maintaining a healthy BMI is important. Consider regular physical activity and consult a healthcare provider for a tailored fitness plan.', 'It is recommended to monitor your blood sugar levels, maintain a balanced diet, and consult a doctor for personalized advice.', and 'High glucose level detected, risk of diabetes.'

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The screenshot shows a window titled "HealthGuard Diabetes Prediction". Inside, there's a section titled "Diabetes Prediction" with several input fields and a "Predict" button. The inputs are: Number of Pregnancies: 0, Plasma Glucose Concentration: 95, Diastolic Blood Pressure (mm Hg): 70, Triceps Skinfold Thickness (mm): 20, 2-hour Serum Insulin (mu U/ml): 85, Body Mass Index (BMI): 23.0, Diabetes Pedigree Function: 0.2, and Age: 30. Below the button, it says "Predicted Disease: Negative" and "Reasoning Output:". The reasoning output text is: "Family history of diabetes detected. While this increases likelihood, no other risk factors were identified. Consider monitoring and regular check-ups. No significant risks identified. Keep maintaining a healthy lifestyle to minimize the chances of diabetes."

| Input                            | Value |
|----------------------------------|-------|
| Number of Pregnancies            | 0     |
| Plasma Glucose Concentration     | 95    |
| Diastolic Blood Pressure (mm Hg) | 70    |
| Triceps Skinfold Thickness (mm)  | 20    |
| 2-hour Serum Insulin (mu U/ml)   | 85    |
| Body Mass Index (BMI)            | 23.0  |
| Diabetes Pedigree Function       | 0.2   |
| Age                              | 30    |

**Predict**

**Predicted Disease: Negative**

**Reasoning Output:**

Family history of diabetes detected. While this increases likelihood, no other risk factors were identified. Consider monitoring and regular check-ups. No significant risks identified. Keep maintaining a healthy lifestyle to minimize the chances of diabetes.

## 8. Conclusion

The HealthGuard project demonstrates how machine learning and expert systems can be used together to provide accurate and interpretable predictions for diabetes risk. Future improvements could include expanding the dataset and enhancing the reasoning rules.

## 9. References

- Pima Indians Diabetes Dataset
- Scikit-learn for Random Forest Model
- Experta for Expert System Implementation
- Tkinter for GUI Development