Perceptron from Scratch – Diabetes Prediction

1. Introduction

This project demonstrates the implementation of a Perceptron algorithm from scratch to predict diabetes using medical input features. The goal is to understand the internal working of a single-layer neural network without relying on pre-built machine learning models.

2. Project Objective

The objective is to design and train a custom Perceptron model for binary classification and apply it to a diabetes prediction problem to strengthen machine learning fundamentals.

3. Dataset Overview

The dataset contains medical attributes such as number of pregnancies, glucose level, blood pressure, skin thickness, insulin level, BMI, diabetes pedigree function, and age. Each record represents a patient, with the target indicating diabetic or non-diabetic status.

4. Data Preprocessing

Data preprocessing includes separating features and labels, converting values to numerical format, and preparing the dataset for training to ensure stable and accurate learning.

5. Perceptron Algorithm Explanation

The Perceptron computes a weighted sum of input features and applies an activation function to produce a binary output. Weights and bias are updated iteratively based on prediction errors.

6. Model Training Process

The model is trained over multiple epochs. Predictions are compared with actual labels, and weights are adjusted accordingly until convergence or maximum iterations are reached.

7. Prediction Workflow

After training, new input data is reshaped and passed through the trained Perceptron model to classify the patient as diabetic or non-diabetic.

8. Results and Observations

The custom Perceptron achieves reasonable classification performance, effectively demonstrating the learning behavior of a linear classifier.

9. Limitations

The Perceptron works only for linearly separable data and may struggle with complex non-linear patterns that require advanced neural networks.

10. Conclusion

This project successfully illustrates the implementation of a Perceptron from scratch for diabetes prediction, reinforcing foundational concepts in machine learning.

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