# **Linear Regression Analysis Report**

**Introduction** This report presents the results of a linear regression analysis performed on a self-created dataset reflecting 20 days of routine activities. The primary objective was to explore how various factors such as sleep hours, food quality, working hours, health condition, and mood affect productivity.

**Dataset Description** The dataset consists of the following variables:

**Independent Variables:** Sleep Hours, Rank of Food Quality, Working Hours, Rank of Health Condition, Rank of Mood.

**Dependent Variable:** Rank of Productivity. Each variable's values range from 1 to 10, simulating daily assessments over 20 days.

# **Methodology**

**Data Generation:** The dataset was programmatically generated with controlled random values for independent variables and a derived value for the dependent variable based on a hypothetical relationship.

**Exploratory Data Analysis (EDA):** Included scatter plots to visualize relationships and a correlation matrix to quantify the strength of associations.

**Gradient Descent Implementation:** Custom implementation of the multi-variable linear regression model using gradient descent from scratch. Parameters were initialized randomly, and model fitting was visualized through parameter updates and cost history.

# **Results**

**Model Training**: Parameters converged effectively, indicating successful learning. The evolution of the cost function illustrated decreasing error, and parameter trajectories showed stabilization.

**EDA Findings:** Initial visualizations did not reveal meaningful insights due to an oversight in data generation where the dependent variable was constant. Adjustments were recommended for realistic analysis.

**Conclusion** The analysis highlighted the importance of proper data simulation in experimental setups. Future iterations of the dataset generation should ensure variability in the dependent variable to meaningfully apply and interpret regression analysis. Recommendations include refining the data generation process and extending the analysis with validation techniques.

# Some Screenshots of Visualizations:













