# Sales Prediction Using Linear Regression with Gradient Descent

## 🎯 Purpose / Motive

The objective of this project is to predict product sales based on the amount spent on advertisements across three major media channels:  
- 📺 TV  
- 📻 Radio  
- 📰 Newspaper  
  
By analyzing the historical dataset and using a machine learning algorithm (Linear Regression with Gradient Descent), we aim to forecast how changes in advertising spend affect sales.

## 🧠 What the Code Does

1. Data Loading:  
 - Reads a dataset (CSV) containing columns: 'TV', 'Radio', 'Newspaper', and 'Sales'.  
  
2. Data Normalization:  
 - Normalizes the feature values to bring them to the same scale, which improves gradient descent performance.  
  
3. Gradient Descent Training:  
 - Uses manual implementation of gradient descent to optimize the model parameters (weights and bias).  
  
4. Model Saving:  
 - Saves the trained weights (w), bias (b), mean, and standard deviation using `joblib` so they can be used later for predictions.  
  
5. Prediction Interface (Flask Web App):  
 - Users can input ad spend manually or upload a CSV file.  
 - The model returns predicted sales based on learned parameters.

## 🌍 Real-World Applications

- Marketing Strategy: Companies can estimate how changes in ad budgets affect product sales.  
- Sales Forecasting: Sales teams can predict future demand based on planned advertising efforts.  
- ROI Optimization: Helps determine which advertising channel yields the best returns.

## 🧪 Example Use Case

A marketing team plans to spend:  
- ₹200,000 on TV  
- ₹50,000 on Radio  
- ₹30,000 on Newspaper  
  
By entering these values into the web app, the model predicts expected sales — allowing the team to better allocate resources.

## 📁 Summary Table

|  |  |
| --- | --- |
| Component | Description |
| Data | Advertising spend vs actual sales |
| Model | Linear Regression via Gradient Descent |
| Input | TV, Radio, Newspaper ad spend |
| Output | Predicted Sales |
| Interface | Flask + HTML (manual input & file upload) |
| Use Case | Forecasting, marketing strategy, ROI estimation |

Additional:

Here’s a concise one-line project description perfect for your portfolio or resume:

**Built a Flask web app to predict product sales using custom Linear Regression with Gradient Descent based on multi-channel advertising data.**