Assignment No 3: Report

Course: ML for Robotics
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Objective

To develop a car price prediction machine learning model using all types of gradient descent, apply regularization and early stopping, upload the trained model to Hugging Face, and deploy a web interface using Flask integrated in Google Colab.

Technologies & Tools Used

- Python, Pandas, NumPy
- Scikit-learn (Linear Regression, SGDRegressor, Ridge, Lasso)
- Weights & Biases (for experiment tracking)
- Hugging Face Model Hub (for model sharing)
- Flask (for web app interface)
- pyngrok (to expose Flask app from Colab)
- Google Colab

Steps Performed

 1. Data Preprocessing
- Loaded `Automobile_data.csv`
- Cleaned missing values (`?` replaced with `NaN`, dropped rows)
- Selected 9 relevant numeric features for training
- Normalized using `StandardScaler`

 2. Model Development
- Implemented Linear Regression with Gradient Descent variants (Batch, Stochastic, Mini-batch)
- Used `SGDRegressor` for incremental learning

- Applied **L1 (Lasso)** and **L2 (Ridge)** Regularization
- Included Early Stopping based on validation loss

 3. Model Tracking
- Used **Weights & Biases (W&B)** to log metrics such as training loss, R² score
- Captured training curves and logged hyperparameters

4. Model Hosting
- Saved pipeline using `joblib`
- Uploaded trained model to Hugging Face:
  https://huggingface.co/heerheer/Car_ML

 5. Flask Web Application
- Created a web UI using Flask (within Colab)
- Hosted the app using pyngrok for public access
- Users can input 9 car attributes and get predicted price

Testing

- Verified model predictions against sample rows from dataset
- Successfully predicted values were close to actual prices

Links

- 📂 GitHub Repository:
https://github.com/HEERHARISH1/ANO3_ML
- 🤗 Hugging Face Model:
https://huggingface.co/heerheer/Car_ML
- 📊 Weights & Biases Dashboard:
https://wandb.ai/heer-harish04-national-university-of-computing-and-emerg/ml-regression-model
?nw=nwuserheerharish04
- 🧪 Notebook with Flask App (Colab):
  [![Open In
Colab](https://colab.research.google.com/assets/colab-badge.svg)](https://colab.research.googl
e.com/github/HEERHARISH1/ANO3_ML/blob/main/i222371_ANO3%20(5).ipynb)

📸 Screenshots

FLask output

Values and actual price:

engine-size: 130.0

horsepower: 111.0

peak-rpm: 5000.0

city-mpg: 21.0

highway-mpg: 27.0

curb-weight: 2548.0

compression-ratio: 9.0

bore: 3.47
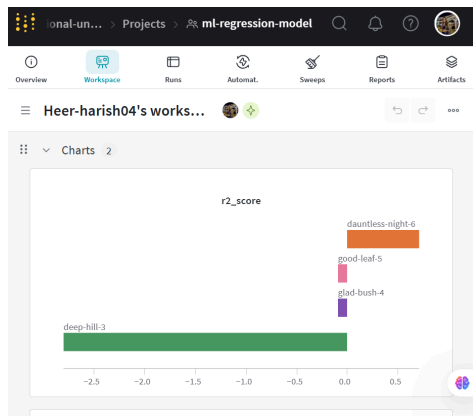
stroke: 2.68

Actual price (for reference): $13495.0

Car Price Predictor

Engine Size	Horsepower
130.0	111.0

Peak Rpm	City Mpg
5000.0	21.0

Highway Mpg	Curb Weight
27.0	2548.0

Compression Ratio	Bore
9.0	3.47

Stroke

2.68

Predict Price

Estimated Price: $13731.07

Weight and Biases..

Conclusion

This project demonstrates the end-to-end lifecycle of a machine learning model — from development to deployment — using industry-standard tools and frameworks. The integration of Hugging Face and Flask provides a scalable and interactive prediction system.