AI-POWERED VEHICLE DAMAGE ASSESSMENT FOR COST ESTIMATION AND INSURANCE CLAIMS

Milestone 1: Project Initialization and Planning Phase

The "Project Initialization and Planning Phase" marks the project's outset, defining goals, scope, and stakeholders. This crucial phase establishes project parameters, identifies key team members, allocates resources, and outlines a realistic timeline. It also involves risk assessment and mitigation planning. Successful initiation sets the foundation for a well-organized and efficiently executed machine learning project, ensuring clarity, alignment, and proactive measures for potential challenges.

Activity 1: Define Problem Statement

The traditional vehicle damage assessment and insurance claim process is slow, subjective, and often inconsistent due to manual inspection. This project proposes an AI-powered solution that analyzes vehicle images to detect damage, classify its severity, and estimate repair costs automatically. The goal is to streamline insurance claims, reduce processing time, and enhance accuracy and customer satisfaction.

AI-Powered Vehicle Damage System Problem Statement Report: Click here

Activity 2: Project Proposal (Proposed Solution)

The proposed solution uses deep learning and computer vision techniques to automatically detect and assess vehicle damage from images. It classifies the severity of the damage and estimates the repair cost based on trained models. The system also generates structured reports to assist in faster and more accurate insurance claim processing.

AI-Powered Vehicle Damage System Project Proposal Report: Click here

Activity 3: Initial Project Planning

The project will begin with data collection and preprocessing, including gathering and labeling vehicle damage images. Next, suitable deep learning models will be trained for damage detection, severity classification, and cost estimation. Finally, a user-friendly web interface will be developed to upload images and display results for insurance use.

AI-Powered Vehicle Damage System Project Planning Report : Click here

Milestone 2: Data Collection and Preprocessing Phase

The Data Collection and Preprocessing Phase involves executing a plan to gather relevant application data from Kaggle, ensuring data quality through verification and addressing missing values. Preprocessing tasks include cleaning, encoding, and organizing the dataset for subsequent exploratory analysis and machine learning model development.

Activity 1: Data Collection Plan, Raw Data Sources Identified, Data Quality Report

The data collection plan involves sourcing vehicle damage images from publicly available datasets such as the **Car Damage Dataset**, **VDDB**, and **Kaggle** repositories. Additional images may be gathered from open-access web sources or simulated using image augmentation techniques. Each image will be labeled with damage type, severity, and associated repair costs for model training.

AI-Powered Vehicle Damage System Data Collection Report: Click here

Activity 2: Data Quality Report

The raw dataset was assessed for quality issues such as inconsistent image resolutions, duplicate entries, and missing labels. Several images lacked proper annotations for damage severity or repair cost, requiring manual correction or removal. After cleaning, the dataset was standardized, balanced across damage classes, and verified for model readiness.

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Activity 3: Data Exploration and Preprocessing

Data exploration involved analyzing class distribution, image quality, and identifying patterns in damage severity and cost. Preprocessing steps included image resizing, normalization, and augmentation to enhance model generalization. Labels were encoded for classification tasks, and the dataset was split into training, validation, and test sets.

AI-Powered Vehicle Damage System Data Exploration and Preprocessing Report: Click here

Milestone 3: Model Development Phase

The Model Development Phase entails crafting a predictive model for estimating the cost. It encompasses strategic feature selection, evaluating and selecting models (CNN,Vgg16), initiating training with code, and rigorously validating and assessing model performance for informed decision-making in the estimation process.

Activity 1: Feature Selection Report

Feature selection focused on extracting meaningful visual features from images using convolutional layers of pretrained CNN models like VGG16 and ResNet50. For cost estimation, additional features such as damage severity and affected car parts were included. These selected features significantly improved model performance in both classification and regression tasks.

AI-Powered Vehicle Damage System Feature Selection Report: Click here

Activity 2: Model Selection Report

Several deep learning models were evaluated for damage classification and cost estimation, including VGG16, ResNet50, and EfficientNet. ResNet50 provided the best trade-off between

accuracy and computational efficiency for damage severity classification, while a separate regression model using Dense layers performed well for cost prediction.
AI-Powered Vehicle Damage System Model Selection Report: Click here

Activity 3: Initial Model Training Code, Model Validation and Evaluation Report

The initial model training involved fine-tuning pretrained CNNs like ResNet50 on the labeled vehicle damage dataset using transfer learning. The classification model was trained to identify damage severity, while a separate regression model predicted repair costs. Training was monitored using validation accuracy and loss to prevent overfitting and ensure generalization.
AI-Powered Vehicle Damage System Model Development Phase Template: Click here

Milestone 4: Model Optimization and Tuning Phase

In the model optimization phase, hyperparameters such as learning rate, batch size, and number of epochs were systematically tuned using techniques like grid search and early stopping. Regularization methods, including dropout and weight decay, were applied to reduce overfitting. Additionally, data augmentation was enhanced to improve model robustness and overall accuracy.

Activity 1: Hyperparameter Tuning Documentation

Hyperparameter tuning involved experimenting with different learning rates, batch sizes, and optimizer algorithms to find the best combination for model convergence. Grid search and random search methods were used alongside early stopping to optimize training efficiency. The final settings improved validation accuracy and reduced overfitting.

Activity 2: Performance Metrics Comparison Report

The performance comparison showed that ResNet50 outperformed VGG16 and EfficientNet in damage classification, achieving the highest accuracy of 88%. For cost estimation, a Dense regression model yielded the lowest mean squared error (MSE) compared to other regression approaches. Overall, the selected models balanced accuracy and inference speed, making them suitable for real-time damage assessment.

Activity 3: Final Model Selection Justification

ResNet50 was selected as the final model for damage classification due to its superior accuracy and efficient feature extraction capabilities compared to other architectures. For cost estimation, the Dense regression model was chosen for its low error rates and consistent performance across diverse damage cases. Together, these models provide a reliable and scalable solution for automated vehicle damage assessment and cost prediction.
AI-Powered Vehicle Damage System Model Optimization and Tuning Phase Report: Click here

Milestone 5: Project Files Submission and Documentation

For project file submission in Git hub, Kindly click the link and refer to the flow. Click here

For the documentation, Kindly refer to the link. Click here

Milestone 6: Project Demonstration

In the upcoming module called Project Demonstration, individuals will be required to record a video by sharing their screens. They will need to explain their project and demonstrate its execution during the presentation.