AutoMate

Automobile Damage Detection App

using Machine Learning

(with code implementation)

A report on

Trend Recognition and Forecasting Market Growth

By

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ABSTRACT

AutoMate - Your Mate for everything Automobile is set to revolutionize the automotive industry by introducing a cutting-edge Machine Learning-based Automobile Damage Detection App. In today's fast-paced world, this app fills a critical gap by providing users with instant and accurate assessments of car damage through AI-powered image recognition and text analysis.

This app addresses this pressing need by harnessing the power of Machine Learning and Artificial Intelligence. AutoMate employs state-of-the-art computer vision and deep learning techniques to provide users with a comprehensive and unprecedented tool for assessing automobile damage.

In a world where time and resources are precious commodities, AutoMate emerges as an indispensable companion for vehicle owners, enthusiasts, and industry professionals. Its potential to minimize accidents, save money, and enhance convenience positions it as a transformative solution in the realm of automobile management. AutoMate is not just an app; it's a game-changer that promises to redefine the way we interact with our automobiles in the 21st century.

1. Problem Statement

The issue of vehicle damage plagues the automotive industry. Various factors, such as accidents, collisions, natural disasters, and regular wear and tear, make vehicles susceptible to damage.

The conventional approach to evaluating vehicle damage and managing the repair process poses significant challenges for customers. Inaccurate or delayed damage assessments can lead to increased costs, longer processing times for claims and customer dissatisfaction.

There exists a demand for an inventive solution harnessing machine learning technology.

1.1 SCOPE: AutoMate offers real-time guidance to customers, enabling them to make well-informed choices and simplify the vehicle repair journey.

1.2 OBJECTIVES:

- **Precise Damage Analysis:** AutoMate will utilize state-of-the-art machine learning algorithms to conduct an in-depth examination of images submitted by customers illustrating vehicle damage.

- **Real-time Support:** This app is committed to providing real-time assistance to customers throughout the process of assessing damage. The app will supply clear, step-by-step instructions and prompts, ensuring that customers capture high-quality images of the damaged areas, ensuring that all critical details are captured for accurate assessments.

- **Repair Details:** Comprehensive information about repair facilities, their areas of expertise, and user reviews will be readily available, empowering customers to make well-informed decisions when selecting the most suitable repair services.

2. Market/Customer/Business Need Assessment

2.1 Market Assessment

Scope of the App

AutoMate is positioned to address a critical need in the automotive industry - the efficient and accurate assessment of vehicle damage. AutoMate, a Machine Learning-based Automobile Damage Detection App, offers a wide-ranging scope that encompasses:

- Instant and Accurate Damage Assessment
- Real-time Support and Guidance
- Transparency in Repair Options

Market Need for an ML-Based Vehicle Damage Detection App

- **Accurate Damage Assessment**: The automotive industry faces a persistent challenge where inaccurate or delayed damage assessments can lead to increased costs and customer dissatisfaction.
- **Time and Cost Efficiency**: In today's fast-paced world, saving time and money is paramount. AutoMate streamlines the repair process by offering real-time support, guidance, and cost estimates.
- **Enhanced Convenience and Decision-Making**: With the abundance of repair options available, users often face confusion when selecting suitable repair services. AutoMate's transparency in providing comprehensive information about repair facilities and user reviews empowers users to make well-informed decisions.

2.2 Customer Assessment

AutoMate is designed to be Your Mate for everything Automobile

Customer Needs:

- **User-Friendly and Intuitive Interface:** Customers appreciate a user-friendly interface, making it easy for both tech-savvy and non-tech-savvy users to navigate the app effortlessly.
- **Time and Cost Savings:** Users are highly satisfied with the ability of an app to save them time and money. By providing accurate damage assessments and repair cost estimates, the app helps users make informed decisions promptly, minimizing repair expenses and reducing downtime.
- **Enhanced Confidence in Assessments:** Customer no longer need to rely solely on subjective judgments, and the app's guidance ensures they capture all critical details for an accurate assessment.
- **Transparent Repair Options:** Customers appreciate the transparency in providing comprehensive information about repair facilities, including areas of expertise and user reviews.

2.3 Business Need Assessment

AutoMate addresses critical business needs in the automotive industry, including market demand, revenue generation, scalability, regulatory compliance, and customer retention:

- **Market Demand:** The automotive industry is witnessing a growing demand for innovative solutions to address the challenges associated with vehicle damage assessment and repair.
- **Revenue Generation:** AutoMate opens new revenue streams by partnering with repair facilities, insurance companies, and other stakeholders in the automotive industry.
- **Scalability:** AutoMate's business model allows for scalability, potentially expanding its services to cover a broader range of vehicle-related issues beyond damage assessment.
- **Regulatory Compliance:** Staying compliant with automotive industry regulations and standards is crucial. AutoMate ensures compliance with relevant regulations, safeguarding the business against legal and regulatory risks.
- **Customer Retention:** Satisfied customers are more likely to remain loyal to the app, resulting in a stable user base.

3. Target Specifications and Characterization

Target audience

Any individual possessing a vehicle under a valid driving license and vehicle registration. These may include:

- **Vehicle Owners:** AutoMate caters to a diverse group of vehicle owners, including individuals who own cars, motorcycles, and other types of vehicles. These users value a hassle-free and efficient solution for assessing and managing vehicle damage.
- **Automotive Enthusiasts:** Enthusiasts who are passionate about their vehicles, such as collectors, hobbyists, and performance enthusiasts, appreciate AutoMate's ability to provide accurate damage assessments and enhance the overall ownership experience.
- **Insurance Customers:** AutoMate's services are of particular interest to insurance customers looking to expedite claims processing and reduce disputes related to vehicle damage assessments

Demographic Diversity

AutoMate aims to be inclusive and accessible to a diverse range of demographics, including different age groups, cultural backgrounds, and income levels, ensuring that vehicle owners from various walks of life can benefit from its services.

4. External Search (online information sources/references/links)

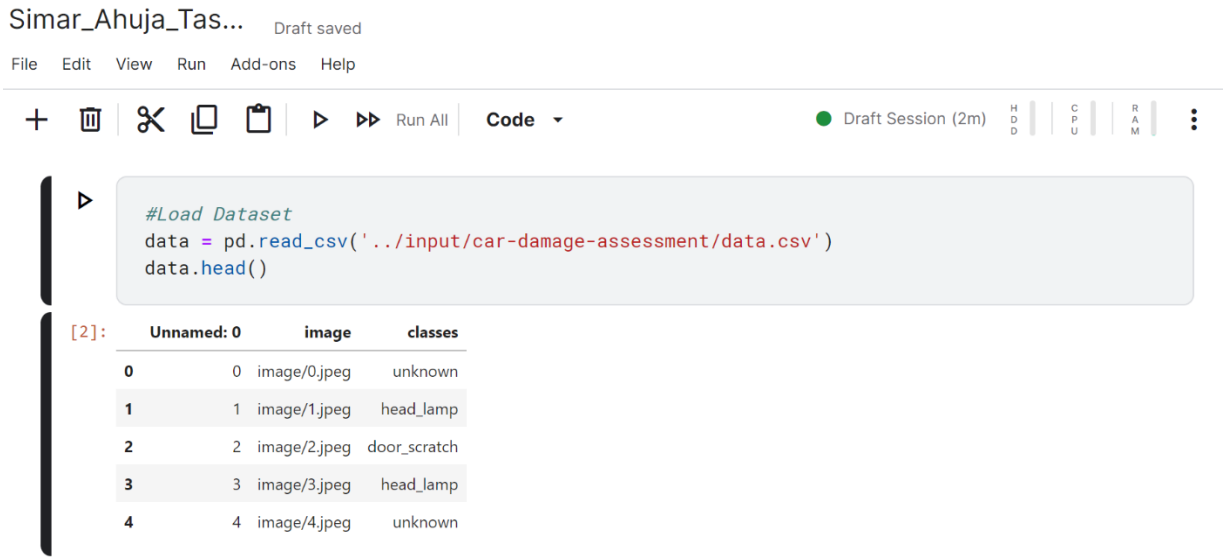
References:

ML Beginner's Guide to Build Car Damage Detection AI Model (https://www.labellerr.com/blog/ml-beginners-guide-to-build-car-damage-detection-ai-model/)

Dataset:

Kaggle Car Damage Assessment Dataset: (https://www.kaggle.com/datasets/hamzamanssor/car-damage-assessment)

View dataset:



5. Bench Marking Alternate Products

AutoMate is benchmarked against various alternate products to meet the requirements and expectations of users and stakeholders in the following areas:

- **Accuracy and Efficiency:** This app is benchmarked against traditional vehicle inspection services to ensure that it provides more accurate and efficient damage assessments through its machine learning algorithms.
- **User Experience:** We benchmark AutoMate against competing mobile apps to ensure that its user interface, real-time support, and transparency in repair information offer superior user experience.

- **Claims Processing:** Our app is benchmarked against tools used by insurance companies for claims processing to ensure that it expedites the claims process and reduces disputes, benefiting both insurers and policyholders.

6. Applicable Patents

US20140309805A1- Vehicle damage detection and indication

This patent may be kept in mind while designing the patent for AutoMate.

7. Applicable Regulations

The mentioned patents could potentially assert rights over the technology if the algorithms are not independently developed and optimized to align with our specific needs. The use of pre-existing models is not a viable option if it could result in a patent infringement claim.

- **Access to Third-Party Websites:** It is essential to grant access to third-party websites for the purpose of auditing and monitoring the authenticity and behavior of the service.
- **Compliance with Data Collection Laws:** Adherence to data collection laws is paramount, as some websites may have policies prohibiting the collection of customer data in the form of reviews and ratings.
- **Responsible Data Handling:** It is imperative to exercise responsibility in handling scraped data, ensuring the protection of privacy and respecting the original intent behind the data extraction.

8. Applicable Constraints

- **Data Availability:** The app's effectiveness relies on the availability of high-quality data, including images of vehicle damage and repair information. Limited or low-quality data could limit the accuracy of assessments.
- **Internet Connectivity:** Users need a stable internet connection to access and use the app effectively. In areas with poor connectivity, users may experience difficulties or delays in using the service.

- **Device Compatibility:** The app's compatibility with various devices and operating systems is essential to reach a broad user base. Ensuring a seamless experience on both Android and iOS platforms, as well as different screen sizes, can be a challenge.
- **Regulatory Compliance:** Staying compliant with changing regulations related to vehicle safety, insurance, and data privacy can be a constraint that requires ongoing attention and adaptation.

Addressing these constraints effectively is essential to the success and sustainability of the AutoMate app in the dynamic landscape of automobile management and damage assessment.

9. Business Model

Monetization Strategies:

- **Freemium Model:** A free basic version of AutoMate with essential features such as damage assessment is available to everyone.

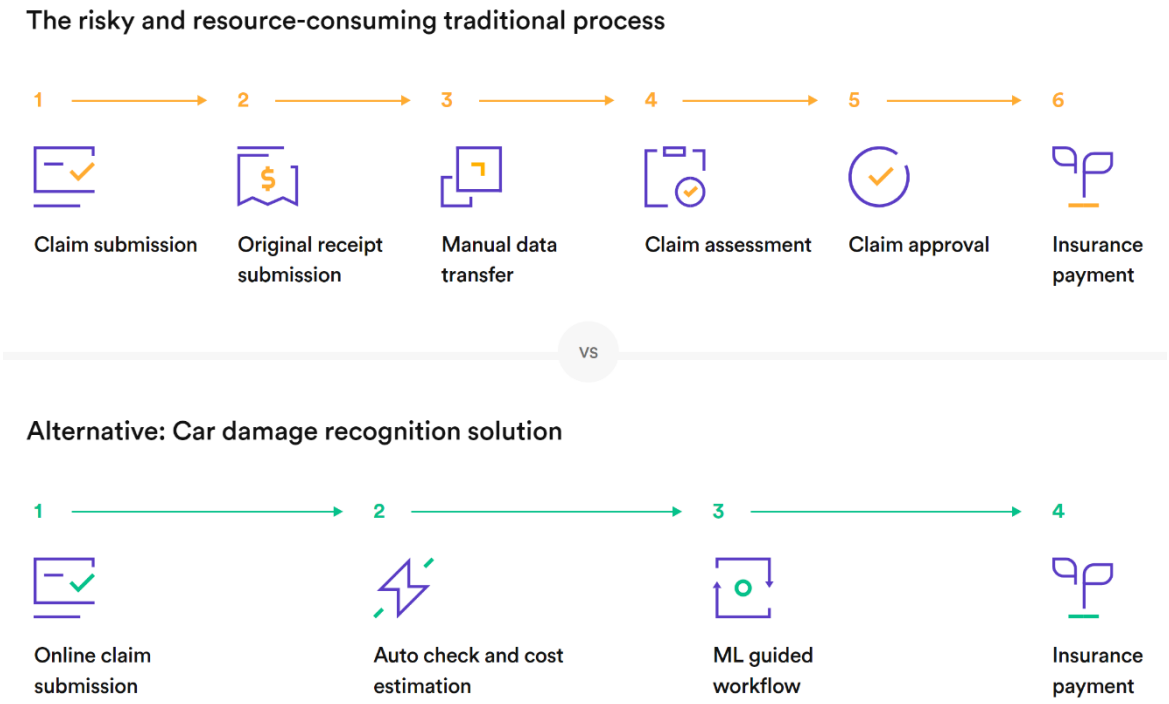
- **Subscription Model**: A premium subscription plan for users who require advanced functionalities. Premium features include faster assessments, priority customer support, exclusive partner discounts and comprehensive information about repair facilities.

- **Strategic Partnerships:** Collaboration with repair facilities, insurance companies and automotive service providers within the app. These partners can pay a fee or commission for customer referrals from AutoMate, generating revenue for the app.

- **In-App Advertising:** Incorporate non-intrusive advertising within the app. Advertisers, such as automotive parts manufacturers, insurance companies and car rental agencies, can pay for sponsored listings or banner placements targeting users with specific damage-related needs.

10. Concept Generation

The concept of AutoMate- Your Mate for everything Automobile, emerged from a pressing need to enhance and modernize the traditional methods of vehicle assessment. The motivation behind this innovative concept was born out of the limitations and challenges inherent in the conventional approach to vehicle damage assessment



11. Concept Development

In the concept development phase for the AutoMate web app, we will focus on creating a cutting-edge product/service that leverages deep learning and computer vision to revolutionize the way users assess and manage vehicle damage. The primary objective is to develop an intelligent platform that offers:

Key Features:

- **Image Classification for Damage Assessment**: AutoMate will utilize deep learning and computer vision algorithms to analyze user-uploaded images of vehicle damage. It will accurately classify and assess the extent of damage, providing users with real-time insights.

- **Interactive User Interface:** The platform will feature an intuitive and interactive user interface, making it easy for users to submit images, receive damage assessments, and explore repair options seamlessly.
- **Real-time Guidance and Support:** AutoMate will offer step-by-step guidance during the damage assessment process. Real-time support will be available through chat or assistance features.
- **Transparent Repair Information:** Users will have access to comprehensive repair information, including cost estimates, repair shop recommendations, and user reviews. This transparency will empower users to make informed decisions about repair services.
- **Data Insights and Trends**: The platform will collect anonymized data on vehicle damage trends, repair preferences, and user behavior. This data will be analyzed to provide valuable insights and market trends to industry stakeholders.
- **Scalable Infrastructure**: AutoMate will be built on a scalable infrastructure, allowing for future growth and expansion as the user base and data volume increase.

12. Final Product Prototype with Schematic Diagram

12.1 Product/Service Overview:

AutoMate will be a user-friendly web application designed to empower vehicle owners, enthusiasts, insurance professionals, and repair facility managers with advanced tools for vehicle damage assessment and management.

The prototype showcases a user-friendly and interactive interface, enabling users to upload images of vehicle damage effortlessly. Upon submission, the deep learning algorithms within AutoMate swiftly analyze and classify the damage, providing users with real-time, accurate assessments.

The prototype also highlights the platform's commitment to user support, offering step-by-step guidance during the assessment process and real-time assistance through chat and other features.

Feasibility: AutoMate's streamlined interface and powerful AI make it technologically feasible for diverse users in the Indian market, simplifying vehicle damage assessment. As the protype is ready, creating a customer UI and datacollection will take no more than 1.5 years to roll out the app.

Viability: With the rising demand for efficient automobile solutions, AutoMate's real-time analysis and user support enhance its viability, meeting the market's needs effectively.

Monetization: As mentioned above, AutoMate's market potential lies in subscription models for premium features, partnering with insurance providers and licensing its advanced algorithms, ensuring sustainable monetization in the Indian automotive landscape.

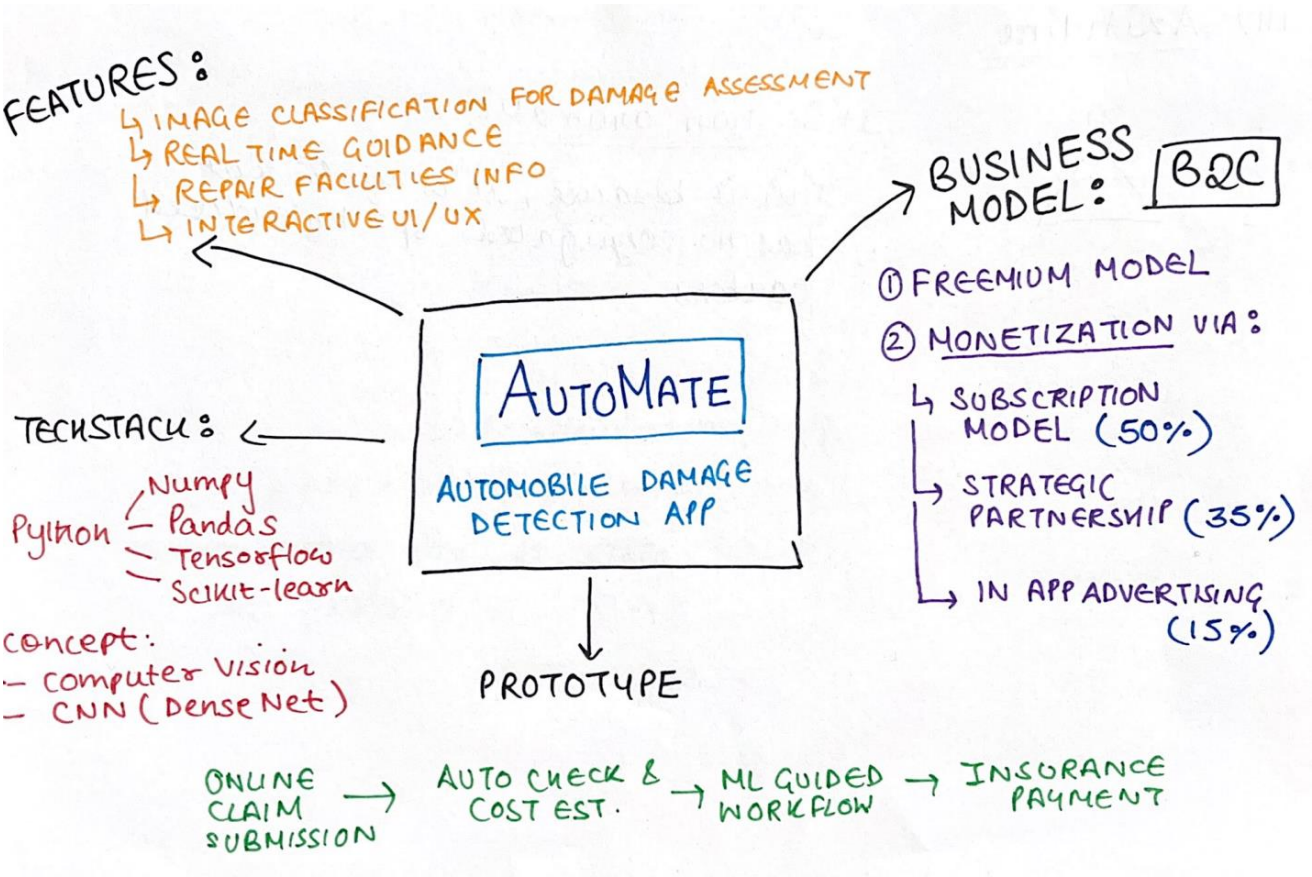
- **Freemium Model:** A free basic version of AutoMate with essential features such as damage assessment is available to everyone.

- **Subscription Model**: A premium subscription plan for users who require advanced functionalities. Premium features include faster assessments, priority customer support, exclusive partner discounts and comprehensive information about repair facilities.

- **Strategic Partnerships:** Collaboration with repair facilities, insurance companies and automotive service providers within the app. These partners can pay a fee or commission for customer referrals from AutoMate, generating revenue for the app.

- **In-App Advertising:** Incorporate non-intrusive advertising within the app. Advertisers, such as automotive parts manufacturers, insurance companies and car rental agencies, can pay for sponsored listings or banner placements targeting users with specific damage-related needs.

12.2 Schematic Diagram:



13. Product details - How does it work?

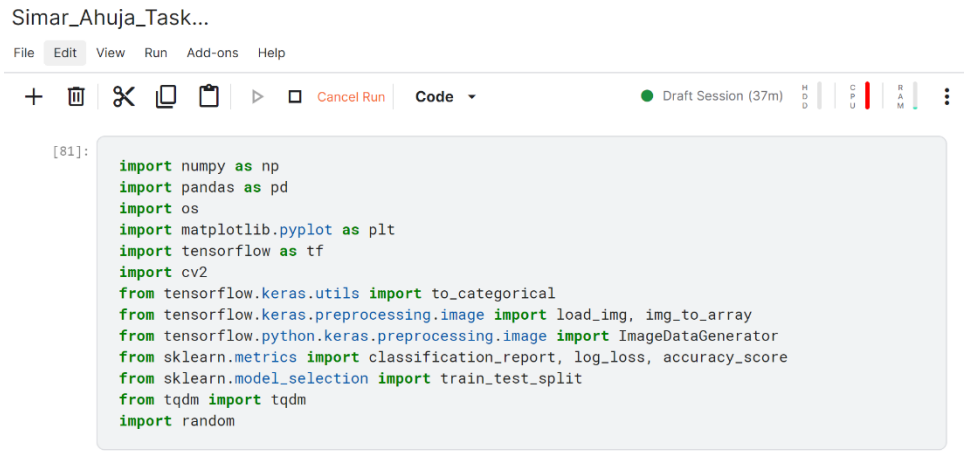
- **Image capture:** The first step is to capture images of the damaged vehicle using a smartphone, tablet or another device.
- **Image processing:** Once the images are captured, they are uploaded to AutoMate, which computer vision algorithms process.
- **Damage estimation:** Based on the analysis of the images using deep learning algorithms (neural networks), AutoMate estimates the repair cost.
- **Claims processing:** The insurance company then uses the estimated repair cost to process the claim.

14. Code Implementation

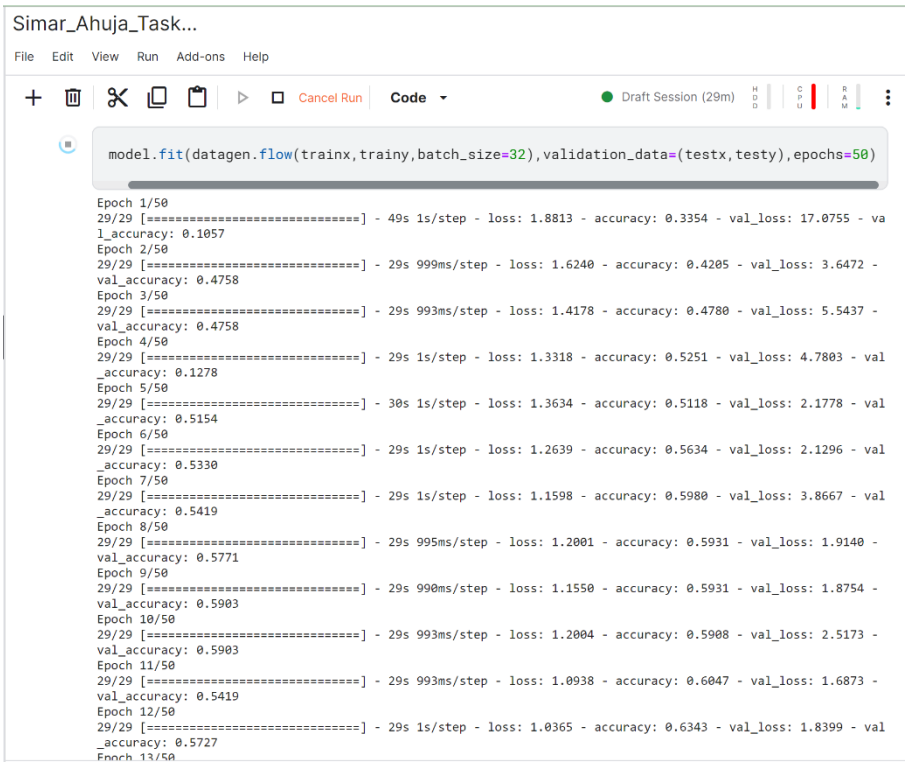
Link to GitHub Repository: https://github.com/simxr/AutoMate

Image classification using Convolutional Neural Network- **DenseNet**

Libraries and Frameworks



Train and Test Split: for epochs=50

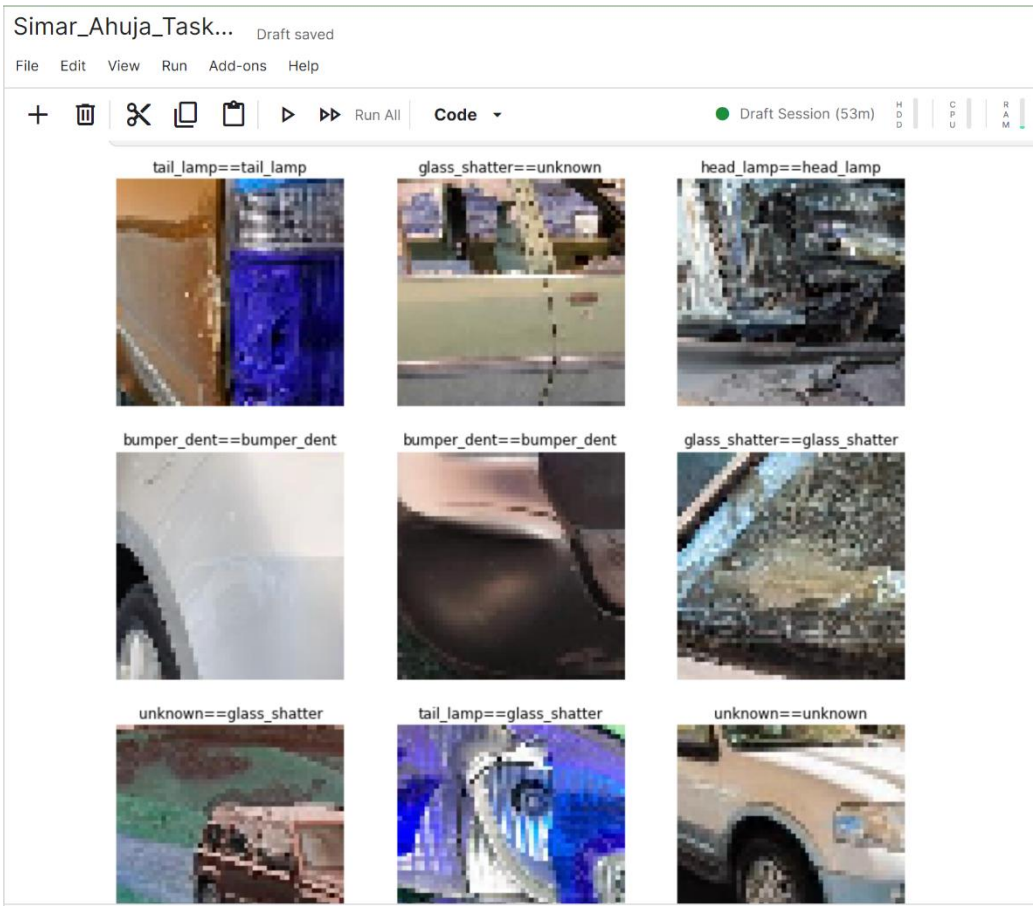


Output/ Result

Final plot for mapping:

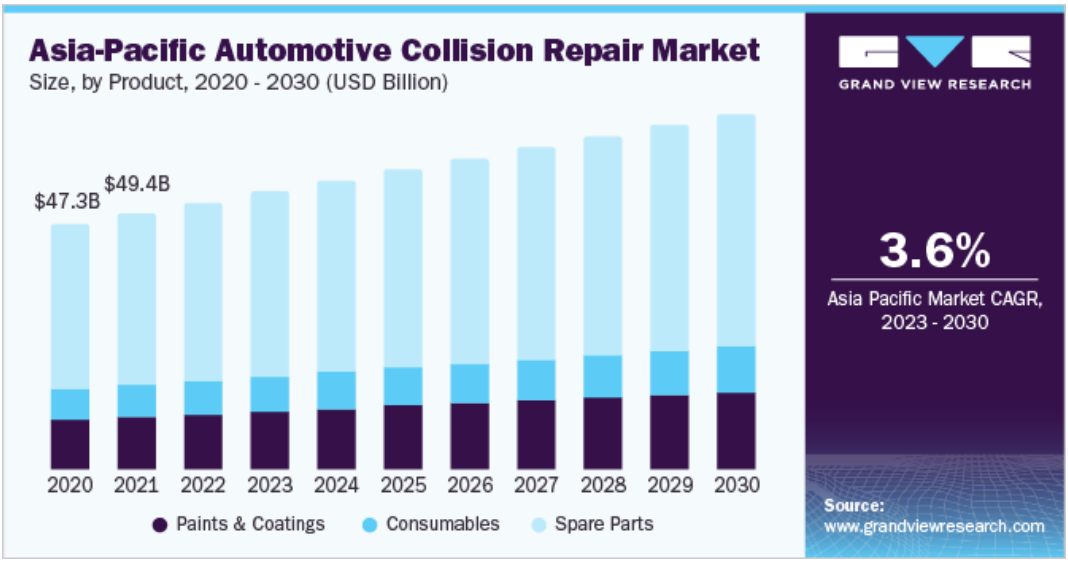
In [ ]:

```
fig, axs = plt.subplots(3,3,figsize=(12,12))
for i in range(9):
    r=i//3
    c=i%3
    img1 = testX[i]
    ax=axs[r][c].axis("off")
    actual=reverse_mapping[testY0[i]]
    predict=reverse_mapping[PRED[i]]
    ax=axs[r][c].set_title(actual+'=='+predict)
    ax=axs[r][c].imshow(img1)
plt.show()
```



15. Financial Equation

Lets look at the market size of Automobile Damage and Repair:



Exponential Financial Model for Exponential Market Growth:

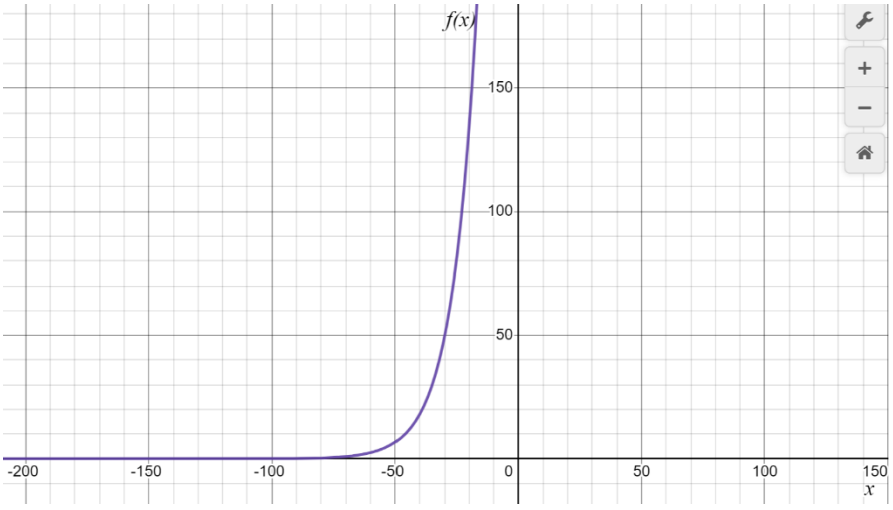
$$y = 1000 \cdot e^{0.1x}$$

a=1000 (initial profit or profit at the starting point)

b=0.1 (growth rate constant)

x represents time.

This exponential equation reflects a situation where the total profit (y) grows exponentially over time (x) with a base growth rate of **10%.**



16. Conclusion

The concept of AutoMate arose from a clear and compelling need: to improve upon the limitations of traditional methods of vehicle assessment.

AutoMate - Your Mate for everything Automobile, is set to revolutionize the automotive industry by introducing a cutting-edge Machine Learning-based Automobile Damage Detection App. In today's fast-paced world, this app fills a critical gap by providing users with instant and accurate assessments of car damage through AI-powered image recognition and text analysis.

In conclusion, AutoMate represents a revolution in automobile management, a transformative tool that aligns technology, data and user needs. This project report serves as a testament to the vision, innovation and dedication to reshaping the future of vehicle damage assessment, one image at a time.

Solo submission by:

Simar Ahuja