Final Project Report

Project Title: Crime Vision - Advanced Crime Classification with Deep Learning
Team ID : 738181

1. Introduction

1.1 Project Overview

Crime Vision is a cutting-edge project dedicated to revolutionizing crime classification and management through the application of advanced deep learning techniques. In collaboration with law enforcement agencies, Crime Vision aims to enhance the accuracy, efficiency, and responsiveness of crime categorization, ultimately contributing to improved public safety and security.

In today's rapidly evolving landscape of criminal activities, traditional methods of crime classification often fall short in accurately identifying and prioritizing incidents. Manual processes are time-consuming, error-prone, and subject to biases, leading to delays in investigations and suboptimal allocation of resources. Crime Vision seeks to address these challenges by harnessing the power of deep learning to automate and optimize the crime classification process. Through continuous refinement and optimization, Crime Vision endeavors to provide law enforcement agencies with actionable insights and real-time monitoring capabilities, enabling them to respond swiftly and effectively to emerging threats.

In summary, Crime Vision represents a paradigm shift in crime classification technology, empowering law enforcement agencies with the tools and capabilities needed to combat crime more efficiently and proactively. By harnessing the potential of deep learning, Crime Vision strives to create safer and more secure communities for all.

1.2 Objective

The primary objective of Crime Vision is to develop and deploy an advanced crime classification system powered by deep learning algorithms. By leveraging state-of-the-art computer vision techniques, the system aims to automate the process of analyzing and categorizing criminal incidents, enabling law enforcement agencies to identify, prioritize, and respond to threats more effectively.

Overall, the objective of Crime Vision is to empower law enforcement agencies with a state-of-the-art crime classification system that enhances their capabilities to combat crime, protect communities, and ensure public safety and security. By harnessing the power of deep learning and computer vision, Crime Vision strives to be a valuable tool in the ongoing effort to create safer and more secure societies.

2. Project Initialization and Planning Phase

2.1 Define Problem Statements:

The task is to develop a comprehensive Crime Vision dataset that encompasses diverse forms of criminal activities captured through various visual mediums such as surveillance cameras, dashcams, and mobile recordings.

The dataset should address the following challenges: Design a system capable of categorizing different types of criminal activities into distinct classes, including but not limited to theft, assault, vandalism, burglary etc. Implement algorithms to detect and track objects relevant to criminal activities, such as individuals, vehicles, weapons, and stolen items, within the visual data. Addressing these challenges will contribute to the development of advanced surveillance and security systems capable of detecting, preventing, and responding to criminal activities more effectively, ultimately enhancing public safety and security.

Ref. template: Click Here

2.2 Project Proposal (Proposed Solution)

This project proposal outlines a solution to address a specific problem. With a clear objective, defined scope, and a concise problem statement, the proposed solution details the approach, key features, and resource requirements, including hardware, software, and personnel.
Ref. template: Click Here

2.3 Initial Project Planning

Product Backlog, Sprint Schedule, and Estimation

Ref. template: Click Here

3. Data Collection and Preprocessing Phase

3.1 Data Collection Plan and Raw Data Sources Identified

Elevate your data strategy with the Data Collection plan and the Raw Data Sources report, ensuring meticulous data curation and integrity for informed decision-making in every analysis and decision-making endeavor.

Ref. template: Click Here

3.2 Data Quality Report

The Data Quality Report will summarize data quality issues from the selected source, including severity levels and resolution plans. It will aid in systematically identifying and rectifying data discrepancies.

Ref. template: Click Here

3.3 Data Preprocessing

The images will be preprocessed by resizing, normalizing, augmenting, denoising, adjusting contrast, detecting edges, converting color space, cropping, and batch normalizing, and whitening data.
These steps will enhance data quality, promote model generalization, and improve convergence during neural network training, ensuring robust and efficient performance across various computer vision tasks.

Ref. template: Click Here

4. Model Development Phase

4.1 Model Selection Report

In the model selection report for future deep learning and computer vision projects, various architectures, such as CNNs or RNNs, will be evaluated. Factors such as performance, complexity, and computational requirements will be considered to determine the most suitable model for the task at hand.

Ref. template: Click Here

4.2 Initial Model Training Code, Model Validation and Evaluation Report

The initial model training code will be showcased in the future through a screenshot. The model validation and evaluation report will include a summary and training and validation performance metrics for multiple models, presented through respective screenshots.

Ref. template: Click Here

5. Model Optimization and Tuning Phase

5.1 Tuning Documentation

The Model Optimization and Tuning Phase involves refining neural network models for peak performance. It includes optimized model code, fine-tuning hyper parameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.
Ref. template: Click Here

5.2 Final Model Selection Justification

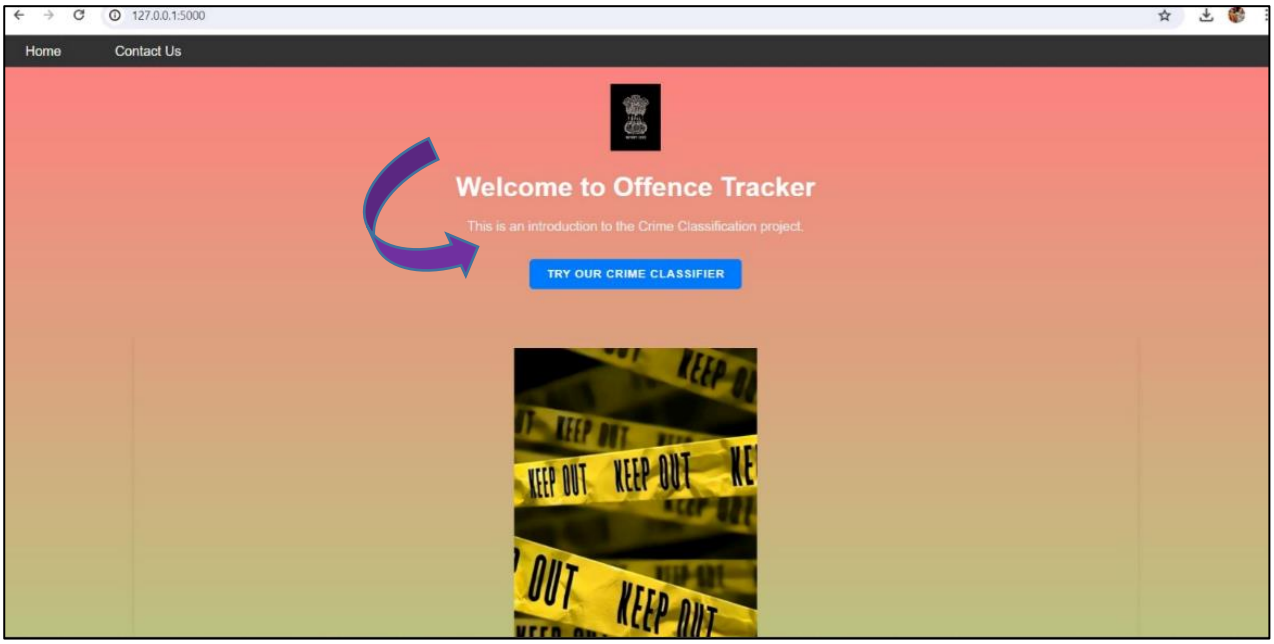
Ref. template: Click Here

6. Results

6.1 Output Screenshots

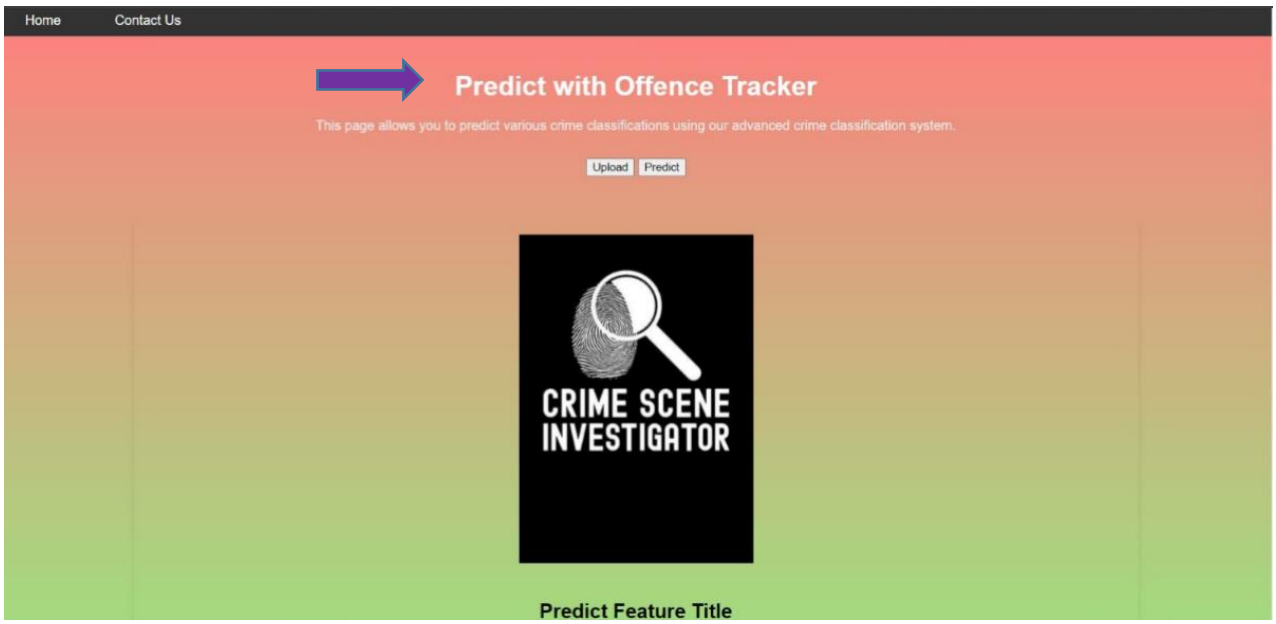
✓ Introduction to Crime Vision Platform:

Users start by exploring the home page, where they learn about the Crime Vision platform and its capabilities.



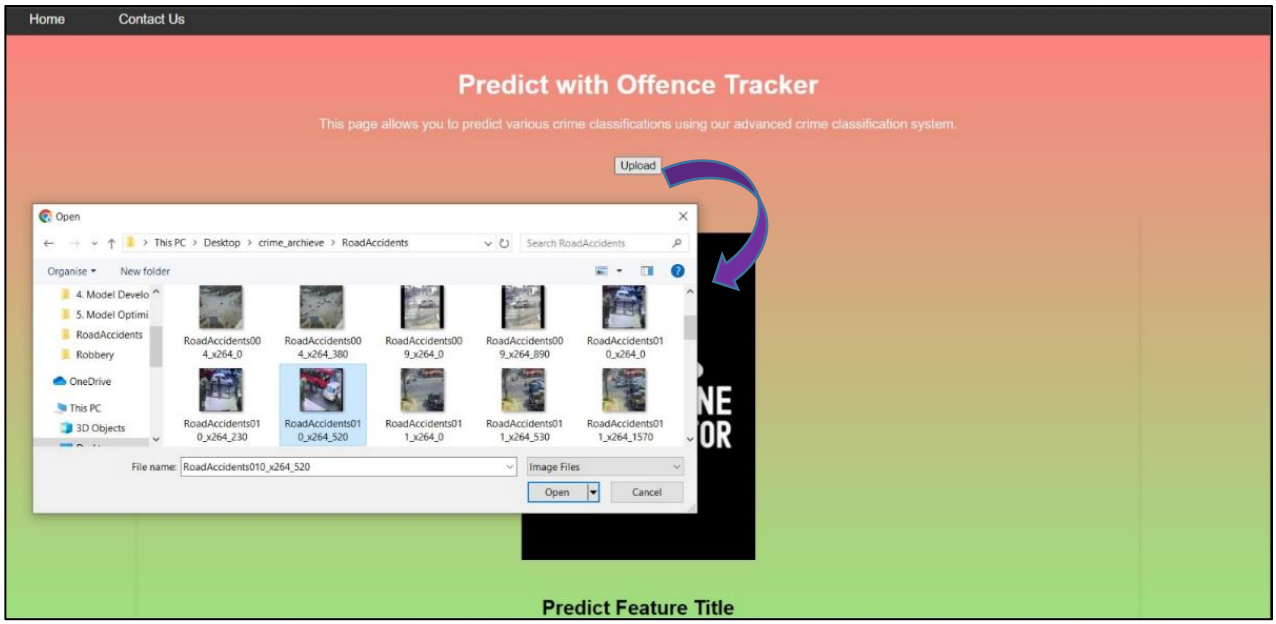
✓ Accessing Prediction Functionality:

Users navigate to the predict page to access the crime classification feature.



✓ Uploading Image:

Users upload an image containing the scene or incident they want to classify.

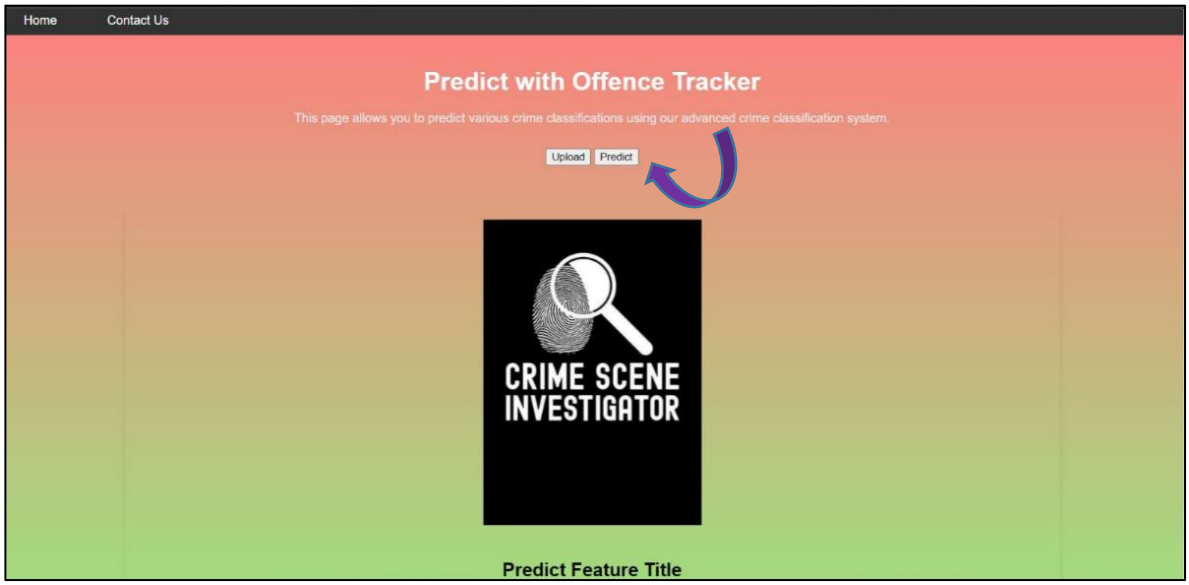


✓ Reviewing Uploaded Image:

Users review the uploaded image to ensure it accurately represents the incident they intend to classify.

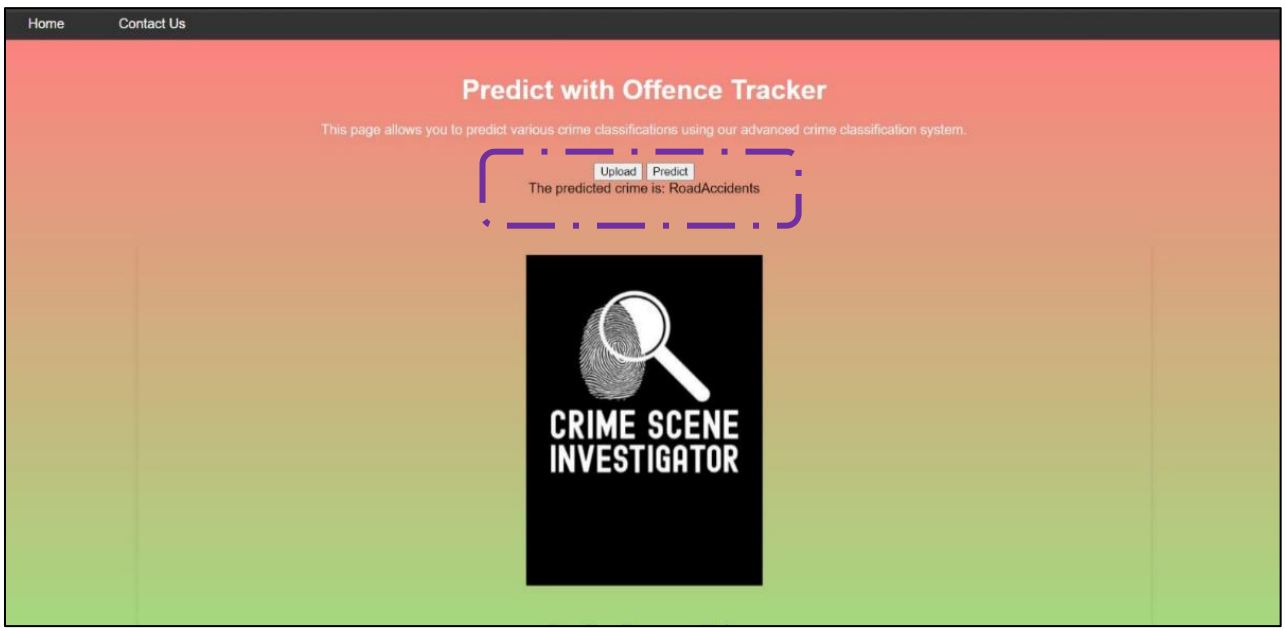
✓ Initiating Prediction:

Users click on the "Predict" button to initiate the crime classification process.



✓ Receiving Prediction Result:

Users receive the prediction result, confirming the successful classification of the uploaded image.



7. Advantages & Disadvantages

Advantages:

1. Enhanced Accuracy:
   Crime Vision leverages advanced deep learning techniques to accurately classify and categorize criminal incidents, reducing errors and inconsistencies associated with manual classification methods.

2. Efficiency Improvement:
   Automation of the crime classification process through Crime Vision leads to significant time savings for law enforcement agencies, allowing them to allocate resources more effectively and respond to incidents in a timely manner.

3. Real-time Monitoring:
   The real-time monitoring capabilities of Crime Vision enable law enforcement agencies to detect and respond to emerging threats promptly, enhancing public safety and security.

4. Data-driven Decision-making:
   By providing actionable insights and intelligence, Crime Vision supports data-driven decision-making at various levels within law enforcement organizations, enabling more informed strategies and resource allocations.

5. Scalability:
   Crime Vision is designed to be scalable, allowing it to handle large volumes of data and adapt to changing crime patterns and trends over time.

Disadvantages

1. Privacy Concerns:
   The use of advanced surveillance technologies and data analytics in Crime Vision may raise privacy concerns among the public, particularly regarding the collection and analysis of personal data and surveillance footage.

2. Potential Bias:
   Like any machine learning system, Crime Vision may exhibit biases in its classification decisions, particularly if the training data is not sufficiently diverse or representative of the population.

3. Resource Intensive:
   Implementing and maintaining a sophisticated deep learning system like Crime Vision requires significant computational resources, expertise, and financial investment.

4. Integration Challenges:
   Integrating it with existing law enforcement systems and workflows may present technical challenges & require coordination across multiple agencies & departments.

5. Ethical Considerations:
   The use of automated systems for crime classification raises ethical considerations regarding accountability, transparency, and the potential for unintended consequences, such as exacerbating existing biases in law enforcement practices.

   Overall, while Crime Vision offers significant advantages in terms of accuracy, efficiency, and real-time monitoring, it also poses challenges related to privacy, bias, resource requirements, integration, and ethical considerations. Addressing these challenges requires careful planning, collaboration, and adherence to ethical principles to ensure the responsible and effective use of technology in law enforcement.

8. Conclusion

In conclusion, Crime Vision represents a pioneering effort to revolutionize crime classification and management through the integration of advanced deep learning and computer vision technologies. By automating and optimizing the crime classification process, Crime Vision offers significant advantages in terms of accuracy, efficiency, and real-time monitoring, empowering law enforcement agencies to combat crime more effectively and safeguard public safety and security. Despite challenges related to privacy, bias, resource requirements, integration, and ethical considerations, Crime Vision holds immense potential to transform law enforcement practices and enhance the capabilities of agencies worldwide.

9. Future Scope

Looking ahead, the future scope of Crime Vision is promising and multifaceted. Potential areas for future development and enhancement include:

1. Continued Research and Development:
   Further research and development efforts can focus on refining the algorithms and models used in Crime Vision to improve accuracy, reduce biases, and enhance performance across diverse crime scenarios and environments.

2. Integration with Emerging Technologies:
   Crime Vision can be integrated with emerging technologies such as block chain, Internet of Things (IoT), and edge computing to enhance data security, scalability, and real-time decision-making capabilities.

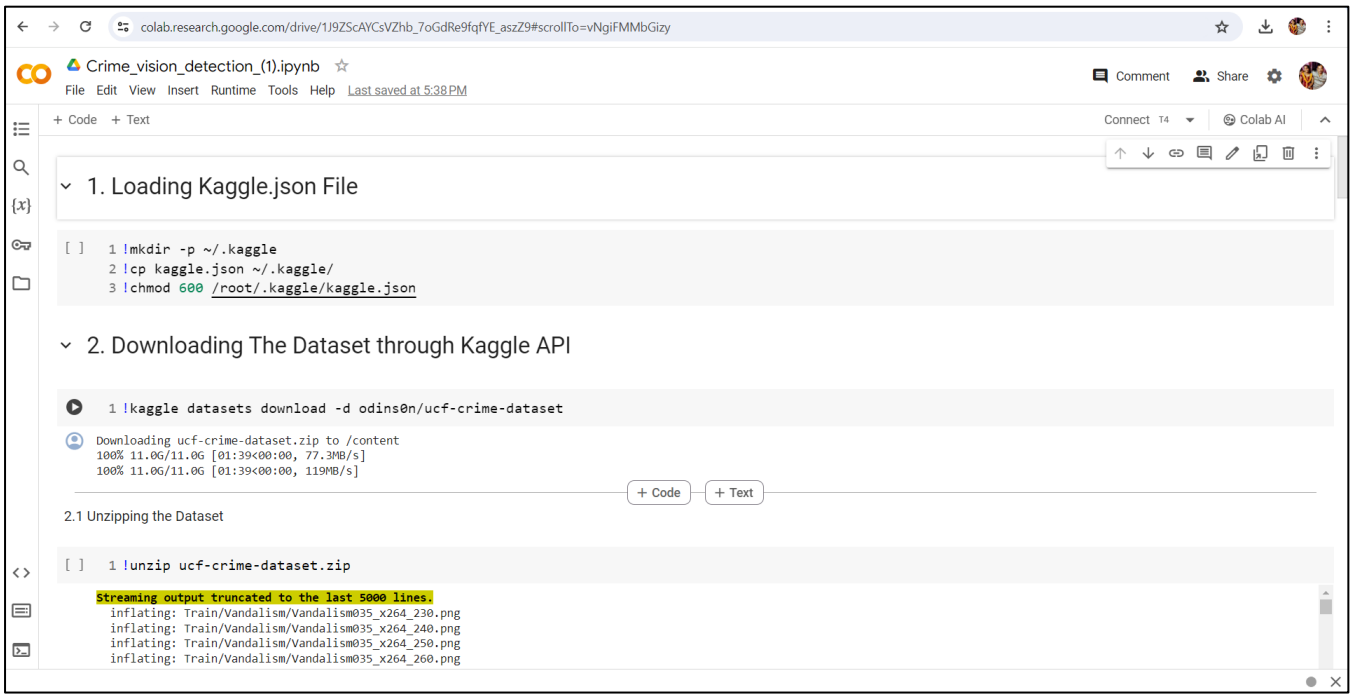
3. Expansion of Features and Capabilities:
   Crime Vision can be expanded to include additional features and capabilities, such as predictive analytics, anomaly detection, and natural language processing, to provide comprehensive support for law enforcement operations.

4. Collaboration and Knowledge Sharing:
   Collaboration with academic institutions, research organizations, and industry partners can facilitate knowledge sharing, benchmarking, and validation of Crime Vision's performance against industry standards and best practices.

5. Ethical and Legal Considerations:
   Ongoing attention to ethical and legal considerations is essential to ensure the responsible and ethical use of Crime Vision, including transparency, accountability, and fairness in decision-making processes.

10. Appendix

10.1 Source Code



+ Code + Text — Connect T4 — Colab AI

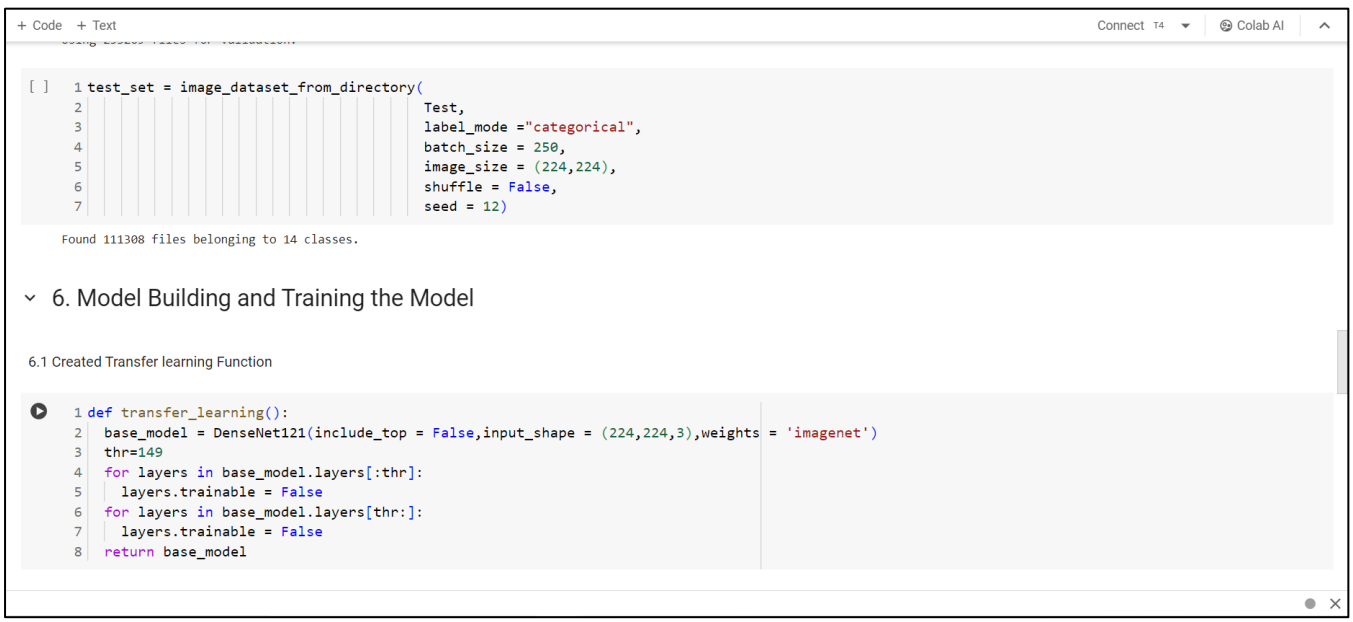
5. Image Preprocessing

```
[ ] train_gen = image_dataset_from_directory(
                                        Train,
                                        label_mode ="categorical",
                                        batch_size = 250,
                                        image_size = (224,224),
                                        shuffle = True,
                                        seed = 12,
                                        validation_split = 0.2,
                                        subset = "training")
```

```
Found 1266345 files belonging to 14 classes.
Using 1013076 files for training.
```

```
val_gen = image_dataset_from_directory(
                                        Train,
                                        label_mode ="categorical",
                                        batch_size = 250,
                                        image_size = (224,224),
                                        shuffle = True,
                                        seed =12,
                                        validation_split = 0.2,
                                        subset = "validation")
```

```
Found 1266345 files belonging to 14 classes.
Using 253269 files for validation.
```



+ Code + Text — Connect T4 — Colab AI

```
[ ] test_set = image_dataset_from_directory(
                                        Test,
                                        label_mode ="categorical",
                                        batch_size = 250,
                                        image_size = (224,224),
                                        shuffle = False,
                                        seed = 12)
```

```
Found 111308 files belonging to 14 classes.
```

6. Model Building and Training the Model

6.1 Created Transfer learning Function

```
def transfer_learning():
  base_model = DenseNet121(include_top = False,input_shape = (224,224,3),weights = 'imagenet')
  thr=149
  for layers in base_model.layers[:thr]:
    layers.trainable = False
  for layers in base_model.layers[thr:]:
    layers.trainable = False
  return base_model
```

6.2 Building DenseNet121 Model with appropriate Layers

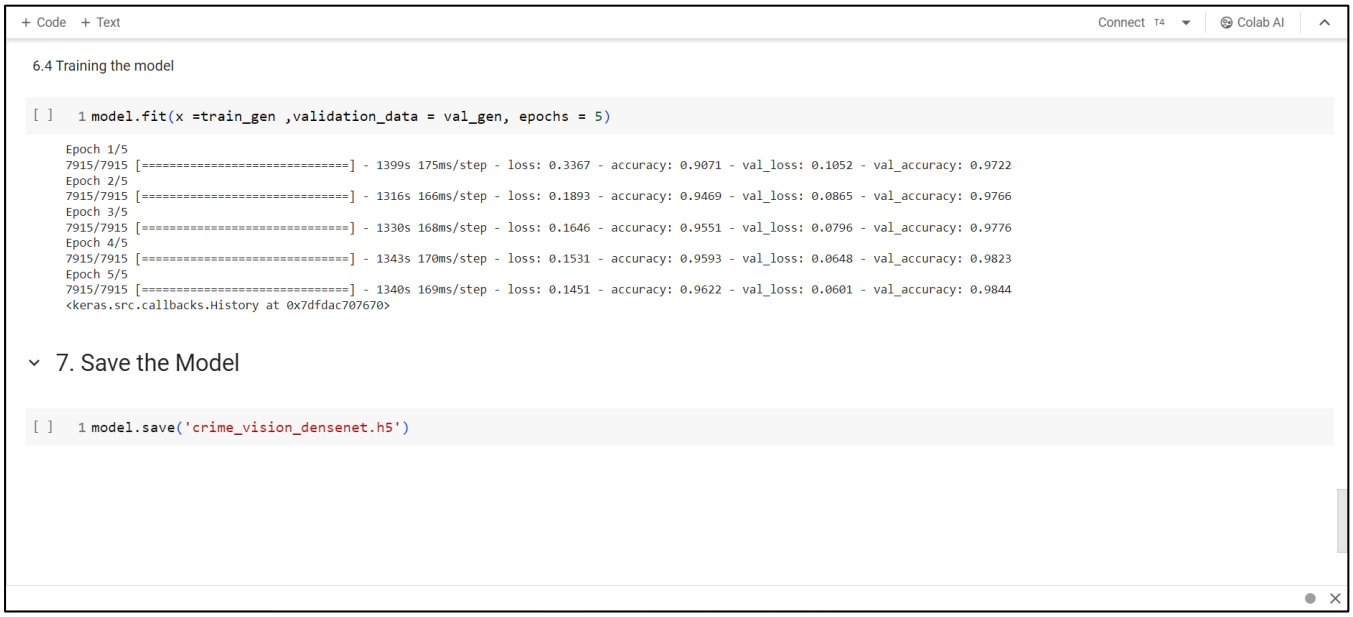
```
def create_model():
  model=Sequential()
  base_model=transfer_learning()
  model.add(base_model)
  model.add(GlobalAveragePooling2D())
  model.add(Dense(256, activation="relu"))
  model.add(Dropout(0.2))
  model.add(Dense(512, activation="relu"))
  model.add(Dropout(0.2))
  model.add(Dense(1024, activation="relu"))
  model.add(Dense(14, activation="softmax"))
  model.summary()
  return model
```

+ Code + Text Connect T4 Colab AI

6.3 Compile the Model

```
model=create_model()
model.compile(optimizer="adam",loss='categorical_crossentropy',metrics=['accuracy'])
```

```
Model: "sequential_3"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 densenet121 (Functional)    (None, 2, 2, 1024)        7037504

 global_average_pooling2d_3  (None, 1024)              0
  (GlobalAveragePooling2D)

 dense_12 (Dense)            (None, 256)               262400

 dropout_6 (Dropout)         (None, 256)               0

 dense_13 (Dense)            (None, 512)               131584

 dropout_7 (Dropout)         (None, 512)               0

 dense_14 (Dense)            (None, 1024)              525312

 dense_15 (Dense)            (None, 14)                14350

=================================================================
Total params: 7971150 (30.41 MB)
Trainable params: 933646 (3.56 MB)
Non-trainable params: 7037504 (26.85 MB)
_________________________________________________________________
```



10.2 Github and Project Demo Link

Github Link:

https://github.com/rahulisnotbehara/Crime_Vision_Advanced_Crime_Classification_With_Deep_Learning/tree/main/Crime_Vision_Advanced_Crime_Classification_With_Deep_Learning

Project Demonstration Link:

https://drive.google.com/file/d/1XkA4a8g-VG1nqQAc6lAp-8g8n5H8i1rs/view