**3rd Sem Mini Project Report on**



**PROJECT TITLE**



**Submitted in partial fulfillment of the requirement for the award of the degree of**

**BACHELOR OF TECHNOLOGY**

**IN**

**COMPUTER SCIENCE & ENGINEERING (AI-ML)**

**Submitted by:**

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***Under the Guidance of***

**Guide Name**

**Designation**

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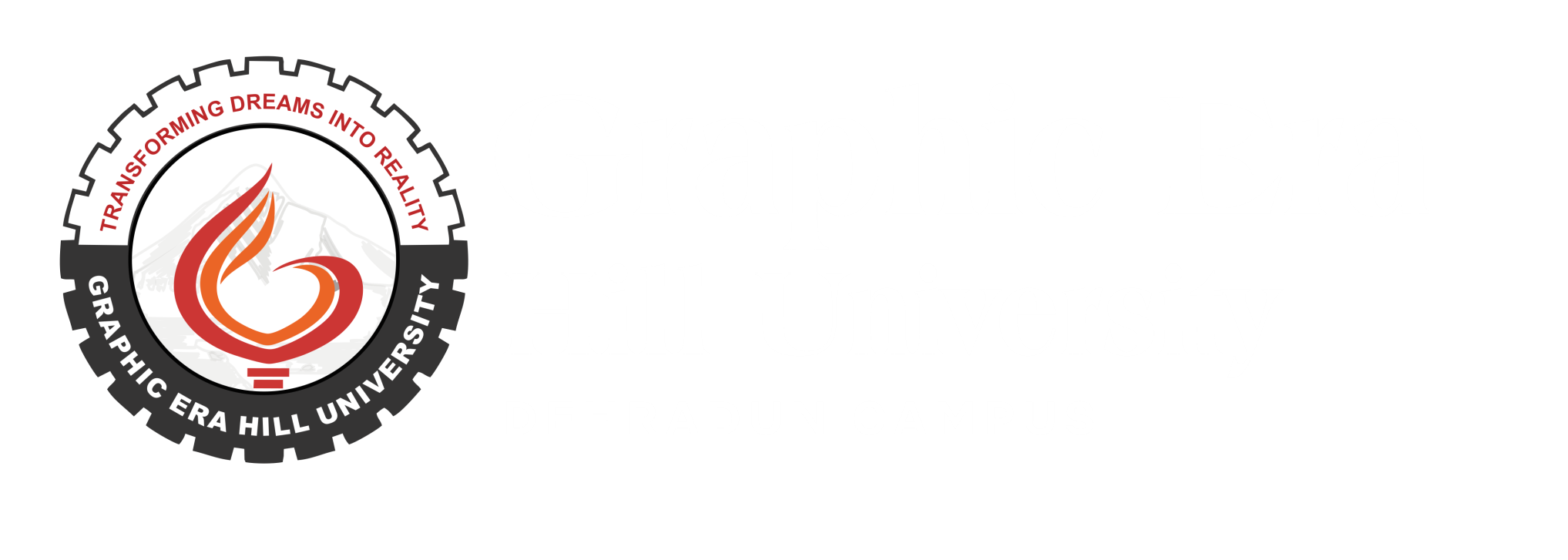


**Department of Computer Science and Engineering**

**Graphic Era Hill University**

**Dehradun, Uttarakhand**

**2024-25**



**CANDIDATE’S DECLARATION**

I hereby certify that the work which is being presented in the project report entitled **“Anomaly Detection in Crime Videos Using Convolutional Neural Networks and Isolation Forest”** in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Computer Science and Engineering **(AI-ML)** in the Department of Computer Science and Engineering of the Graphic Era Hill University, Dehradun shall be carried out by the undersigned under the supervision of **Mr. AMIT GUPTA ,**  Department of Computer Science and Engineering, Graphic Era Hill University, Dehradun.

Name-KARAN SINGH University Roll no- 2318948

The above mentioned student shall be working under the supervision of the undersigned on the **“Anomaly Detection in Crime Videos Using Convolutional Neural Networks and Isolation Forest”**

**Supervisor** **Head of the Department**

**Table of Contents**

|  |  |  |
| --- | --- | --- |
| **Chapter No.** | **Description** | **Page No.** |
| Chapter 1 | Introduction and Problem Statement | **4** |
| Chapter 2 | Methodology | **5** |
| Chapter 3 | Project Work Carried Out | **6** |
| Chapter 4 | Results and Discussion | **7** |
| Chapter 5 | Conclusion and Future Work | **8** |
|  | References | **10** |
|  |  |  |

**Chapter 1**

**Introduction and Problem Statement**

**Introduction**

Criminology has become a critical issue in the modern world due to crimes such as assault, theft, shoplifting, and road accidents. These incidents result in both monetary damage and loss of lives, sometimes causing long-term trauma to victims or society. Millions of cases are reported worldwide annually, placing massive burdens on victims and authorities. Quick identification and response to cases involving injuries help reduce further danger to safety.

The integration of AI with computer vision and deep learning enables real-time surveillance and incident detection. By leveraging existing surveillance infrastructure, this project aims to build a robust model capable of detecting criminal activities and accidents in real-time, potentially decreasing casualties and financial losses.

The project combines state-of-the-art computer vision techniques by merging pre-trained models such as DenseNet with a custom deep learning architecture. The system classifies activities into specific categories including abuse, assault, fighting, road accidents, shoplifting, stealing, and normal activities.

**Problem Statement**

The main objective is to develop an automated surveillance system with enhanced insights for measure-taking. This system should:

1. Detect and classify criminal activities in real-time video footage
2. Enable authorities to take quick and effective measures in crucial situations
3. Minimize losses and enhance public safety through early detection
4. Process video data using deep learning algorithms for accurate classification

**Chapter 2**

**Methodology**

The methodology employed in this project consists of several key components:

1. **Data Collection and Preprocessing:** 
   * Collection of video footage containing various criminal activities
   * Image preprocessing including resizing to 64x64 pixels
   * Normalization of pixel values
   * Application of data augmentation techniques
2. **Deep Learning Architecture:** 
   * Implementation of Convolutional Neural Networks (CNN)
   * Integration with Isolation Forest algorithm
   * Utilization of DenseNet as a pre-trained model
   * Custom fully connected neural network structure
3. **Training and Evaluation:** 
   * Dataset splitting into training and testing sets
   * Implementation of supervised learning approach
   * Use of cross-entropy loss function
   * Performance evaluation using ROC curves and AUC metrics

**Chapter 3**

**Project Work Carried Out**

The project implementation involved several key phases:

1. Model Architecture:
   * Global Average Pooling layer for dimension reduction
   * Dense layers with ReLU activation functions
   * Dropout layers for preventing overfitting
   * Softmax activation in the output layer
2. Data Processing:
   * Image resizing and normalization
   * Implementation of data augmentation techniques
   * Dataset splitting for training and testing
3. Training Process:
   * Utilization of Stochastic Gradient Descent (SGD)
   * Implementation of learning rate scheduling
   * Application of dropout for regularization
4. Evaluation Metrics:
   * ROC curve analysis
   * AUC score calculation
   * Multi-class classification performance assessment

**Chapter 4**

**Results and Discussion**

The implemented model demonstrated the following results:

1. **Classification Performance:** 
   * Successful multi-class classification across seven categories
   * Strong performance in road accident detection
   * Varying accuracy levels across different crime categories
2. **Model Limitations:**
   * Performance constraints due to limited dataset size
   * Challenges in certain classification categories
   * Need for optimization in specific scenarios
3. **Evaluation Metrics:** 
   * Satisfactory AUC scores for major categories
   * Room for improvement in precision-recall metrics
   * Demonstration of model robustness through various tests

**Chapter 5**

**Conclusion and Future Work**

**Conclusion**

The developed CNN-based model effectively performs multi-class image classification for crime detection. The architecture, featuring global average pooling, dense layers, and dropout regularization, successfully classifies images into seven distinct categories. Data augmentation and preprocessing techniques contribute to the model's robustness.

**Future Work**

1. Implementation of transfer learning using pre-trained models
2. Expansion of data augmentation techniques
3. Integration of early stopping mechanisms
4. Implementation of Adam optimizer
5. Cross-validation for improved generalization
6. Enhancement of the dataset size and diversity

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