**VIETNAM NATIONAL UNIVERSITY – HO CHI MINH CITY INTERNATIONAL UNIVERSITY  
SCHOOL OF COMPUTER SCIENCE AND ENGINEERING**

Semester 1 (2024-2025)

**ARTIFICIAL INTELLIGENCE**

IT097IU

**FINAL REPORT**

**TRAFFIC DENSITY DETECTION**

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1. Introduction
   1. Overview of the System

Scope:

The scope of this project is focus on creating a Traffic jams detection system based on Convolutional Neural Network (CNNs). This system classifies status into different categories based on the sparseness of the road. The system is created to adjust the number of vehicles stably which avoid the “overload” status.

The scope of the project:

**Dataset Consideration:** The system will rely on the large dataset about traffic congestion. The dataset will cover all of types of traffic congestion in Kaggle.

**Technology platform:** The system is developed as a web-based platform. The primary technologies include Python, OpenCV, scikit-image, PyTorch, and matplotlib.

Objective:

The primary objectives of this project are:  
**Automated traffic congestion detection:** Develop an intelligence system which can automated detect traffic congestion to notice and adjust the number of vehicles which will go to the other roads in purpose reducing traffic congestion.

**High-performance model:** Utilize CNNs to build robust and high-performance traffic density detection models that can classify a large of traffic density.

**Accurate and Reliable Diagnosis:** Achieve high diagnostic accuracy to ensure that the system can be integrated in Maps-application to identify the status in a road. The system will provide confidence scores with predictions and make it easy to identify the density.

Solution

The proposed solution to the problem of traffic density detection is deep learning-based image classification system that leverages CNNs to process and classify images of traffic congestion. Components of solution:

Data Collection and Preprocessing:

We will use a publicly available dataset in Kaggle, traffic\_dataset\_v1 which contains tested and trained images.

The images will undergo preprocessing steps (standard size, normalization of pixel values) to optimize the robustness of the model.

Model Architecture:

A Convolutional Neural Network (CNN) will be used as the main of the classification system. We will use a pre-trained model which has been demonstrated to perform well on image classification tasks.

The model will have layers specifically to capture the status in the roads before analysis and identify the density.

Model Training and Evaluation:

The model will be trained on training set and evaluated using a test set of traffic density image.

* 1. Problem Statement

Problem Analysis:

The traffic condition is one of the most important problems in the world, especially in urban area. Every year, countries waste thousands of hours because of this problem. To solve the problem, this project is created to adjust number of vehicles, especially rush hour. The system will notice about the way which is having traffic jams, and the driver will receive that information to go to the low-density roads.

Key problems in Traffic Density Detection:

**Choosing the best but not suitable way:** Driver, they always choose the shortest road because they think it is the best way which spend time most. However, there are too many vehicles make the density increase and it will lead to traffic congestion.

**Density changes suddenly:** In some situations, the limited roads which is damaged or lockdown by some internal and external factors like festivals, limited roads or maintenance also causes density in a road decrease. If there is no notice before, it will lead to congestion.

1. Related Work
   1. Existing work and solution

Evaluation of the Application:

The Traffic Density Detection seeks to address the problems by automating the process of traffic density identification through IoT and machine learning. By providing the accurate and reliable dataset, this system can notice to driver timely and reduce the traffic congestion.

Application Evaluation:

Scalability: The system is scalable and can handle large datasets. The more images are provided, the more accuracy the system is. With a large data, it will provide enough cases, and make the system get the better knowledge.

Practical Impact: By offering an affordable and accessible solution, the system can significantly reduce wasted time for countries, ensuring that everyone who use it can get benefit. The driver can have more free time, and work effectively. Governments and companies also solve a dilemma.

Evaluation of the Tools and Techniques:

The heart of the traffic density detection system is computer vision and deep learning, specifically CNNs. This system has so many advantages like automatic feature extraction, highly accurate at image recognition and classification, weight sharing, minimizes computation, use same knowledge across all image locations, ability to handle large dataset and hierarchical learning.

Evaluation of the Techniques:

Definition:

The Convolutaional Neutral Networks (CNNs): used to classify density images into different categories. Their ability to automatically learn spatial hierarchies of features from images makes them ideal for task.

Training: In this syste

Evaluation of the Tools:

Definition:

Python: This programming language due to its widespread use in AI. It has a variety of library which help created system easily such as OpenCV, scikit-learn,…

OpenCV: short for Open-Source Computer Vision Library, is an open-source computer vision and machine learning software library. Originally developed by Intel, it is now maintained by a community of developers under the OpenCV Foundation.

* 1. Gaps and challenges in current Approaches

1. Methodology
   1. Proposed Method
   2. Data and tools
   3. System Architecture
   4. Challenges and Assumptions
2. Results and Evaluation
   1. Implementation
   2. Results and Evaluation
   3. Demo Program
3. Evaluation and Conclusion
   1. Evaluation
   2. Conclusion