SYNOPSIS

Report on

Vehicle Classification Using ANN on NVIDIA DGX100

by

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ABSTRACT

This paper presents a novel approach to vehicle classification using Artificial Neural Networks (ANN) on the powerful NVIDIA DGX100 platform. The escalating complexity of traffic management systems makes efficient and accurate vehicle classification for various applications, including traffic flow optimization, surveillance, and law enforcement. Traditional methods often struggle with real-time processing demands and the complexities of diverse vehicle types.

Our proposed system addresses these challenges by handling the computational prowess of the NVIDIA DGX100 and the capability of ANN for pattern recognition. We employ a deep learning architecture that learns intricate features from raw vehicle images, enabling robust classification across multiple classes such as cars, trucks, buses, and motorcycles.

The NVIDIA DGX100, with its parallel processing capabilities and optimized deep learning frameworks, facilitates rapid model training and deployment, crucial for real-time applications. We use the computational efficiency of the platform to train large-scale ANN models on extensive datasets, ensuring superior classification accuracy and scalability.

Experimental results demonstrate the effectiveness of our approach, showcasing high classification accuracy even in complex real-world scenarios with varying lighting conditions, conclusions, and backgrounds. Furthermore, the deployment of the trained model on the NVIDIA DGX100 enables seamless integration into existing traffic management systems, providing enhanced capabilities for efficient traffic monitoring and control.

Additionally, the proposed system offers flexibility and adaptability to evolving traffic environments. Through continuous learning and regulating mechanisms, the Artificial Neural Networks (ANN) model can dynamically adjust to changes in vehicle characteristics and traffic patterns. This adaptability is crucial for maintaining high classification accuracy over time, especially in dynamic urban settings where vehicle types and behaviours may evolve.

Furthermore, the scalability of the solution makes it suitable for deployment in diverse geographical locations and infrastructure setups. The NVIDIA DGX100's parallel processing architecture allows for efficient utilization of computational resources, enabling the system to handle increasing data volumes and processing demands as traffic monitoring requirements grow. This scalability ensures that the proposed vehicle classification system remains viable and effective across various deployment scenarios, contributing to the development of smarter and more responsive transportation ecosystems.

In conclusion, our study demonstrates the potential of using Artificial Neural Networks (ANN) on advanced computing platforms like the NVIDIA DGX100 for robust and scalable vehicle classification. This research contributes to the advancement of intelligent transportation systems, making the safer and more efficient urban mobility solutions.

TABLE OF CONTENTS

1. Introduction

In the era of undeveloped urbanization and escalating vehicle traffic, efficient management and monitoring of roadways have become important. Traditional methods of traffic management often fall short in coping with the complexities of modern traffic systems, necessity of innovative solutions to address challenges such as congestion, safety, and impact on environment. Among these solutions, the application of Artificial Intelligence (AI) and deep learning techniques stands out for its potential to revolutionize how we analyse and regulate traffic flow.

This project focuses on the paper for of a sophisticated vehicle classification system leveraging Artificial Neural Networks (ANN) and the high-performance computing capabilities of the NVIDIA DGX100 platform. Vehicle classification, the process of categorizing vehicles into distinct classes based on their characteristics, holds immense significance for various applications including traffic flow optimization, law enforcement, and urban planning.

The integration of ANN with advanced computing platforms like the NVIDIA DGX100 offers a compelling approach to address the challenges of real-time vehicle classification. The parallel processing capabilities of the DGX100, coupled with optimized deep learning frameworks, enable rapid training and deployment of complex neural network models, crucial for achieving high classification accuracy.

Requirements: -

i. Hardware –

Processor: Pentium i3 or higher.

RAM: 4 GB or higher.

Hard Disk Drive: 20 GB (free).

Peripheral Devices: Monitor, Mouse and Keyboard

ii. Software –

Operating system: Windows 8/10.

IDE Tool: PyCharm

Coding Language: Python 3.6

APIs: Keras, OpenCV, NumPy, Matplotlib, CUDA

Modules: -

- **Data Acquisition module:**

  This model is responsible for collecting raw image data from various sources such as video feeds but we are taking a dataset from the Kaggle for this system that make it easy to train this system for processing.

- **Data Preprocessing module:**

  This module cleans and prepares the collected vehicle data for analysis. This may involve tasks such as removing duplicate images, data augmentation (e.g. rotation, flipping), and noise reduction.

- **Neural Network Architecture Module**:

  This module involves designing the architecture of the artificial neural network (ANN) for vehicle classification.

- **Model training module:**
  - This module is responsible for training the neural network using labeled data.
  - It involves selecting appropriate loss functions, optimization algorithms (e.g., stochastic gradient descent, Adam), and hyperparameters.

- **Model evaluation module:**

  This module evaluates the performance of the trained model on a held-out test set. This helps to determine how well the model will generalize to new data.

  Metrics such as accuracy, precision, recall, and F1 score can be computed to assess the classification performance across different vehicle classes

- **Model deployment module:**

  This module involves deploying the trained model for real-time inference on the NVIDIA DGX100 platform.

2. Literature Review:

Vehicle classification in Indian traffic presents unique challenges, prompting research into convolutional neural networks (CNNs) for accurate classification. Studies examine deep learning methods tailored to diverse Indian road conditions, emphasizing efficiency and real-time performance. Optimization efforts aim to enhance classification accuracy, critical for effective traffic management and safer roads in India. The adaptation of CNNs for Indian traffic scenarios underscores the importance of developing robust and efficient classification systems. By leveraging deep learning techniques, researchers strive to address the complexities of Indian road environment.

3. Project / Research Objective:

1. **Adapt CNNs for Indian Traffic:** Optimize CNNs to handle diverse vehicle types, variable road conditions, and unpredictable traffic patterns in Indian traffic environments.
2. **Enhance Classification Accuracy:** Improve accuracy by optimizing deep learning techniques and neural network architectures for better feature extraction.
3. **Optimize for Efficiency:** Focus on computational efficiency and real-time performance for timely and accurate vehicle classification in dynamic traffic scenarios.
4. **Address Unique Challenges:** Identify and tackle challenges like varying lighting conditions and non-standard vehicle configurations prevalent in Indian road conditions.
5. **Evaluate Performance:** Conduct thorough evaluation experiments to assess system performance under diverse Indian traffic conditions, validating against benchmark datasets and existing methods.

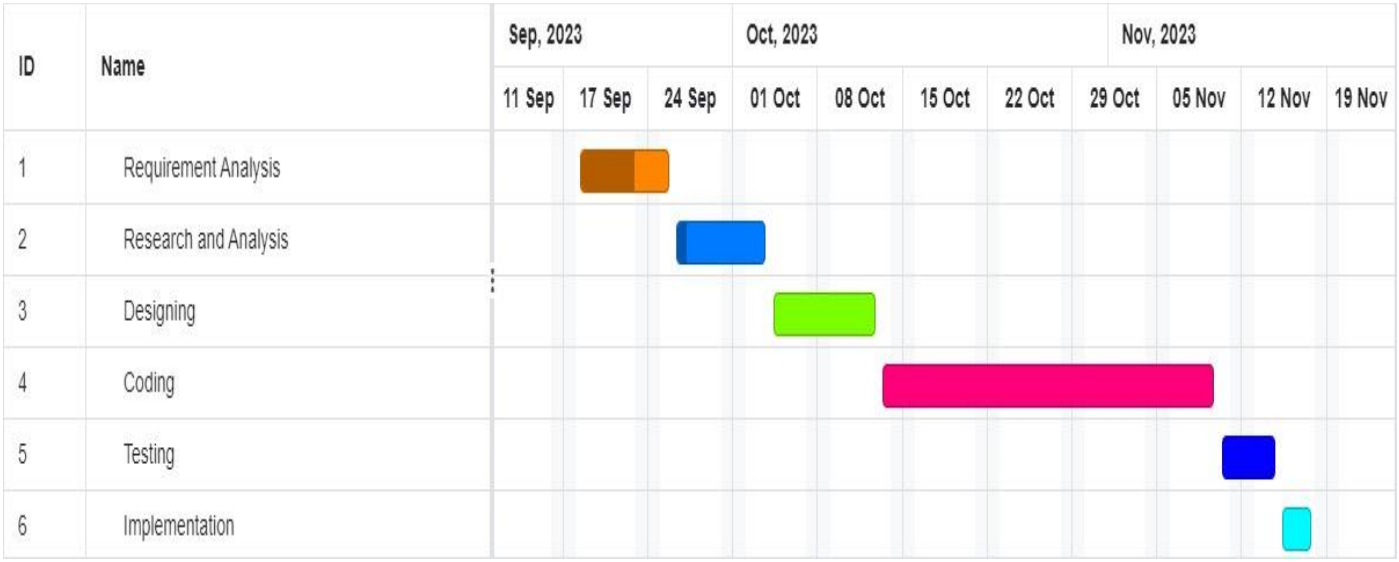
4. Project Outcome

The anticipated outcomes of this research project include:

1. **Robust Vehicle Classification System:** Development of a robust vehicle classification system tailored to Indian traffic scenarios, capable of accurately identifying and categorizing vehicles in diverse road conditions.
2. **Improved Accuracy and Efficiency:** Enhancement of classification accuracy and computational efficiency through optimized convolutional neural networks (CNNs) and deep learning techniques.
3. **Real-time Performance:** Achievement of real-time performance for timely and accurate vehicle classification in dynamic traffic scenarios, facilitating effective traffic management and monitoring.

4. **Adaptation to Indian Road Conditions:** Adaptation of the classification system to address the unique challenges posed by Indian road conditions, including varying lighting conditions and non-standard vehicle configurations.
5. **Validation and Validation:** Validation of the developed system through extensive evaluation experiments, comparing against existing methods and benchmark datasets, ensuring reliability and effectiveness in practical applications.

5. Proposed Time Duration



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