Title Page:

An Effective Approach for Classification of Traffic Vehicles in Moving Object Tracking using Novel Deep sort algorithm over Multilayer Perceptron to Improve Accuracy

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Keywords: Deep Learning, Machine learning, Multilayer Perceptron, Novel Deep Sort, Object detection, Traffic, Vehicle.

ABSTRACT

Aim: The proposed work focuses on Classification of Traffic Vehicles in Moving Object Tracking using Novel Deep Sort, algorithm over Multilayer Perceptron based on Accuracy. **Materials and Methods:** Vehicle classification in traffic is performed by Novel Deep Sort, (N=24) of sample size and Multilayer Perceptron of sample size (N=24), obtained by G power of 80%. **Results**: Novel Deep Sort, has the accuracy of 88.54% which is relatively higher than Multilayer Perceptron which has accuracy of 83.63% and it shows that there is statistical significance difference between the Novel Deep Sort, algorithm with Multilayer Perceptron with p=0.037 ($p<0.05$). **Conclusion**: Novel Deep Sort, has higher accuracy of 88.54% in classification of vehicles Multilayer Perceptron algorithm of accuracy 83.63%.

Keywords: Deep Learning, Machine learning, Multilayer Perceptron, Novel Deep Sort, Object detection, Traffic, Vehicle.

INTRODUCTION

Deep learning is the act of teaching multilayer neural networks to automatically recognize complex patterns in data (Yu et al. 2022) opening up a wide range of useful applications such as natural language processing and picture identification (Chen et al. 2021) Its power comes from its capacity to independently extract complex characteristics from massive datasets (Gu, Zhu, and You 2023) which positions it as an authority in a number of industries, including language comprehension, autonomous systems, and healthcare. The primary issue is the vehicle's lack of accuracy during classification (Chetouane et al. 2022). Intelligent transportation systems use this efficient method of classifying traffic vehicles among moving objects for real-time traffic control and monitoring. This technology facilitates analysis of data for better urban mobility, improves traffic flow, and increases road safety (Parekh et al. 2022).

In the research work, various articles are available which performed research on classification of moving objects for vehicle in traffic are found in IEEE xplore, ScienceDirect and springer. 603 journals are found form IEEE Xplore digital library, 3958 articles from science direct, 13476 articles articles from springer. Research work (Huang et al. 2021) contains more citations 64 times and is about the vehicle classification on traffic. The article (Dewangan and Sahu 2021) contains more citations 62. The article provides the road classification of convolutional neural networks for intelligent vehicle systems. Article (Jagannathan et al. 2021) contains more citations 51 times and is about the multiple Vehicle detection using deep learning . The article (Lin, Jeng, and Lioa 2021) contains more citations 35 times and it's about the enhanced vehicle detection using YOLOv5 method for vehicle detection and to improve detection accuracy. The article (G. Xu et al. 2021) his paper provides a survey of deep learning techniques for vehicle detection .

The existing problem with is the current algorithm on vehicle Detection, classification and counting on highways using YOLOv5l, YOLOv5m, YOLOv5n and YOLOv5s which give low accuracy (Dewangan and Sahu 2021). The novel algorithm aims to utilize advanced deep learning techniques for enhanced accuracy by combining a unique Multilayer Perceptron with the reliable Novel Deep Sort algorithm. (Tan and Yeh 2021) a Novel approach on Novel Deep Sort and Multilayer Perceptron which as given high accuracy to classify the vehicles.A previously employed technique for classifying vehicles in traffic is the feature-based classifier based on Haar features (Llorca, Martínez, and Daza 2021) Following the implementation challenges include resource-intensive computations, sensitivity to environmental variables, and difficulties handling a variety of traffic circumstances. These challenges call for ongoing developments to improve robustness and flexibility. The goal is to increase and make it more effective approach for classification of traffic vehicles in moving object tracking using the Novel Deep Sort, algorithm over Multilayer Perceptron based on accuracy.

MATERIALS AND METHODS

The Saveetha Institute of Medical and Technical Sciences well-equipped AR and VR lab was the site of research activities at the Saveetha School of Engineering. where a high configuration system is installed in the lab to conduct research and obtain results. Two groups with a sample size of 24 were taken into consideration for the review.80% of the G-power value with a 0.05 alpha value and 0.8 beta value with a 95% confidence interval are derived from the computation. (Kaur and Randhawa 2022)

The detection of automobiles in traffic videos file dataset is the dataset used in this suggested work. This Kaggle dataset can be downloaded. A traffic CCTV film and a few regular videos make up the 2GB file dataset. There are moving vehicles in the video. The dataset used in this recommended research is an mp4 file containing some vehicles, as it deals with the recognition of moving objects in traffic. This work proposes an algorithm that is implemented using a dataset and compares the outcome with a comparison algorithm (Taheri Tajar, Ramazani, and Mansoorizadeh 2021)

Google Colab, sometimes known as Colaboratory, is a cloud-based platform that gives users access to a free interactive Python code editor and runtime. Its quick Google Drive connection, GPU resource access, and collaborative capabilities make it especially popular in the machine learning and data science sectors. It is an accessible and potent tool for a variety of computational jobs since users can run code in a browser, create and share Jupyter notebooks, and utilize Google's computational resources (Taheri Tajar, Ramazani, and Mansoorizadeh 2021)

Novel Deep Sort algorithm

The traffic vehicle categorization from sample size preparation group 1 is used by the Novel Deep Sort method to track moving objects based on accuracy. Multiple deep learning algorithms are combined in Novel Deep Sort to produce complex embeddings that accurately capture visual information about vehicles. Novel Deep Sort is a useful technique for accurately tracking and classifying automobiles in dynamic traffic scenarios. Novel Deep Sort ability to manage challenges, improve online learning, and provide novel identification is very helpful to innovative traffic surveillance systems as it improves multi-object tracking precision. Novel Deep Sort is particularly good at accurately tracking and classifying autos in dynamic traffic scenarios. Novel Deep Sort improves the vehicle's direction accuracy. Because Novel Deep Sort may re-identify, it is an essential part of contemporary traffic management systemsWhen combined, these attributes provide a complete solution for accurate quick tracking in various traffic scenarios. Novel Deep Sort pseudocode algorithm shown in Table1 (Wu et al. 2023)

Multilayer Perceptron

The traffic vehicle categorization from sample size preparation group 2, An inventive development in neural network architectures is the Multilayer Perceptron (MLP). It can detect complex patterns and correlations in data since it usually consists of several hidden layers of linked nodes. The Novel MLP is distinguished by its potential for improvements, such the incorporation of novel activation functions, regularization strategies, or architectural changes with the goal of enhancing the precision of traffic vehicle categorization during moving object tracking. This novel method makes use of the MLP's ability to learn complicated features in order to overcome obstacles and improve performance in settings with changing traffic. proposed MLP pseudocode algorithm shown in Table 2 (Biddle and Fallah 2021)

Statistical Analysis

IBM SPSS (27.0) to examine the standard error mean, mean, and standard deviation value, statistical software was utilized. Independent values for a video frame. In this research project, recorded video data is input, Frame ID is used as a dependent variable, and a T-test analysis is performed (Ullah et al. 2022)

RESULTS

The pseudocode of Novel Deep Sort can be found in table 1. The required libraries are imported from training with the dataset, a data set is divided into two sets of models for testing and training, and those are assigned to different functions to calculate accuracy.

The pseudocode of Multilayer Perceptron can be found in table 2. The required libraries are imported from training with the dataset ,a data set is divided into two sets of models for testing and training ,and those are assigned to different functions to calculate accuracy.

In table 3, the video dataset table accuracy is represented for both Novel Deep Sort and Multilayer Perceptron.

Table 4 represents the N (24), mean (88.54), std.Deviation(2.395), std.error mean values (0.489) for the Novel Deep Sort and N (24), mean (83.63), std.Deviation 3.306, std.error mean values (0.737) for Multilayer Perceptron.

Table 5 represents the T-test values of statistical independence samples. The mean difference is 4.917, std.error difference is 0.884 and 95% Confidence Interval and it shows that there is statistical significance difference between the Novel Deep Sort and Multilayer Perceptron with $p=0.037(p<0.005)$.

Figure 1 represents Line Graph for Accuracy values for N=24 iterations for Novel Deep Sort Model. X-axis:iterations, Y-axis:Accuracy values.

Figure 2 represents Line Graph for Accuracy values for N=24 iterations Multilayer Perceptron for X-axis:iterations, Y-axis:Accuracy values.

Figure 3 represents Line Graph for Accuracy values for N=24 iterations for both DeepSort and Multilayer Perceptron. X-axis:iterations, Y-axis:Accuracy values. The Blue line indicates the Novel Deep Sort algorithm and the Red line indicates the Multilayer Perceptron algorithm. By the above graph Novel Deep Sort has higher Accuracy then Multilayer Perceptron.

Figure 4 is a bar graph which represents the T-test results for the Novel Deep Sort and Multilayer Perceptron. It clearly shows that the accuracy rate of Novel Deep Sort has higher accuracy than the Multilayer Perceptron.

DISCUSSION

Significance is determined through analysis of the results of an independent T-test. Novel Deep Sort accuracy is 88.54, greater than the Multilayer Perceptron 83.63 accuracy, and the difference between the two groups is significant. The significance value is 0.037, which is less than 0.05, which is significant.

In the recent survey, the Novel Deep Sort algorithm has been found to have more promising accuracy than the other real world algorithms (Safavi et al. 2021). The present framework will combine the two datasets with the data collected from the users and found that the Novel Deep

Sort has provided the best accuracy (Yin et al. 2023). Proposed Novel Deep Sort algorithm has been significantly faster than the other gradient boosting methods and has more precise accuracy by all means. The results can be developed by implementing new features and picking the best data set (Q. Xu et al. 2021). Some of the researchers have proposed the Novel Deep Sort algorithm in some of their research articles and concluded that the Novel Deep Sort algorithm has provided better results than the other Deep learning algorithms (Bibi et al. 2021). Some of the articles have proposed the Decision tree Multilayer Perceptron ,SVM algorithm to classify the vehicles in traffic and found it had provided better accuracy in some cases than our proposed Novel Deep Sort algorithm (Kraft et al. 2021). In some research surveys some of the researchers have implemented the Multilayer Perceptron algorithm to provide future An Effective Approach for Classification of Traffic Vehicles in Moving Object Tracking and found out that it provided more accurate results than our Novel Deep Sort algorithm (Yeong et al. 2021).

The classification study of traffic vehicle classification in moving object tracking. To improve overall performance, it is important to evaluate the algorithm's accuracy, computing efficiency, and flexibility in response to changing traffic conditions. The study's generalizability across a range of traffic situations may be limited, which could have an effect on the extent the suggested strategy can be applied. Reliability in real-world traffic settings may be restricted by reliance on quality labeled training data and possible sensitivity to variations in data quality. Subsequent investigations may examine the amalgamation of sophisticated sensor technologies and instantaneous data processing to augment precision in traffic vehicle categorization. Also examining if adaptable and scalable the suggested strategy is for developing smart cities infrastructures presents avenues for further exploration.

CONCLUSION

By utilizing multiple datasets and comparing the accuracy values of the two algorithms, the Novel Deep Sort algorithm achieves a higher accuracy rate of 88.54 than the Multilayer Perceptron algorithm, which is 83.63, for tracking and classifying moving vehicles in traffic. When Novel Deep Sort is used instead of Multilayer Perceptron, it performs better and has a higher classification rate.

DECLARATIONS

Conflict of Interest

No conflict of interest in this manuscript.

Authors Contributions

Author MK was involved in methodology, text analysis and writing the manuscript. Author ND was involved in review and editing, supervision and validation.

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TABLES AND FIGURES

Table 1. Deepsort Pseudo code. Transformers play a key role in Novel Deep Sort . It analyzes the vehicles in traffic

Input: Video dataset
Output: Accuracy
Step1: **Data Collection and Labeling:** ● Collect a labeled dataset with features extracted from tracked vehicles in traffic, including attributes like size, speed, and color. ● Label each example with the corresponding vehicle class.
Step 2: **Data Preprocessing:** Preprocess the dataset by handling missing values, normalizing numeric features, and encoding categorical variables if needed.
Step 3: **Train Novel Deep sort:** Train a Novel Deep Sort classifier using the preprocessed dataset.
Step 4: **Evaluate Novel Deep Sort** : Assess the performance of the Novel Deep Sort on a testing set to calculate accuracy and other relevant metrics.
Step 5: **Integration with Object Tracking:** Integrate the trained Novel Deep Sort classifier with the object tracking system to classify vehicles in real-time
Step 6: **Visualization:** Optionally, visualize the results by displaying tracked objects along with their assigned classifications.

Table 2. Multilayer Perceptron Pseudocode. Transformers play a key role in Multilayer Perceptron. It analyzes the vehicles in traffic

Input: Video dataset
Output: Accuracy
Step1: ● Data collection ● Video data set ● Data processing
Step2:Define the MLP Architecture ● Number of neurons corresponding to input features (e.g., vehicle characteristics) ● Specify the number of hidden layers and neurons in each layer
Step3: Initialize Training Parameters Train a multilayerPerceptron classifier using the preprocessed dataset
Step4:Forward Propagation ● Pass the output of one layer as input to the next layer ● Compute the weighted sum and apply the activation function for each neuron in each layer
Step5:Train Multilayer Perceptron Train a multilayerPerceptron classifier using the preprocessed dataset
Step6:Real-time Object Tracking Real time object classification using the multilayer perceptron.classify the vehicles
Step7:Prediction and Evaluation ● Perform forward propagation with the trained weights and biases ● Output the predicted class based on the highest probability in the output layer

Table 3. With N=24 sample size ,video data input is taken, the accuracy rate is calculated in every for Novel Deep Sort and Multilayer Perceptron. The Novel Deep Sort has more accuracy compared to the Multilayer Perceptron.

S.No	Novel Deep Sort Accuracy (%)	Multilayer Perceptron (%)
1	89	85
2	88	82
3	86	86
4	88	86
5	86	82
6	88	80
7	89	86
8	899	87
9	90	87
10	96	82
11	88	85
12	87	85
13	95	80
14	88	87
15	88	87
16	86	87
17	87	86
18	88	79
19	87	88
20	89	77
21	88	86
22	87	80
23	89	75
24	89	82

Table 4. Statistics for independent samples comparing Novel Deep Sort with Multilayer Perceptron algorithm. In Novel Deep Sort , the mean accuracy is 88.54, whereas in Multilayer Perceptron it is 83.63. Novel Deep Sort has a standard deviation of 2.395 and Multilayer Perceptron has a standard deviation of 3.609. Standard error mean for Novel Deep Sort 0.489 is and Support Vector Machine 0.737.

Group Statistics					
	Algorithm	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Accuracy	DS	24	88.54	2.395	0.489
	NMP	24	83.63	3.609	0.737

Table 5. T-Test for Statistical Independent Samples comparing Novel Deep Sort with Multilayer Perceptron algorithm, 95% Confidence Interval. It shows that there is statistical significance difference between the Novel Deep Sort algorithm and Multilayer Perceptron with $p=0.037(p<0.05)$

Independent Samples Test										
		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
		F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
									Lower	**Upper**
ACCURACY	**Equal variances assumed**	9.632	0.003	5.560	46	0.037	4.917	0.884	3.137	6.697
	Equal variances not assumed			5.560	39.968	0.039	4.917	0.884	3.130	6.704

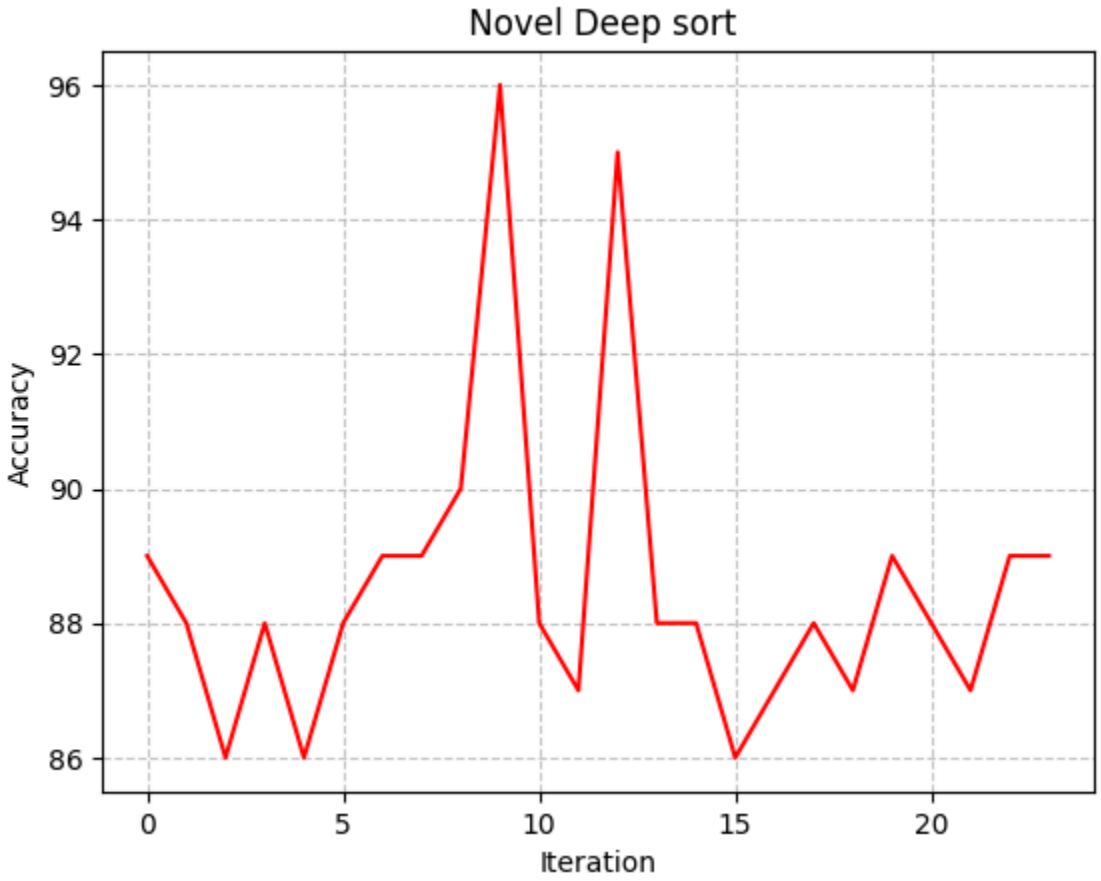

Fig. 1. Line Graph for Accuracy values for N=24 iterations for Novel Deep Sort Model. X-axis:iterations, Y-axis:Accuracy values.

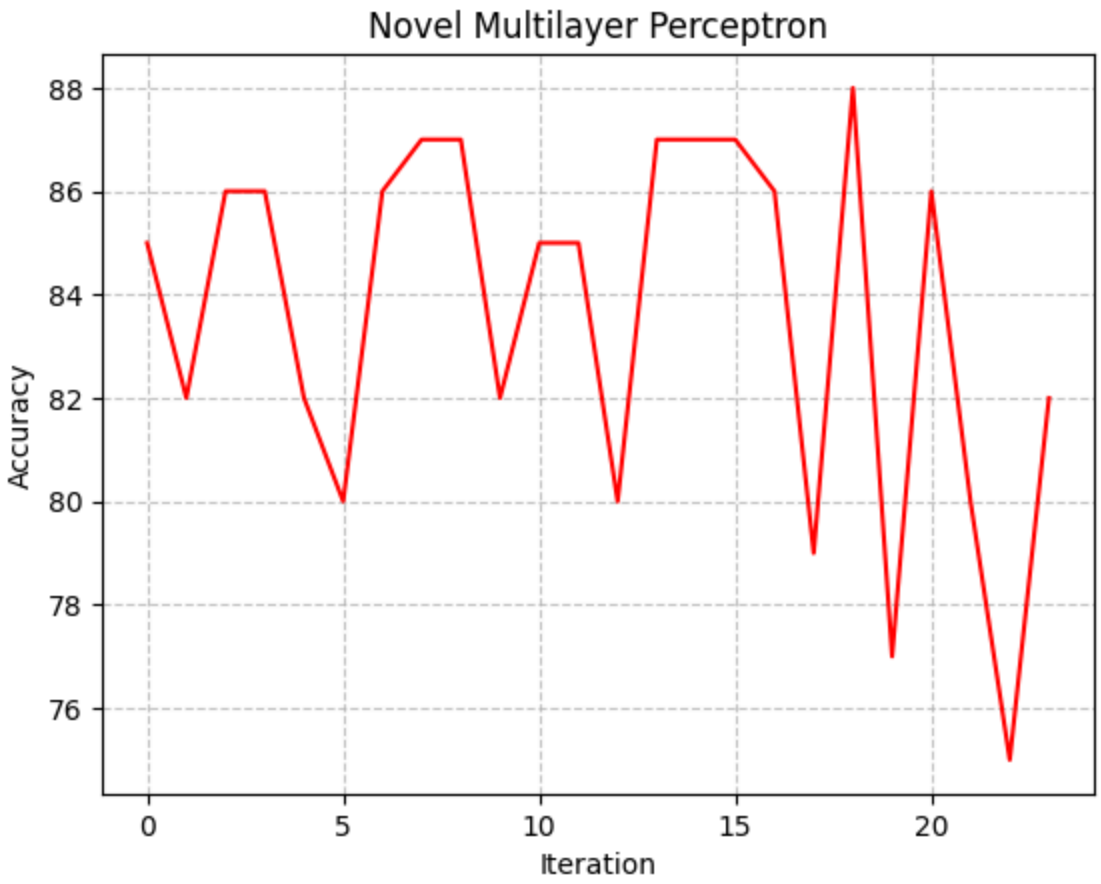

Fig. 2. Line Graph for Accuracy values for N=24 iterations Multilayer Perceptron for X-axis:iterations, Y-axis:Accuracy values

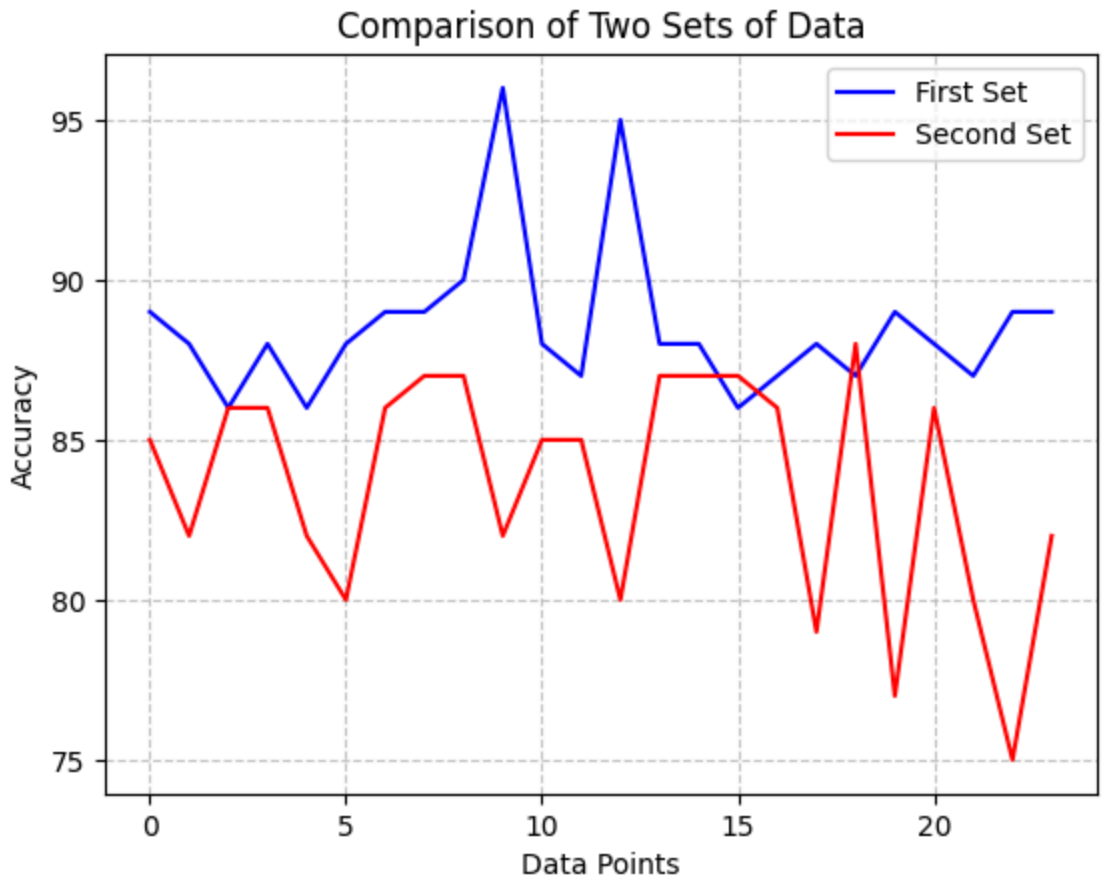

Fig. 3. Line Graph for Accuracy values for N=24 iterations for both DeepSort and Multilayer Perceptron. X-axis:iterations, Y-axis:Accuracy values. The Blue line indicates the Novel Deep Sort algorithm and the Red line indicates the Multilayer Perceptron. By the above graph Novel Deep Sort has higher Accuracy then Multilayer Perceptron.

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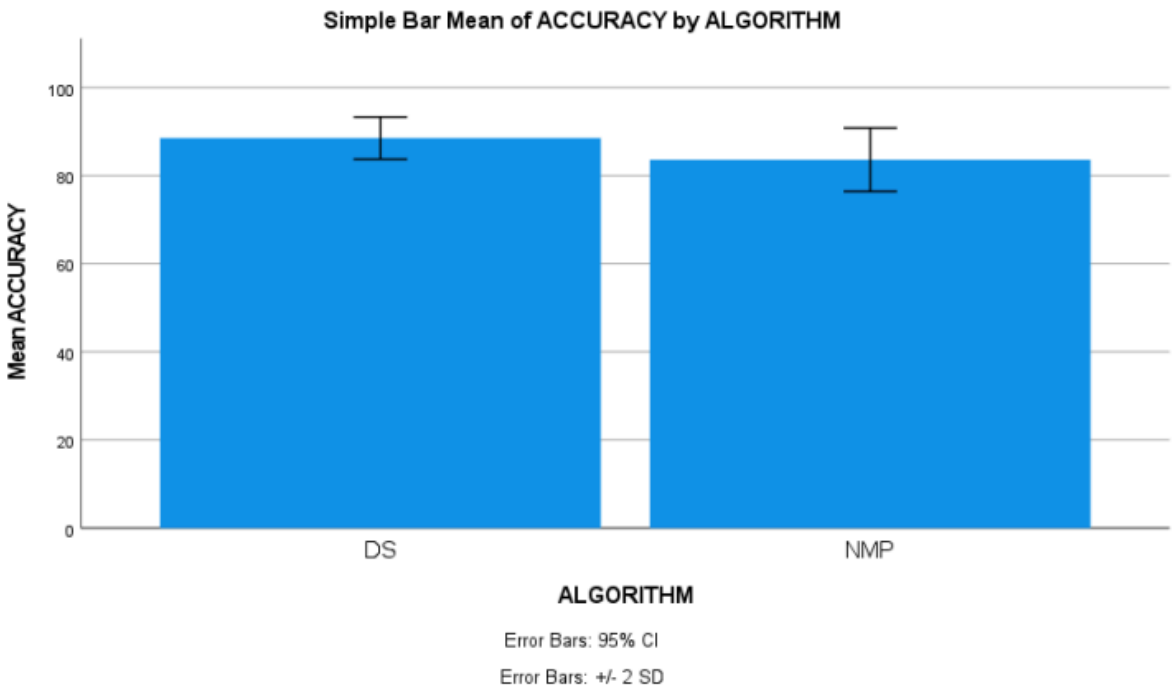

Fig. 4. The mean accuracy comparison between the Novel Deep Sort and Multilayer Perceptron algorithm shows that Novel Deep Sort has a higher mean accuracy of 88.54, compared to the 83.63 of Multilayer Perceptron. The standard deviation of Novel Deep Sort is also lower than that of the l Multilayer Perceptron algorithm. On the X-axis: Novel Deep Sort vs. Multilayer Perceptron algorithm, and on the Y-axis: Mean Accuracy. The error bar is represented by ± 2 SD.