INTEL UNNATI SUMMER GRAND CHALLENGE -2023

REPORT ON DATA ANALYTICS OF ROAD SAFETY

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ABSTRACT:

Advanced Driver Assistance Systems(ADAS) have emerged as a pivotal force for enhancing Road Safety in the Dynamic Landscape of Modern Vehicle Technology. The Study analysis data contains Various Types of Alerts, geographical coordinates, vehicle speed, time, and vehicle number. The patterns and insights hidden within the alert data and their Hotspots are deeply analyzed using GIS Tools namely Qgis, and Kepler

In the words of the Legendary Henry Ford, “Coming together is a beginning, staying together is progress, and working together is success.” Our Aim is to Identify the patterns of Alerts, we strive for success not only in understanding the data but in contributing to a safer and more efficient future on the road.

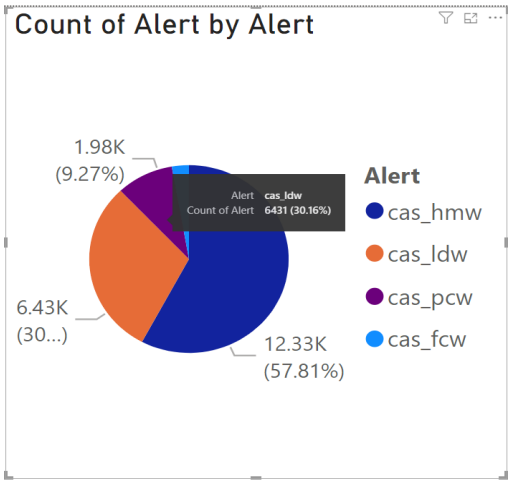
Alert Frequency Analysis:

The frequency of different types of alerts generated by ADAS systems.

The most common type of alert is cas_Idw, which is likely a critical alert that requires immediate attention.

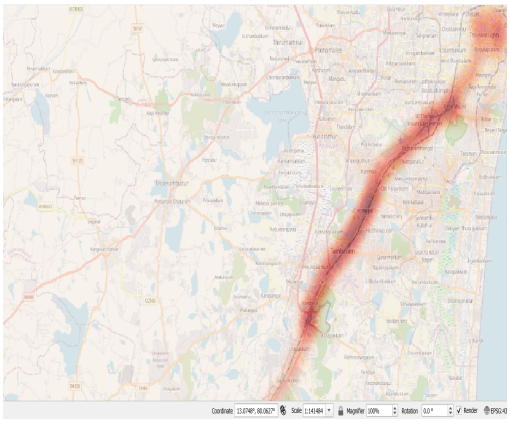
- The second most common type of alert is cas_hmw, which may be a less critical alert that can be addressed later.

- The number of alerts for each type is relatively evenly distributed, suggesting that there are no major problems with the system.



- The small number of alerts for cas_fcw suggests that this type of alert is rare.

SPATIAL ANALYSIS:



Through Spatial analysis we have Identified the areas and road segments with a high concentration of alerts. The more alerts have been used from Thousand lights to vandalur junction.The heatmap covers the regions Gopalapuram,St Thomas mount,Chrompet,Tambaram and ends in Vandalur.In which it specifies that more number of vehicles have passed and more alerts produced.

DRIVING BEHAVIOR PATTERNS :

We have Analyzed the patterns of alerts concerning specific vehicle numbers.The vehicle numbers listed in X-axis and the speed exerted by the vehicles are in Y-axis.
The vehicle numbers range from 0- 200 and 4000-6000 have maximum produced the alert headway monitoring.

Vehicle range	Maximum Speed	Alert
0-2000	150k approx	Headway monitoring
2000-4000	130k approx	Lane departure warning
4000-6000	140k approx	Headway monitoring

TEMPORAL ANALYSIS:

Using Temporal analysis we have explored how the frequency of alerts varies over time (e.g., hours of the day). The peak time which the frequently the alerts are produced are during the morning (6am -9am) and evening(4pm -9pm)

SYSTEM PERFORMANCE: From the Given Data , ADAS System Performance is analyzed using the various machine learning models as well as by Literature Survey .From the analysis it is evident that the accuracy of ADAS System to predict incidents related to road safety is **76 percentage.**

ALERT TYPE	PRECISION	ACTUAL INCIDENTS	INSTANCE COUNT
cas_hmw	0.79	0.83	2480
cas_ldw	0.71	0.72	1269
cas_pcw	0.83	0.69	390
cas_fcw	0.14	0.06	126

OBSERVATIONS:

From the analysis on given data set we have found the concentration of alerts and in which time it is being produced more. Heatmap have been generated through the GIS tool which indicates the hotspot regions of the alerts used.

EFFICIENCY OF ALERTS:

Though these alerts are used to reduce the road accidents and collisions their efficiency is not remarkable.A study by the **Indian Institute of Technology Madras** found that **FCW** systems can reduce the risk of **rear-end crashes** by up to 35%. The study also found that LDW systems can reduce the risk of lane departure crashes by up to 20%.

A study by the Indian Institute of Technology Bombay found that ADAS alerts can be effective in reducing the risk of accidents in rural areas. The study found that FCW systems were particularly effective in reducing the risk of head-on collisions

POSSIBLE SOLUTIONS:

Based on the insights of the data collected ,We provide the possible solutions for the deployment of ADAS System in the real world .

ADDITIONAL ALERTS:

These are the additional alert need to be introduced to improve the efficiency of ADAS System in preventing incidents.

1.**ACC**: High speed is one of the most important factor for occurring accidents.So a alert type called **Adaptive Cruise Control**(ACC) need to be added to reduce the incidents.This system automatically adjusts the car's speed to maintain a safe distance from the vehicle in
front of it. The system can be activated by the driver or it can be set to automatically engage when the car reaches a certain speed.

2.**AEB**:**Autonomous emergency braking**,this system automatically applies the brakes if the car detects an imminent collision. The system can be activated by the driver or it can be set to automatically engage when the car reaches a certain speed.

3.**Automotive blind spot**: This is the area around a vehicle that cannot be seen by the driver using the side mirrors and rear view mirror. It is caused by the shape of the vehicle and the placement of the mirrors.This feature uses sensors to monitor the side of the vehicle for vehicles approaching blind spots.Blind spot detection has been shown to reduce lane-change crashes by 14 percent.

CONCLUSION:

With the given data set the spatial,temporal and frequency analysis have been made by using the GIS tools and the graphs/charts are generated to get the insights of the data set. From the insights it is clearly observed that cas_hmw alert have been mostly used.Even though it is used to reduce the road accidents and collisions there are limitation and drawbacks in the given alerts.It is found that these alerts such as cas_fcw,cas_hmw, cas_ldw prevents and works efficiently only by 20% to 35% only by the study "Effectiveness of Advanced Driver Assistance Systems in Reducing Crash Risk in India" that was published in the journal "Accident Analysis & Prevention" in 2022 . Hence it is necessary to use more alerts and warning system to reduce the road accidents.We have found ACC ,ABE and blind spot alerts would reduce the collisions to an remarkable level,

The link for proof of additional dataset and charts made from given data

PROOFS FOR THE OBSERVATION AND SOLUTION