

## Weekly Report Of CSE623

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### GROUP Cluster 555

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### **Task Done in This Week:**

#### Data Cleaning and Feature Validation

We continued processing the dataset organized into normal and abnormal trajectory folders. Error-prone entries like those with missing or invalid coordinates, were systematically removed to ensure consistency across our pipeline. We reaffirmed the key bounding box attributes frameNo, left, top, w, and h as primary features for vehicle tracking. Labels were verified across directories 10, 11, and 12, with corrections applied to directory 11 to improve annotation fidelity.

#### Feature Engineering

We recalculated bounding box centers using the formula  $(x,y)=(left+w/2,top+h/2)$   $(x, y) = (left + w/2, top + h/2)$ , incorporating logic to skip faulty data. Visualizations were improved by adjusting color brightness making red (abnormal) and green (normal) trajectories more distinguishable. Temporal precision was added to our TrackPoint class via timestamps, enabling time-aware analysis. The VehicleTrack class was also extended to capture trajectory duration.

#### Zone Modeling and Refinement

Our spatial model of the roundabout was refined. We transitioned from five coarse zones to a finer-grained seven-zone model, dividing the outer ring into 60-degree angular sections. This improves sensitivity to subtle directional changes. We also applied KMeans clustering to estimate the roundabout's center more robustly. The outer radius was set to encompass 90% of trajectory points with the inner radius defined as 40% of the outer one yielding a more compact central zone.

## Trajectory-to-Zone Mapping

We improved the `convert_df_to_track` function to log data issues and ensure accurate zone assignment. This function now better handles edge cases and enhances pipeline reliability.

- Speed: Adjusted to account for ground sample distance.
- Turn Angles: Dynamic thresholds ( $30^{\circ}$ – $60^{\circ}$ ) now scale with speed.
- Zone Sequences: Repeated zone visits are flagged as unusual.
- Trip Duration: Adjusted to normalize for varying path lengths.
- Sharp Turns: Detection was fine-tuned to reduce false positives.
- Zone Transitions: Entry into the central zone is weighted more heavily.
- Direction Variance: Now computed over smaller trajectory segments.
- Circular Adherence: Assessed via trajectory curvature.

## New Feature Lane Discipline Score

We introduced a metric for assessing lane discipline within the roundabout, which measures deviations from expected lane paths. This helps identify vehicles with erratic behavior, often indicative of abnormal driving.

A recent feature correlation analysis revealed that direction variance, maximum turning angle, and trip duration are the most predictive of abnormal behavior. Interestingly, the new lane discipline score also showed a moderate association, while zone transition frequency appeared less relevant. Visualizations were updated for clarity and readability.

- experimenting with DBSCAN clustering to uncover latent structure and anomalies in the trajectory data.

## **Tasks Planned for Next Week:**

- Report
- Explore the Time-C algorithm to look for time-based patterns, like changes in speed or pauses, in our trajectories.