HERE Technologies hackathon

Angle-based cycle detection with indegree filtering

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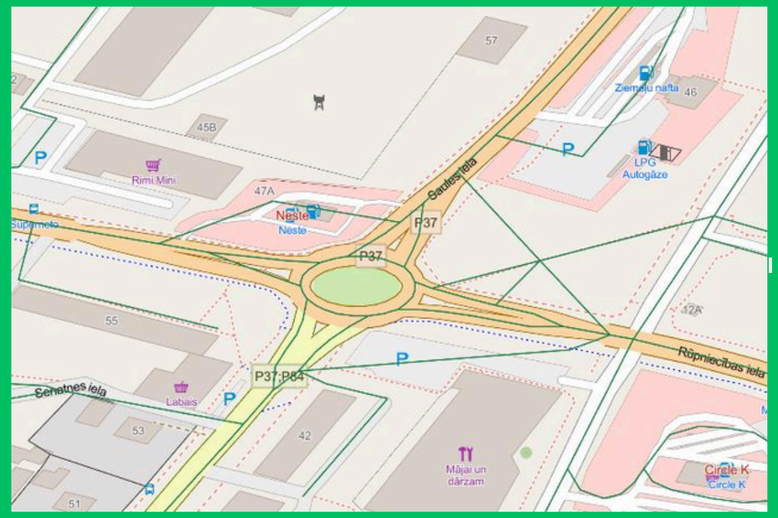
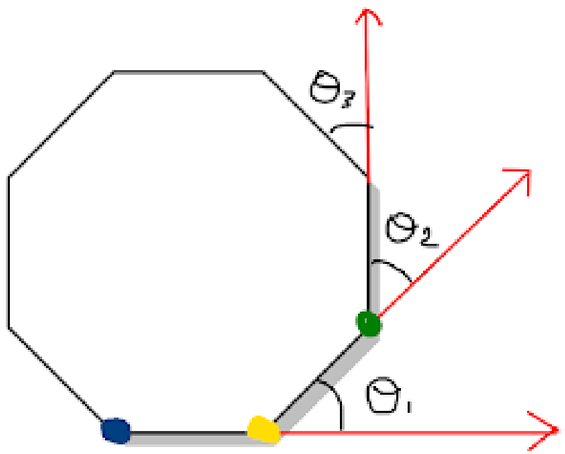


Problem Statement

Database includes roundabouts, which are circular intersections allowing traffic to flow continuously in one direction around a central island. However, some roundabouts are missing in our database, and a provided source contains roundabout geometries but lacks the attributes necessary for proper identification and integration.

Our Solution



1) θ2 > 0

2) | θ2 - θ1 | <= 5

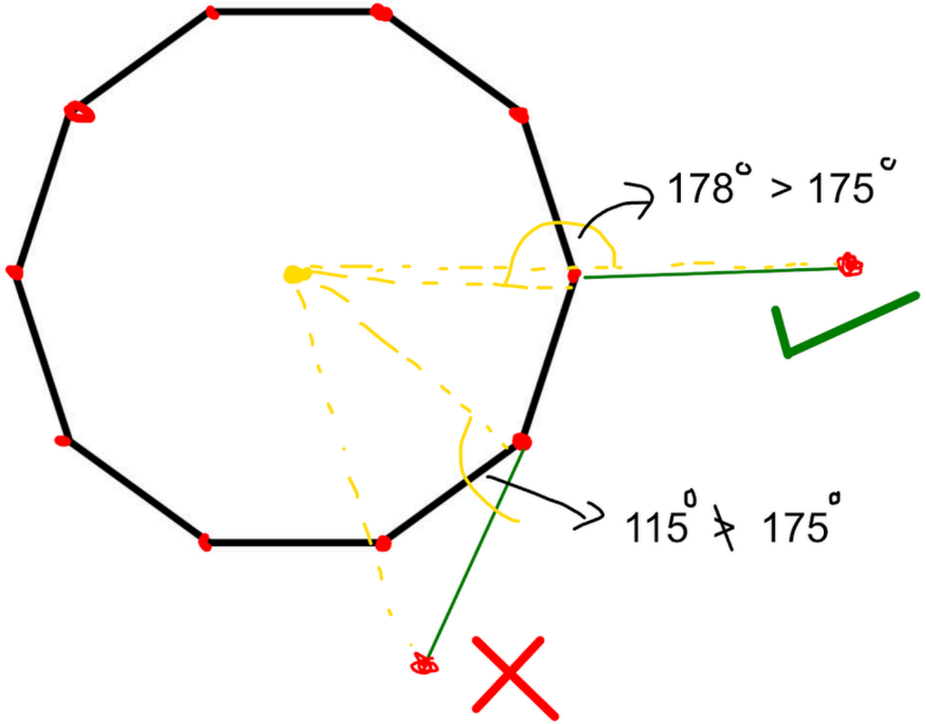
01

Convert LINESTRING from SHP file into a graph using an adjacency list. Each line segment becomes an edge, and each coordinate becomes a node.

02

Use DFS traversal starting from each edge. Move forward only if the difference in the current angle and the previous angle turn is between 0° and 5°, detecting circular loops.

Our Solution



03

For each detected loop, we calculate its center by averaging all the node coordinates and estimate the loop's radius. Then, we examine adjacent roads to see if any intersect the loop nearly perpendicularly (within ±10°). Loops are retained only if they have more than five such intersecting roads.

04

Extract all unique nodes from filtered loops. Match these nodes against original LINESTRINGs in SHP file. Mark each LINESTRING as YES or NO based on whether it contains a loop node.

Speed

1 Million Nodes ~
1 Minute

1.5 Million Nodes ~
1.5 to 2 Minute

Performance

Time Complexity

α = max number of points in turnaround

N = number of nodes

M = number of edges

$$\alpha \times (N + M) + M \log N$$

Thank You

https://github.com/PranayFadtare/HERE_SPIT_HACKATHON_2025