

HERE TECHNOLOGIES

HACKATHON SOLUTION

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OUR SOLUTION

PROVIDE AUTOMATED AND INNOVATING SOLUTIONS
FOR THE POSSIBLE SCENARIOS OF VIOLATION IN
VALIDATION RULES

SCENARIO #1: NO POI IN REALITY
SCENARIO #2: POI PLACED ON INCORRECT SIDE
OF THE ROAD
SCENARIO #3: INCORRECT MULTIPLY DIGITISED
ATTRIBUTION
LEGITIMATE EXCEPTION: CORRECT LOCATION
AND CONFIRMED EXISTENCE

THE PROCESS

FIRST WE DID A PROFOUND ANALISIS OF THE DATASETS AND PROCEED WITH AN EXHAUSTIVE CLEANING OF THE DATA BASE

REPLACE SPECIAL CHARACTERS, SPACES, FILLED EMPTY CELLS WITH NULL, REMOVED ACC_TYPE COLUMN WITH A PYTHON SCRIPT

Unnamed: 0	LINK_ID	POI_ID	SEQ_NUM	FAC_TYPE	POI_NAME	POI_LANGCD	POI_NMTYPE	POI_ST_NUM	ST_NUM_FUL	ST_NFUL_LC	ST_NAME	ST_LANGCD	POI_ST_SD	PH_NUMBER	CHAIN_ID	NAT_IMPORT
244	1296526969	1244439551	1	4013	TOLUCA_CEN SPA	B	NULL	NULL	NULL	AVENIDA_SOI SPA	R	NULL	0 N			
85076	702722866	1244248545	1	9535	MISCELANEA SPA	B	1440	NULL	NULL	CALLE_GLORI SPA	L	NULL	0 N			
104077	702722866	1178939983	1	9535	TIENDA_DE_A SPA	B	NULL	NULL	NULL	CALLE_GLORI SPA	L	NULL	0 N			
151	1296526966	1244944824	1	4013	TOLUCA_CEN SPA	B	NULL	NULL	NULL	AVENIDA_SOI SPA	R	NULL	0 N			
151721	939199332	1178940592	1	7538	NIETO SPA	B	NULL	NULL	NULL	AVENIDA_SOI SPA	L	NULL	0 N			
173875	702721512	1200787905	1	7994	ALCOHOLICO SPA	B	NULL	NULL	NULL	CALLE_PLAN_ SPA	R	NULL	0 N			
136806	702721512	1178940044	1	5800	EL_HUEQUIT SPA	B	NULL	NULL	NULL	CALLE_PLAN_ SPA	R	NULL	0 N			
154838	702650117	1178940773	1	7538	SERVICIO_AU SPA	B	NULL	NULL	NULL	BOULEVARD_ SPA	R	NULL	0 N			
103106	702700358	1179042004	1	9567	POLLERIA_Y_ SPA	B	NULL	NULL	NULL	CALLE_DEL_R SPA	L	NULL	0 N			
104362	702721512	1178940045	1	9988	PAPELERIA SPA	B	NULL	NULL	NULL	CALLE_PLAN_ SPA	L	NULL	0 N			
177397	1341339647	1164892023	1	8211	INSTITUTO_C SPA	B	NULL	NULL	NULL	AVENIDA_BEN SPA	R	NULL	0 N			
136130	1346737015	1154356661	1	5800	TACO_SALSA SPA	B	NULL	NULL	NULL	AVENIDA_JUA SPA	R	NULL	0 N			
100249	1346737015	1154356662	1	9535	OXOXO SPA	B	NULL	NULL	NULL	AVENIDA_JUA SPA	R	NULL	6420 N			
190051	702696670	1059482895	1	8211	ESC_PRIM_M SPA	B	NULL	NULL	NULL	NULL NULL	R	NULL	0 N			
7024	780258077	1112899769	1	9537	FRALAGA SPA	B	NULL	NULL	NULL	CALLE_GUAD SPA	R	2192193072	0 N			
179713	702704160	1222901799	1	8211	ESCUELA_MIC SPA	B	60	NULL	NULL	CALLE_PLAZU SPA	L	NULL	0 N			
141590	1115318748	1005055141	1	5511	GIMSA_AUTO SPA	B	NULL	NULL	NULL	AVENIDA_BEN SPA	L	9172110666	294 N			
143951	1115318748	1122250878	1	7538	GIMSA_AUTO SPA	B	NULL	NULL	NULL	AVENIDA_BEN SPA	L	9172110666	294 N			
169626	702684291	1210225169	1	9992	IGLESIA_CRIS SPA	B	NULL	NULL	NULL	2DA_PRIVADA SPA	L	NULL	0 N			
169627	702684291	1210225169	2	9992	IGL_CRIST_AE SPA	J	NULL	NULL	NULL	2DA_PRIVADA SPA	L	NULL	0 N			
91523	939199332	1178940593	1	9567	HERCULES SPA	B	NULL	NULL	NULL	AVENIDA_SOI SPA	L	7222700788	0 N			
159156	1141740459	1244437412	1	6000	CAJERO_AUT SPA	B	NULL	NULL	NULL	CALLE_FELIPE SPA	R	NULL	0 N			
148307	1267220126	1178919392	1	7538	CHEVY_GALE SPA	B	NULL	NULL	NULL	AVENIDA_PRC SPA	R	7222125906	0 N			
92101	798711119	1178940604	1	9988	PAPELERIA_C SPA	B	NULL	NULL	NULL	CALLE_COLIM SPA	L	NULL	0 N			
64718	1267220126	1192852543	1	9988	EL_SOMBRA SPA	B	NULL	NULL	NULL	AVENIDA_PRC SPA	R	7223546534	0 N			
52952	1267220126	1178918631	1	9567	DEPOSITO_SUS SPA	B	NULL	NULL	NULL	AVENIDA_PRC SPA	R	NULL	0 N			

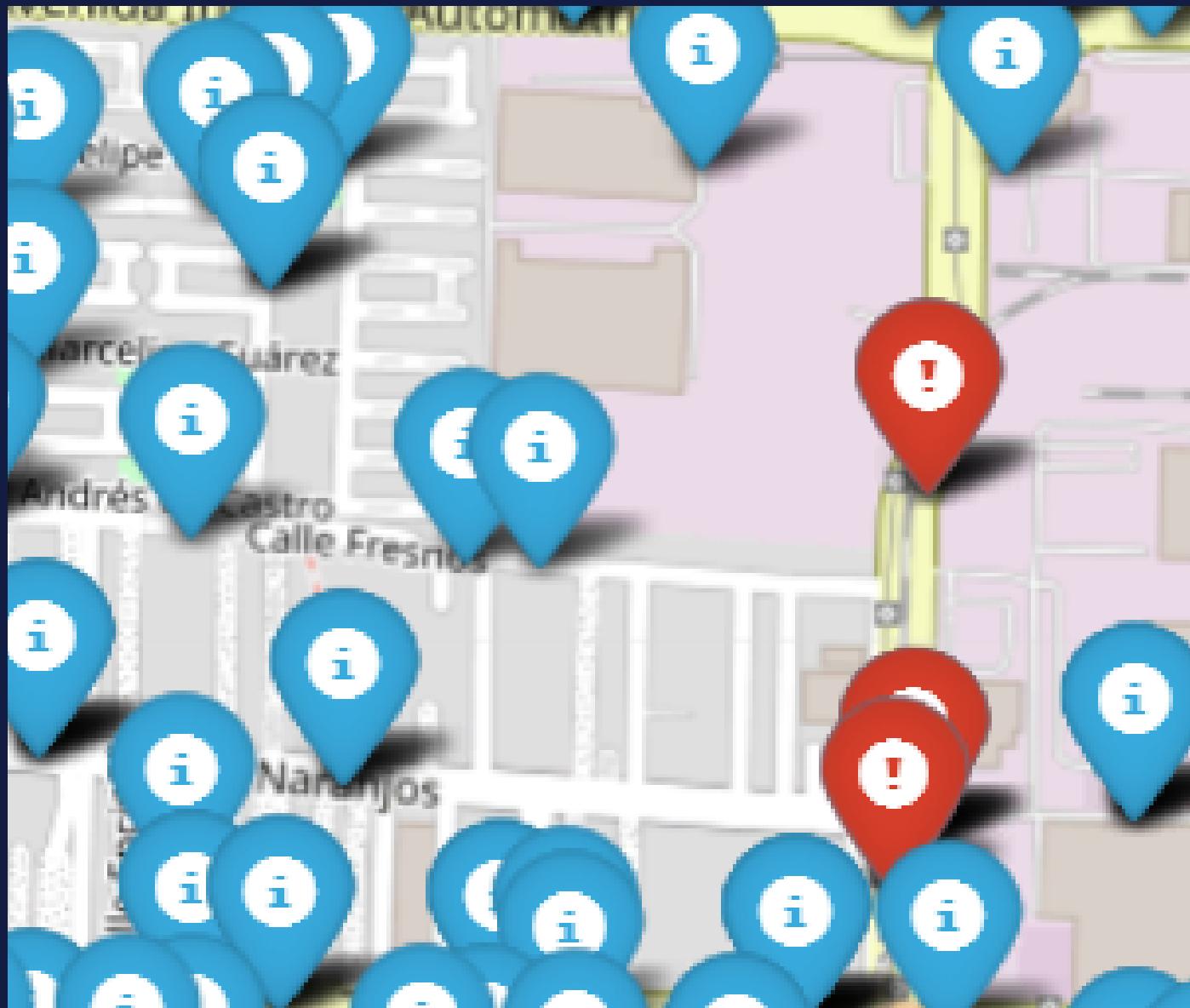
KEYPOINTS IN THE DATASET

- LINK-ID
- POI-ID
- POI-NAME
- ST-NAME
- FAC-TYPE

SCENARIO #1: NO POI IN REALITY

IMPORTS POIS FROM CSV AND STREET DATA FROM GEOJSON FILES BY USING PANDAS AND GEOPANDAS.

FOR TILE GENERATION, EACH POI'S COORDINATES ARE CONVERTED INTO A CORRESPONDING HERE MAP TILE POLYGON USING LATITUDE, LONGITUDE, AND ZOOM LEVEL



IT DISPLAYS THE POIS ON AN INTERACTIVE FOLIUM MAP,
WITH RED MARKERS FOR ERRORS AND BLUE FOR VALID
POINTS

POI_ID	POI_NAME	geometry	EVALUATION
1244439551	TOLUCA_CEN	POINT (-99.64	delete
1244248545	MISCELANEA	POINT (-99.63	delete
1178939983	TIENDA_DE_A	POINT (-99.63	delete
1244944824	TOLUCA_CEN	POINT (-99.64	delete
1178940592	NIETO	POINT (-99.64	correct
1200787905	ALCOHOLICO	POINT (-99.63	correct
1178940044	EL_HUEQUITO	POINT (-99.63	correct
1178940773	SERVICIO_AU	POINT (-99.63	correct
1179042004	POLLERIA_Y_M	POINT (-99.63	correct
1178940045	PAPELERIA	POINT (-99.63	correct
1164892023	INSTITUTO_C	POINT (-99.62	correct
1154356661	TACO_SALSA	POINT (-99.62	correct
1154356662	OXXO	POINT (-99.62	correct
1059482895	ESC_PRIM_M	POINT (-99.62	correct
1112899769	FRALAGA	POINT (-99.62	correct

IT SAVES THE RESULTS IN A CSV FILE AND GENERATE
AN INTERACTIVE HTML MAP

SCENARIO #2: POI PLACED ON INCORRECT SIDE OF THE ROAD



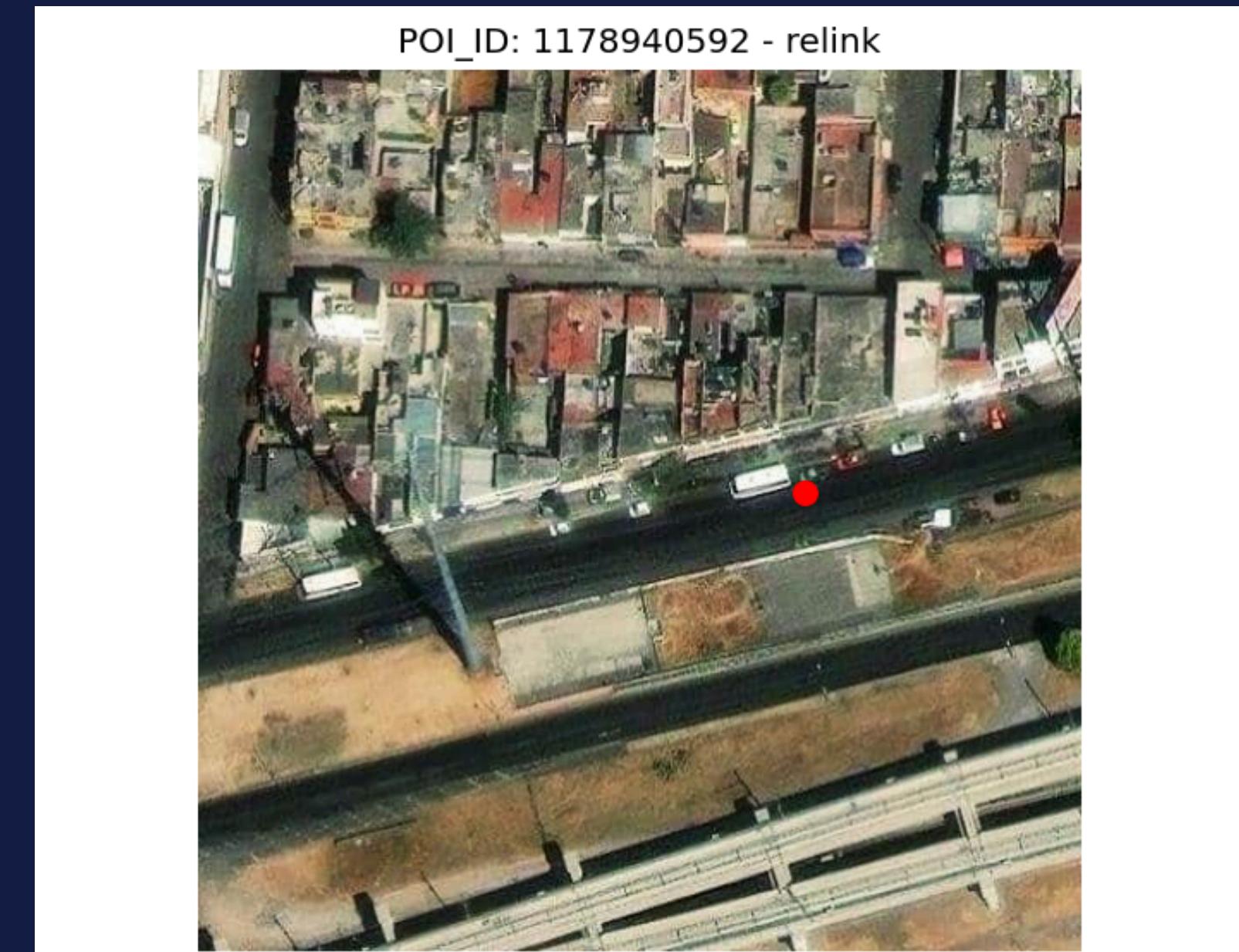
WE DETECT POIS THAT ARE INCORRECTLY ASSIGNED TO THE LEFT OR RIGHT SIDE OF A ROAD SEGMENT USING SPATIAL JOINS AND GEOMETRIC ANALYSIS (CROSS PRODUCT). WE COMPARE THE DECLARED SIDE (L/R) WITH THE REAL SIDE BASED ON STREET GEOMETRY.



POIS WITH MISMATCHES ARE FLAGGED AS RELINK CASES. THE FIRST RELINK POI IS VISUALIZED USING A HERE SATELLITE TILE, WITH ITS POSITION MARKED IN RED TO SUPPORT VISUAL VALIDATION.



RESULTS ARE EXPORTED TO CSV AND IMAGE FOR REPORTING.



EXAMPLE OF A POI FLAGGED AS RELINK

SCENARIO #3: INCORRECT MULTIPLY DIGITISED ATTRIBUTION

WHAT IS A MULTIPLY DIGITISED ROAD SEGMENT?

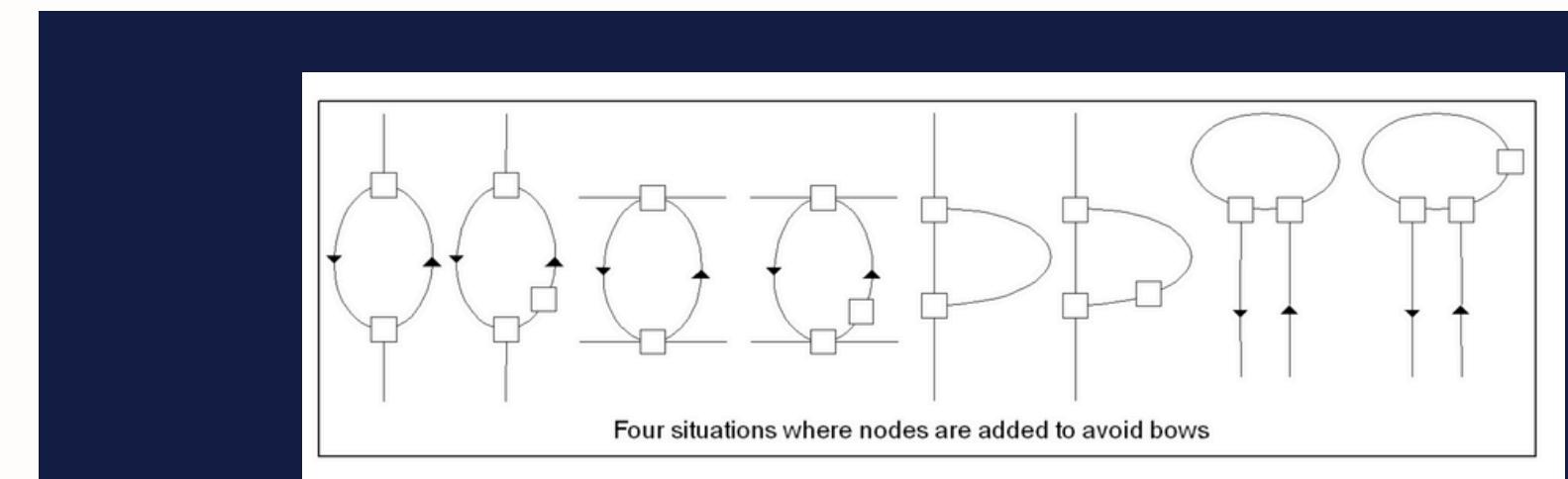
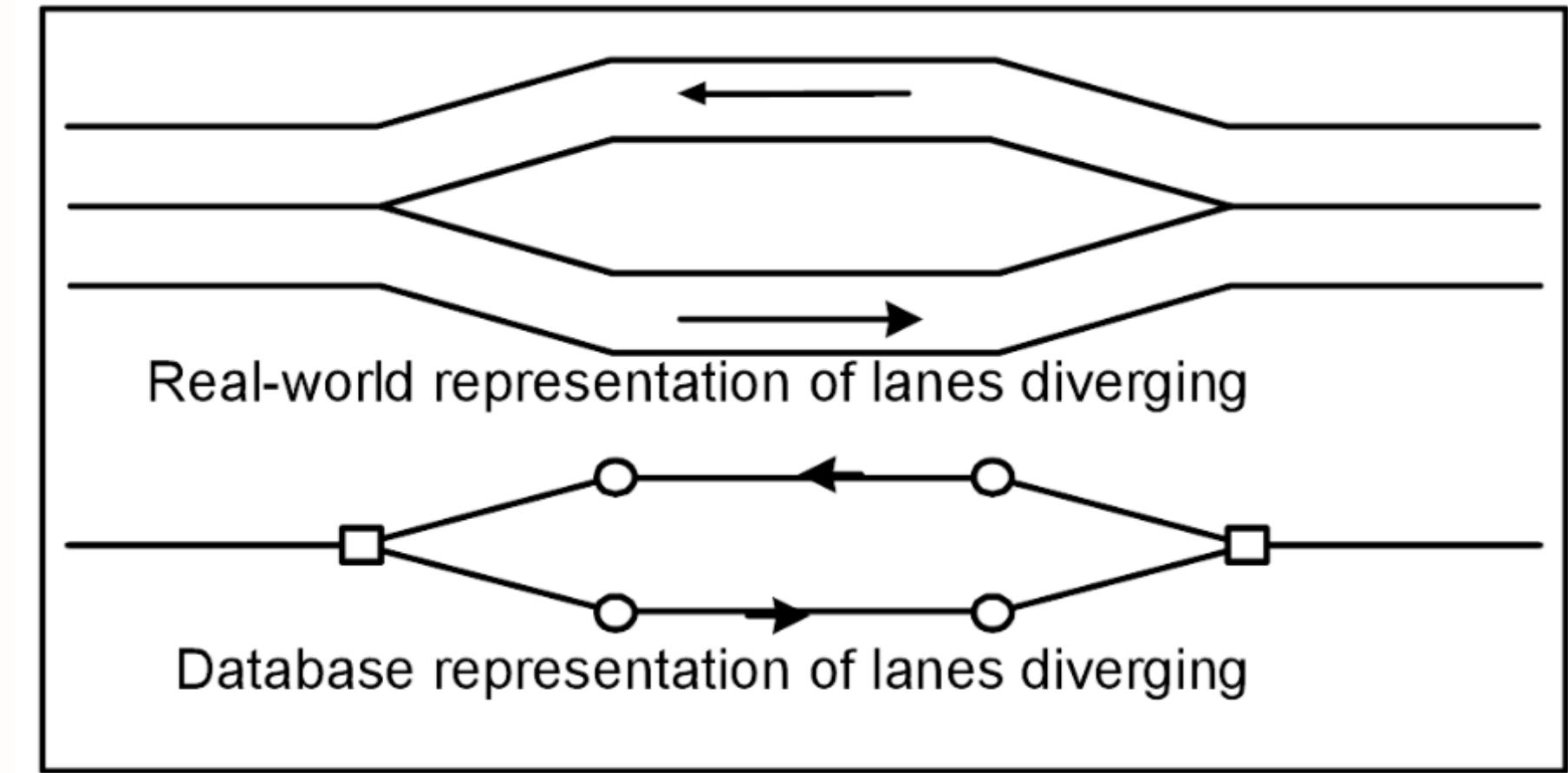
SOME ROADS ARE DIGITISED MULTIPLE TIMES (E.G. PARALLEL LANES, FRONTAGE ROADS), BUT THE MULTIDIGIT ATTRIBUTE IS OFTEN MISLABELED.

THIS LEADS TO NAVIGATION ISSUES, POI MISPLACEMENT, AND INCORRECT NETWORK ANALYSIS.

GOAL

TO AUTOMATICALLY VALIDATE AND CORRECT THE MULTIDIGIT ATTRIBUTE BY ANALYZING THE GEOMETRY AND SURROUNDING CONTEXT OF EACH ROAD SEGMENT.

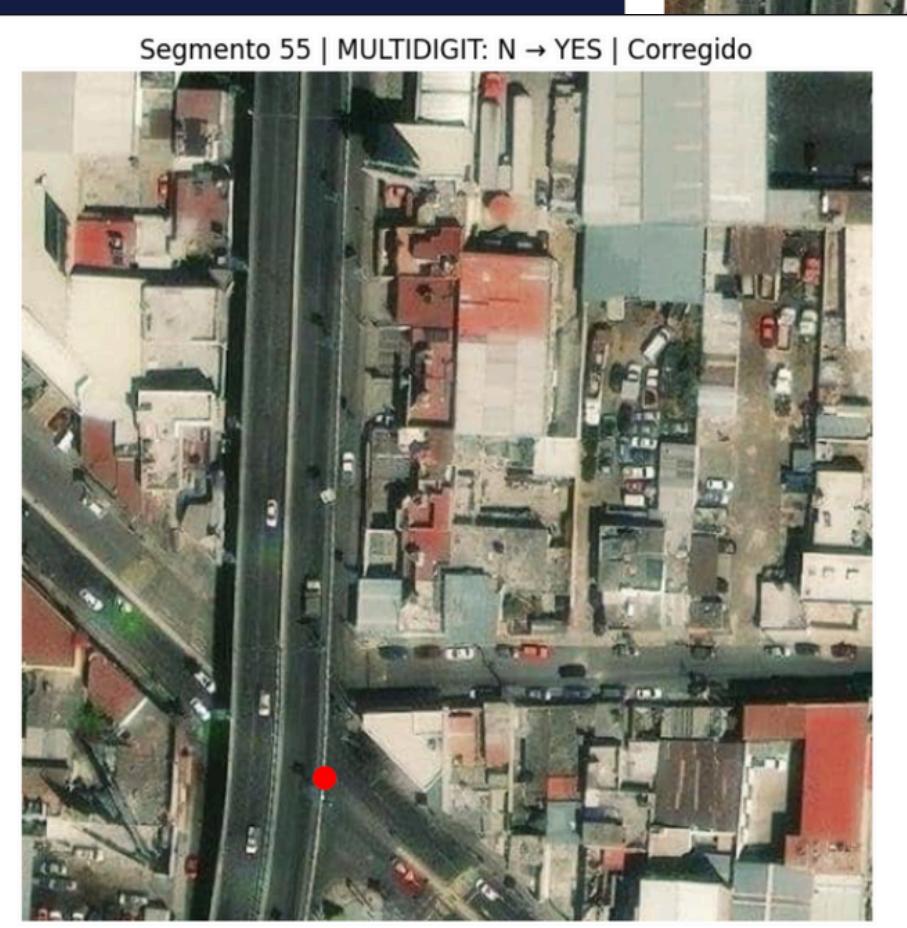
Figure 20:



HOW IT WORKS

FOR EACH ROAD SEGMENT:

- CALCULATE ITS ORIENTATION ANGLE.
- CREATE A BUFFER AROUND IT.
- SEARCH FOR NEARBY SEGMENTS THAT:
 - ARE NOT THE SAME LINK, AND
 - HAVE A SIMILAR DIRECTION
 - EITHER OVERLAP PARTIALLY OR HAVE CLOSE CENTROIDS
- IF AT LEAST ONE VALID NEIGHBOR IS FOUND, WE INFERENCE:
 - MULTIDIGIT = YES
- OTHERWISE:
 - MULTIDIGIT = NO



SCENARIO #4: MULTIPLY DIGITISED ATTRIBUTION

HOW IT WORKS

- LOADS ROAD DATA FROM .GEOJSON FILES
- KEEPS ONLY LINE-SHAPED ROADS (LINESTRING)
- CHECKS EACH ROAD SEGMENT ONE BY ONE:
- SKIPS VERY SHORT ONES
- CALCULATES ITS DIRECTION (ANGLE)
- CREATES A BUFFER AROUND IT
- LOOKS FOR NEARBY SEGMENTS THAT:
 - ARE NOT THE SAME ROAD
 - GO IN THE SAME DIRECTION
 - EITHER OVERLAP OR ARE VERY CLOSE

IF THE SEGMENT:

- IS MARKED AS MULTIDIGIT = YES
- HAS AT LEAST 1 VALID NEIGHBOR
- IS LONGER THAN 10 METERS IT IS CORRECT, SO WE LABEL IT:
EXCEPTION_LEGIT = YES

- OUTPUT
- SAVES A NEW .GEOJSON FILE
- ADDS A NEW COLUMN:
EXCEPTION_LEGIT
- SHOWS HOW MANY EXCEPTIONS WERE FOUND

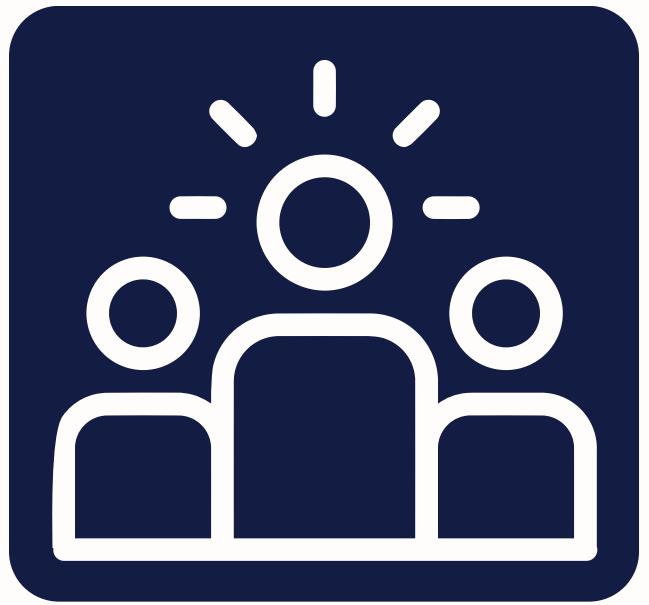
```
PS C:\Users\anett\hackathon_here\here_hackathon> & c:/Users/anett/hackathon_here/here_hackathon/venv/Scr  
prueba4.py
```

```
Analizando archivo: EXCEPCIONES_SREETS_NAV_4815075.geojson
```

```
Archivo con excepciones guardado como: STREETS_NAV\EXCEPCIONES_EXCEPCIONES_SREETS_NAV_4815075.geojson  
Excepciones legítimas detectadas: 1580
```

```
"EXCEPTION_LEGIT": "NO" }  
"EXCEPTION_LEGIT": "YES"
```

RESULTS



IDENTIFICATION

THE DEVELOPED SYSTEM AUTOMATICALLY VALIDATES THE ACCURACY OF POINTS OF INTEREST (POIS) IN DENSE URBAN AREAS ANALYZING POSSIBLE OUTCOME SCENARIOS.



MATCH

IN MOST CASES, THE INFERRED MULTIDIGIT VALUE MATCHED THE REAL-WORLD LAYOUT, IMPROVING THE QUALITY OF THE DATA.



CORRECTIONS

- RESULTADO_POIS.CSV: FULL VALIDATION RESULTS
- POIS_INVALIDOS_COMPLETOS .CSV: POIS WITH BOTH ISSUES (49 POIS RECOMMENDED FOR REMOVAL)



IMPACT

THIS PROCESS IMPROVES THE SPATIAL ACCURACY OF THE ROAD NETWORK BY ENSURING MULTIDIGIT REFLECTS REAL-WORLD CONDITIONS, HELPING NAVIGATION SYSTEMS, POI ASSOCIATION, AND TOPOLOGICAL ANALYSIS.