TRAFFIC CRUISING

DATA SCIENCE FOR SOCIAL GOOD @ UW

FINAL PRESENTATION | 08.17.17

BRETT BEJCEK

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ORYSYA STUS

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MIKE VLAH

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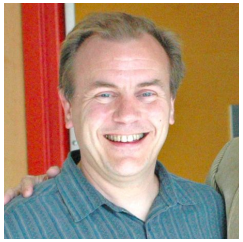
ANAMOL PUNDLE

DSSG FELLOW

VALENTINA STANEVA

DATA SCIENTIST



VAUGHN IVERSON

DATA SCIENTIST

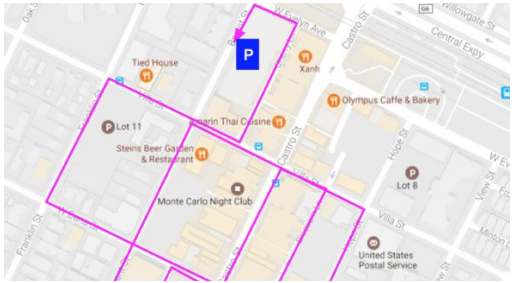
STEVE BARHAM

PROJECT LEAD

LARGE AMOUNT OF CONGESTION CAUSED BY TRAFFIC CRUISING

LOOKING FOR PARKING

DEADHEADING VEHICLES FOR HIRE

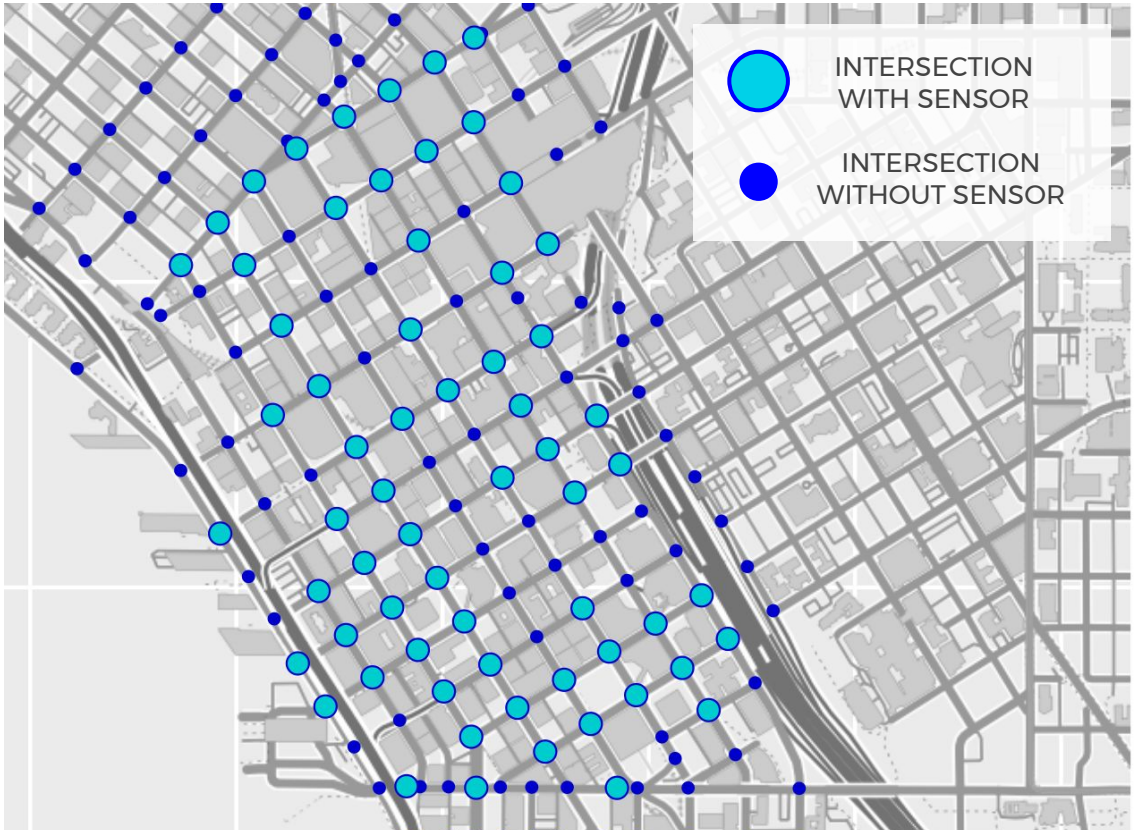


GOOGLE MAPS

10 MILES 7-13 MILES

SCHALLER CONSULTING

PROBLEM



HASHED MAC	TIME	SENSOR	STRENGTH
KD98SDK8AH	8:32:01	276105	-52
8DJSKDLSX0	8:32:01	276102	-55
439WOA09A	8:32:01	265402	-75
777AJDKAL8	8:32:05	293010	-50
QKSJ239A99	8:32:07	251040	-45
DQWPPOA09	8:32:10	265402	-49
KD98SDK8AH	8:32:11	265302	-54

PROBLEM

TECHNICAL CHALLENGES

INCOMPLETE GRID

SENSORS ONLY COVER

37%

OF THE GRID.

BIG DATA

SENSORS PRODUCE

200K

OBSERVATIONS / HR.

SENSOR DETECTION

SENSORS DETECT

38%

OF DEVICES W/ WIFI ON.

PRIVACY AND DATA GOVERNANCE

INEXACT LOCATION

AGGREGATED VIEWS

DATA IS ANONYMIZED

RAW DATA NOT RETAINED

DEPLOYABLE BEHIND TRANSPORTATION DATA COLLABORATIVE

OBJECTIVES

1

REPURPOSE SENSOR NETWORK

2

DIFFERENTIATE TYPES OF TRAFFIC CRUISING

3

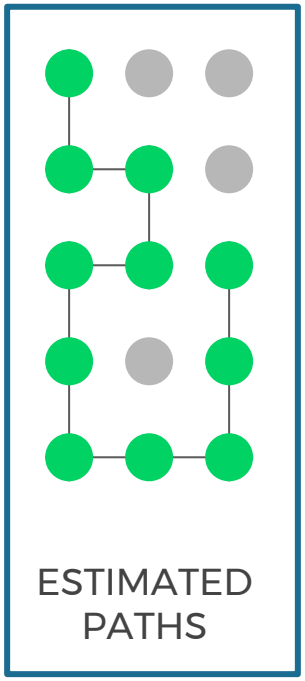
VISUALIZE WITH A HEAT MAP

4

SCALE UP AND DEPLOY

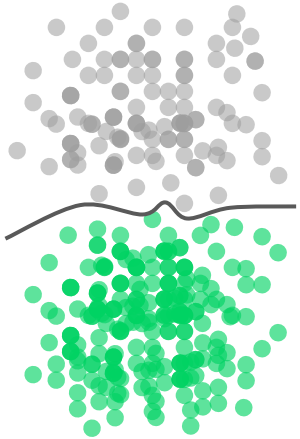
ENCRYPTED HASH	TIME	SENSOR
KD98SDK8AHD8X	8:32:00	276105
8DJSKDLSX0WKK	8:32:01	276102
DQWPPOA09DSD	8:32:01	265402
KDOSPALDKSX03	8:32:01	265302
DJKFOSPHSHAH8	8:32:01	265101
0138DSJCVBNNAA	8:32:01	273777
0DLPZZZZ98A999	8:32:02	265000
NVMCSKDJALKSSS	8:32:02	265103
QALSJDKJHD0000	8:32:02	265434
DQWPPOA09DSD	8:32:02	273099
0138DSJCVBNNAA	8:32:02	273010
0DLPZZZZ98A898	8:32:02	265001
ASKDPPPPQLSLAA	8:32:03	265000

ANONYMOUS SENSOR READINGS →



ESTIMATED PATHS →

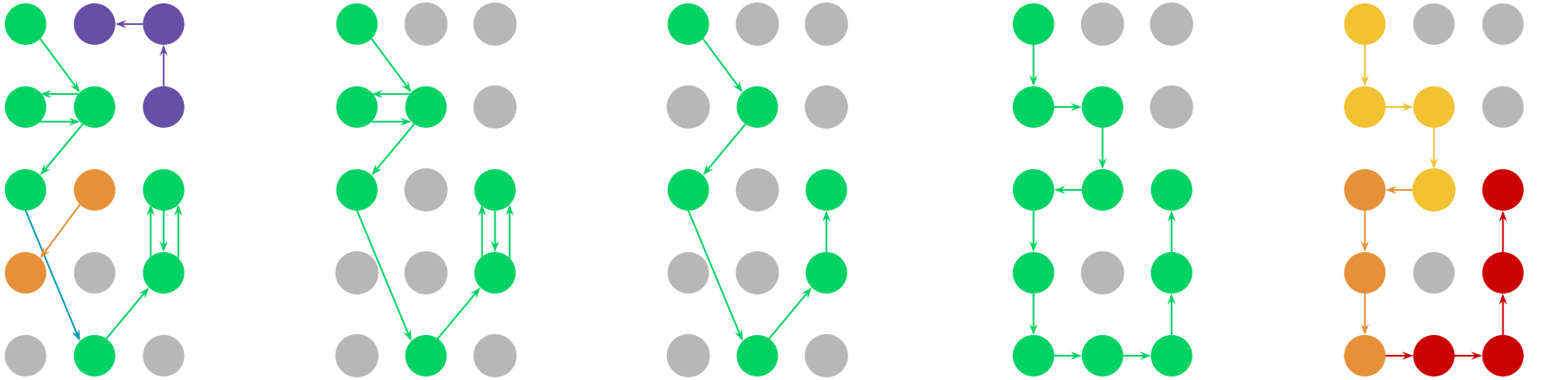
METADATA →



LABELED PATHS →

AGGREGATE HEATMAP

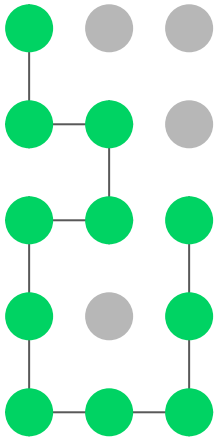
APPROACH OVERVIEW


GROUP ANONYMOUS READINGS
REMOVE SHORT PATHS
REMOVE FALSE DETECTIONS
ESTIMATE ROUTE
SEGMENT AND LABEL

PIPELINE

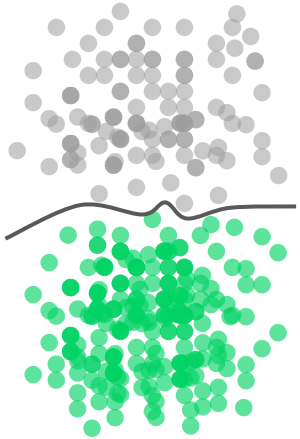
ENCRYPTED HASH	TIME	SENSOR
KD98SDK8AHD8X	8:32:00	276105
8DJSKDLSX0WKK	8:32:01	276102
DQWPPOA09DSD	8:32:01	265402
KDOSPALDKSX03	8:32:01	265302
DJKFOSPHSHAH8	8:32:01	265101
0138DSJCVBNNAA	8:32:01	273777
0DLPZZZZ98A999	8:32:02	265000
NVMCSKDJALKSSS	8:32:02	265103
QALSJDKJHD0000	8:32:02	265434
DQWPPOA09DSD	8:32:02	273099
0138DSJCVBNNAA	8:32:02	273010
0DLPZZZZ98A898	8:32:02	265001
ASKDPPPPQLSLAA	8:32:03	265000

ANONYMOUS SENSOR READINGS →



ESTIMATED PATHS →

METADATA →



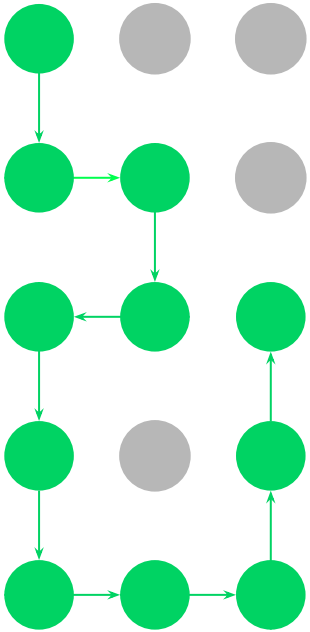
LABELED PATHS →

AGGREGATE HEATMAP

APPROACH OVERVIEW

METADATA COLLECTION

PATH



FEATURES

- NUMBER OF TIMES PATH CROSSED
- AVERAGE SPEED
- MAX SPEED
- STANDARD DEVIATION OF SPEED
- NUMBER OF LONG STOPS
- PERCENTAGE OF TIME DRIVING
- PERCENTAGE OF TIME WALKING

ENCRYPTED HASH	TIME	SENSOR
KD98SDK8AHD8X	8:32:00	276105
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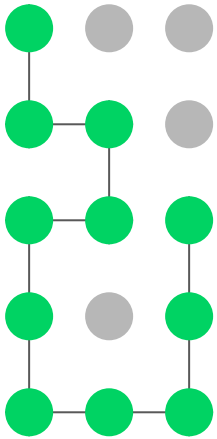
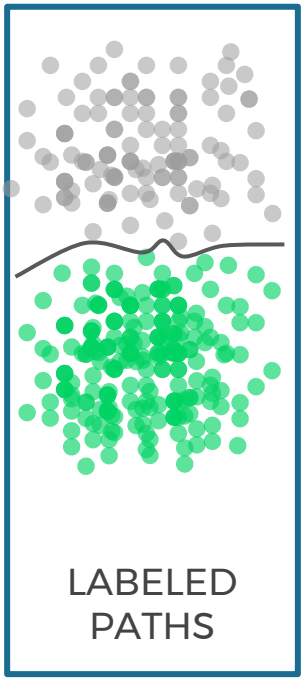




ANONYMOUS SENSOR READINGS → ESTIMATED PATHS → METADATA → LABELED PATHS → AGGREGATE HEATMAP

APPROACH OVERVIEW

DEFINING CRUISING

PROBLEM

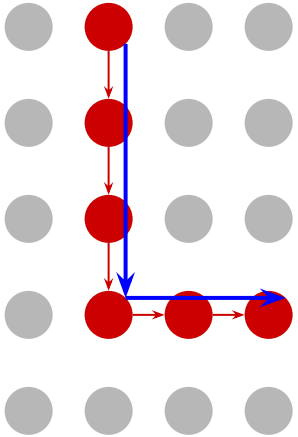
1. NO STANDARD DEFINITION OF CRUISING
2. CURRENTLY NO GROUND TRUTH

SOLUTION

1. MULTI-STEP CLASSIFICATION
2. LABEL SUBSET OF EXTREME CASES
3. MACHINE LEARNING TO IDENTIFY CRUISING INDICATORS

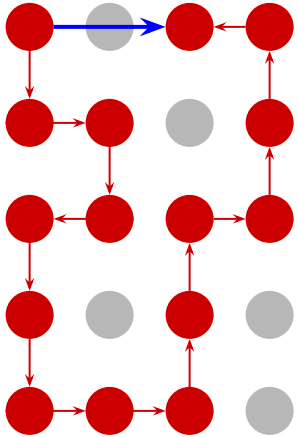
LABELING

USING DISTANCE RATIO



5 / 5 = 1.0

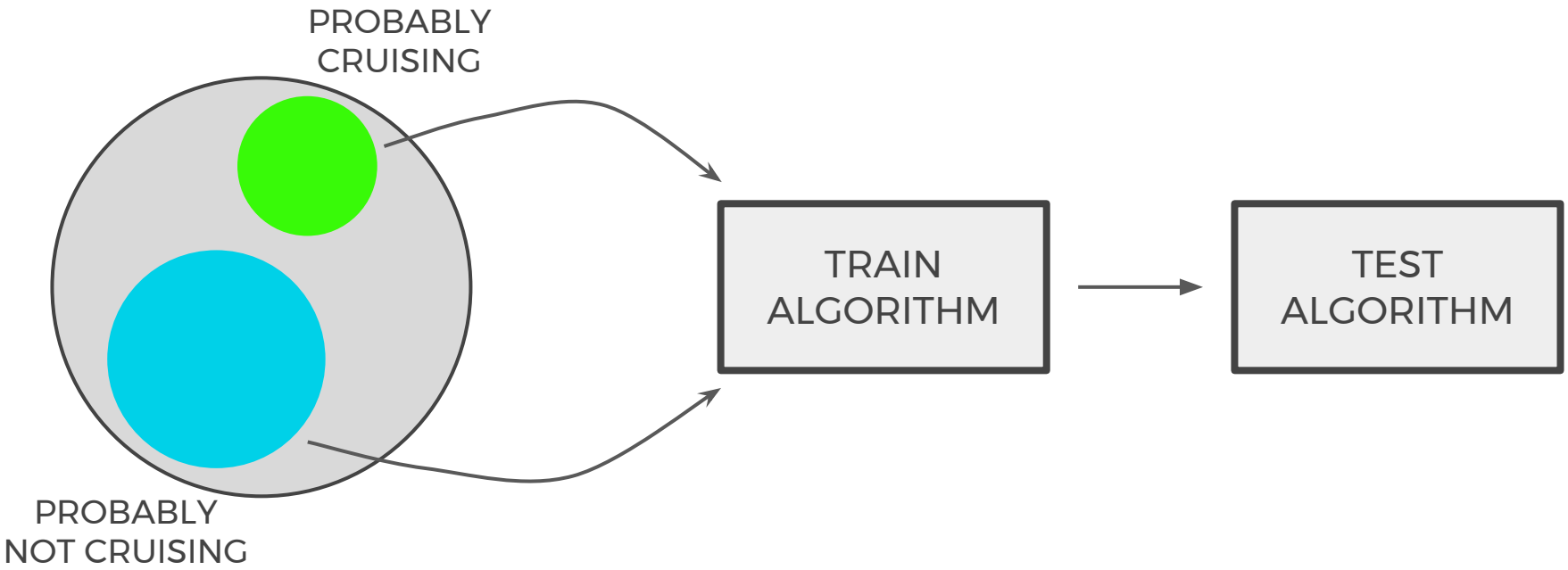
PROBABLY NOT CRUISING



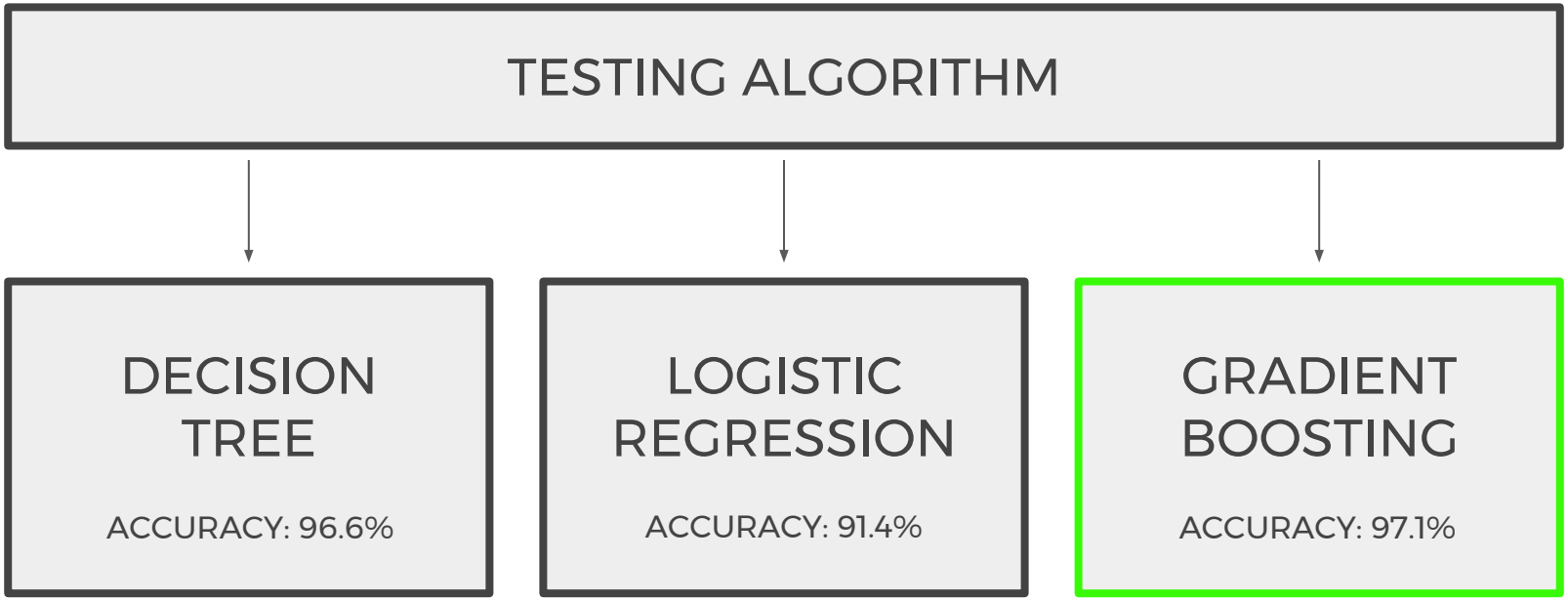
14 / 2 = 7.0

PROBABLY CRUISING

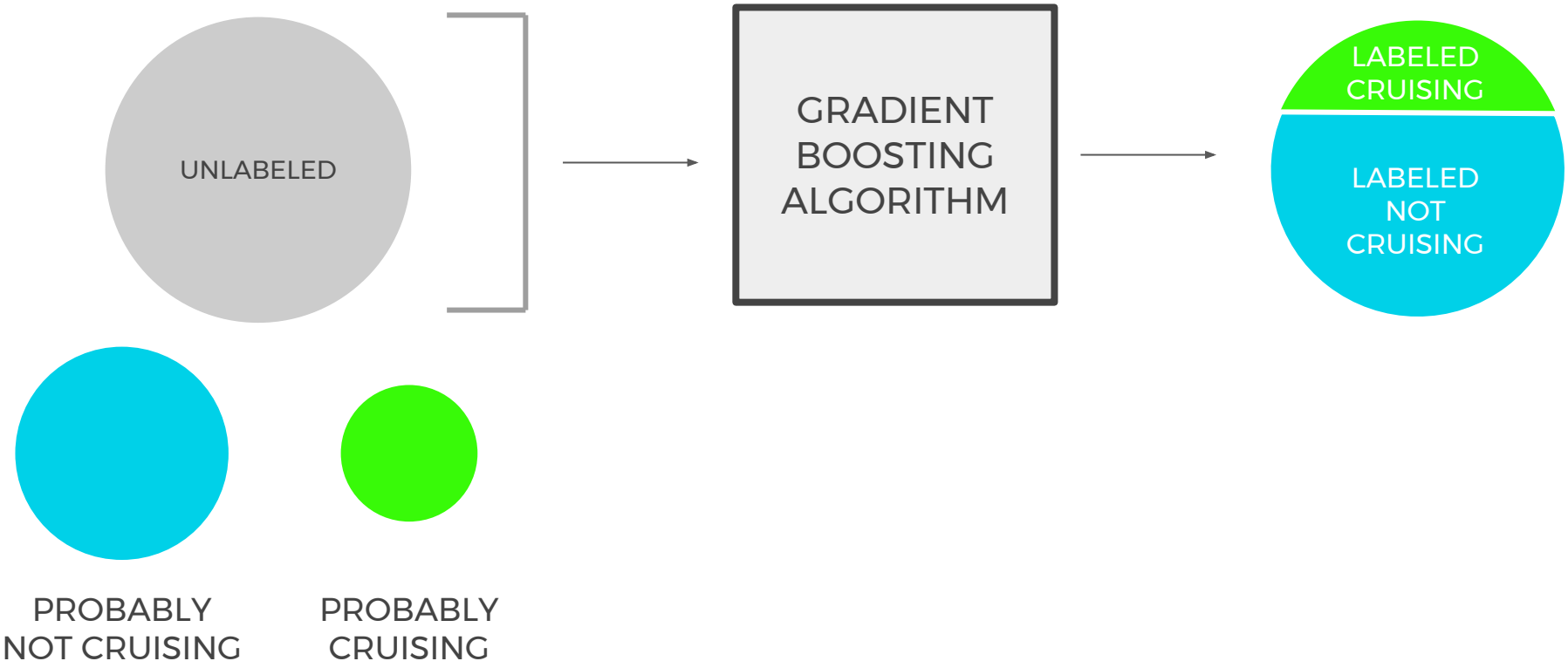
MULTI-STEP CLASSIFICATION



MULTI-STEP CLASSIFICATION



LABELING ALL DATA



IDENTIFYING FOR-HIRE VEHICLES

FOR-HIRE VEHICLE EXAMPLE

4 LARGE GAPS IN READ TIMES (5 TRIPS)

UNIQUE SENSORS / TOTAL READS =

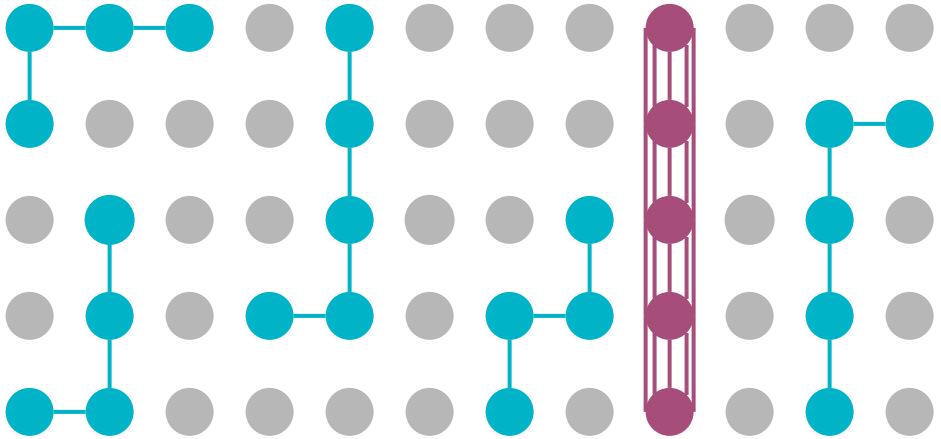
22 / 22 = 1.0 [HIGH DISPERSION]

BUS EXAMPLE

4 LARGE GAPS IN READ TIMES (5 TRIPS)

UNIQUE SENSORS / TOTAL READS =

5 / 25 = 0.2 [LOW DISPERSION]



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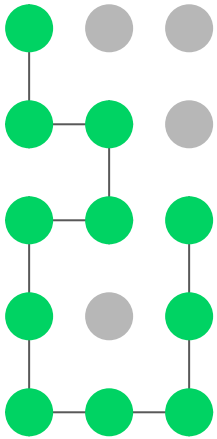
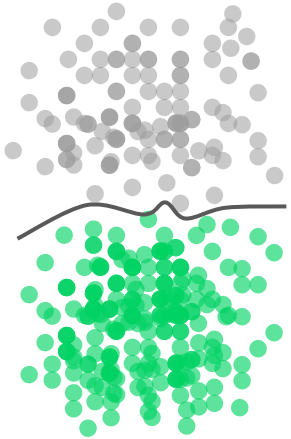
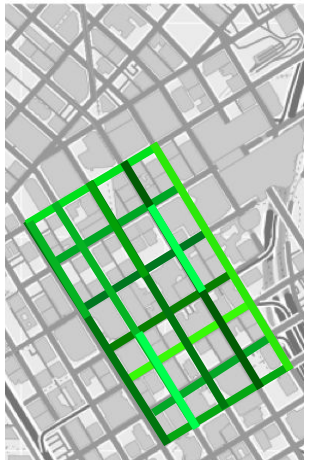
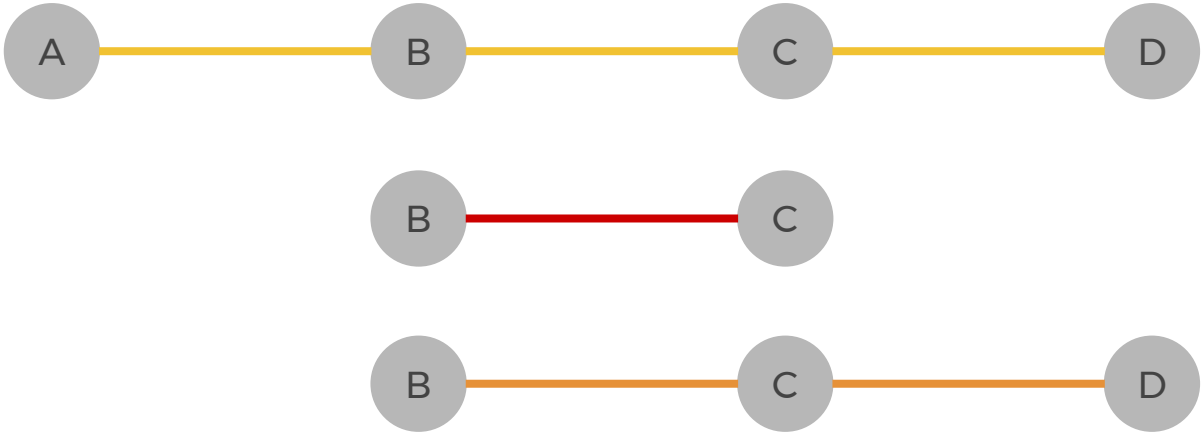






ANONYMOUS SENSOR READINGS → ESTIMATED PATHS → METADATA → LABELED PATHS → AGGREGATE HEATMAP

APPROACH OVERVIEW



AGGREGATION

CRUISING IN DOWNTOWN SEATTLE

As part of The Data Science for Social Good Program at The University of Washington, the Traffic Cruising Team has produced a heatmap to identify cruising in the downtown Seattle area.

SELECT TYPE OF CRUISING

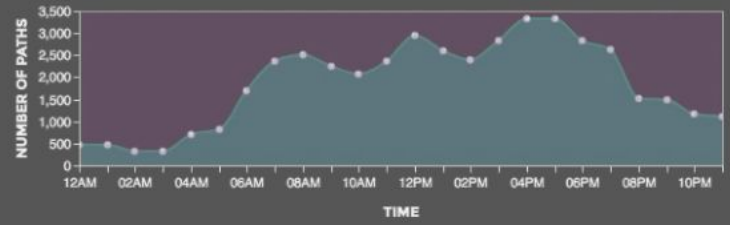
PARKING

SELECT DAY

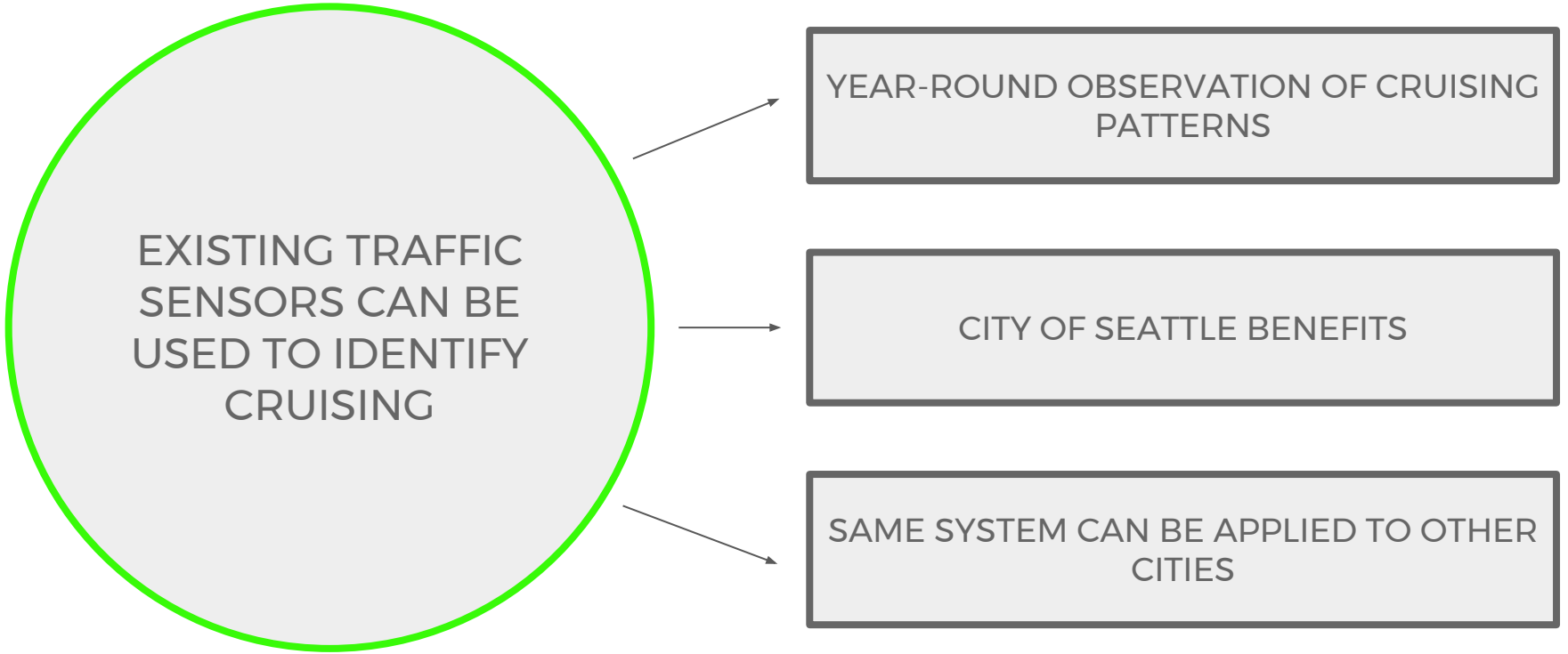
MON | TUE | WED | THR | FRI | SAT | SUN

SELECT TIME

ALL DAY | MORNING | MIDDAY | EVENING



CONCLUSION


EXISTING TRAFFIC SENSORS CAN BE USED TO IDENTIFY CRUISING
YEAR-ROUND OBSERVATION OF CRUISING PATTERNS
CITY OF SEATTLE BENEFITS
SAME SYSTEM CAN BE APPLIED TO OTHER CITIES

UNIVERSITY of WASHINGTON
eScience Institute

CASCADIA URBAN
ANALYTICS COOPERATIVE

GORDON AND BETTY
MOORE
FOUNDATION

Washington Research
FOUNDATION

Seattle
Department of
Transportation

THANK YOU