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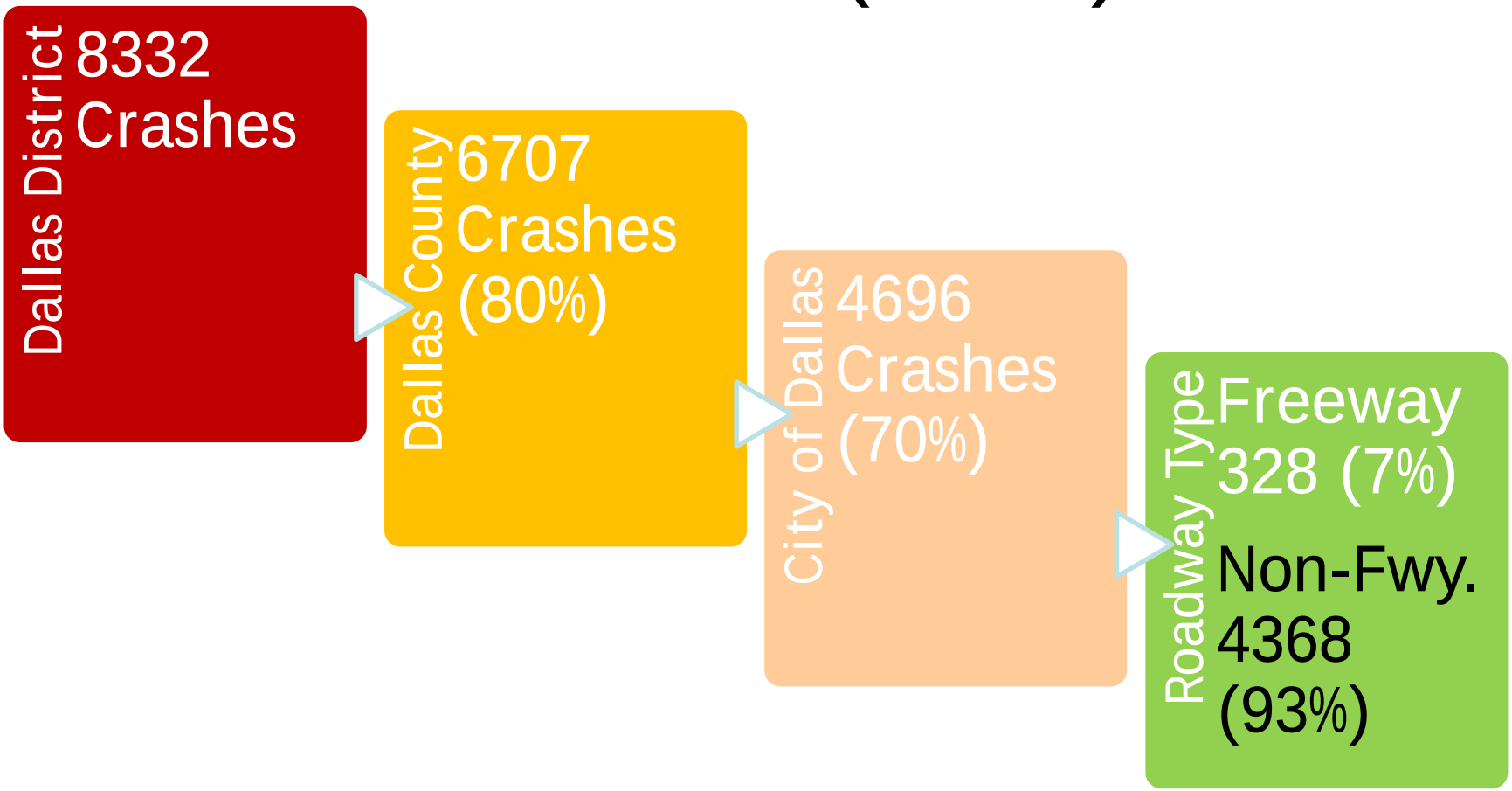
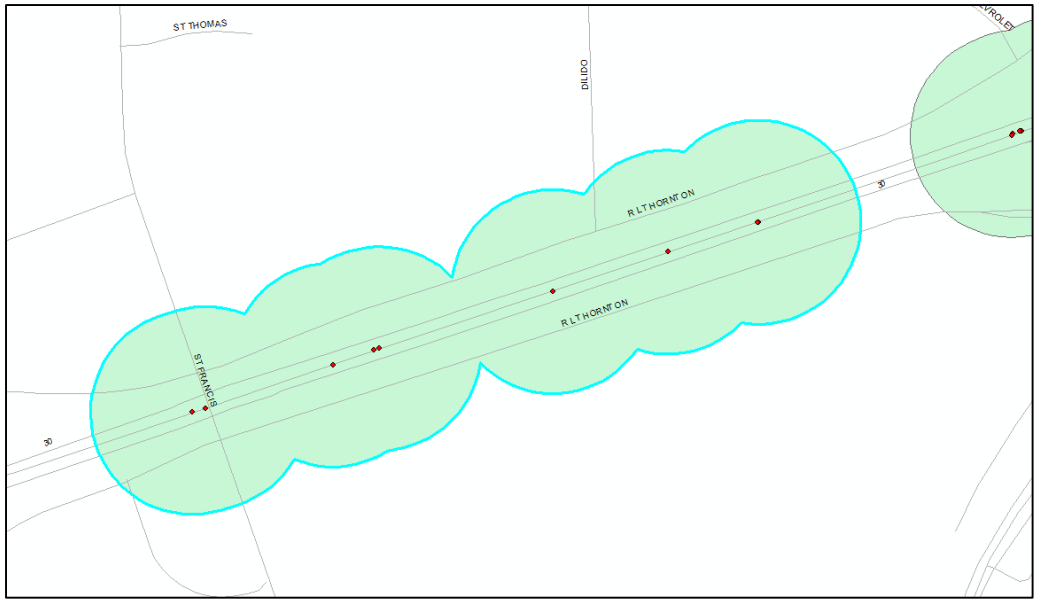
Understanding Dallas District Pedestrian Safety Issues (Part 2) & Applying Machine Learning to Crash Typing Process

Dallas District Pedestrian Crashes 2008-2017 (KABC)

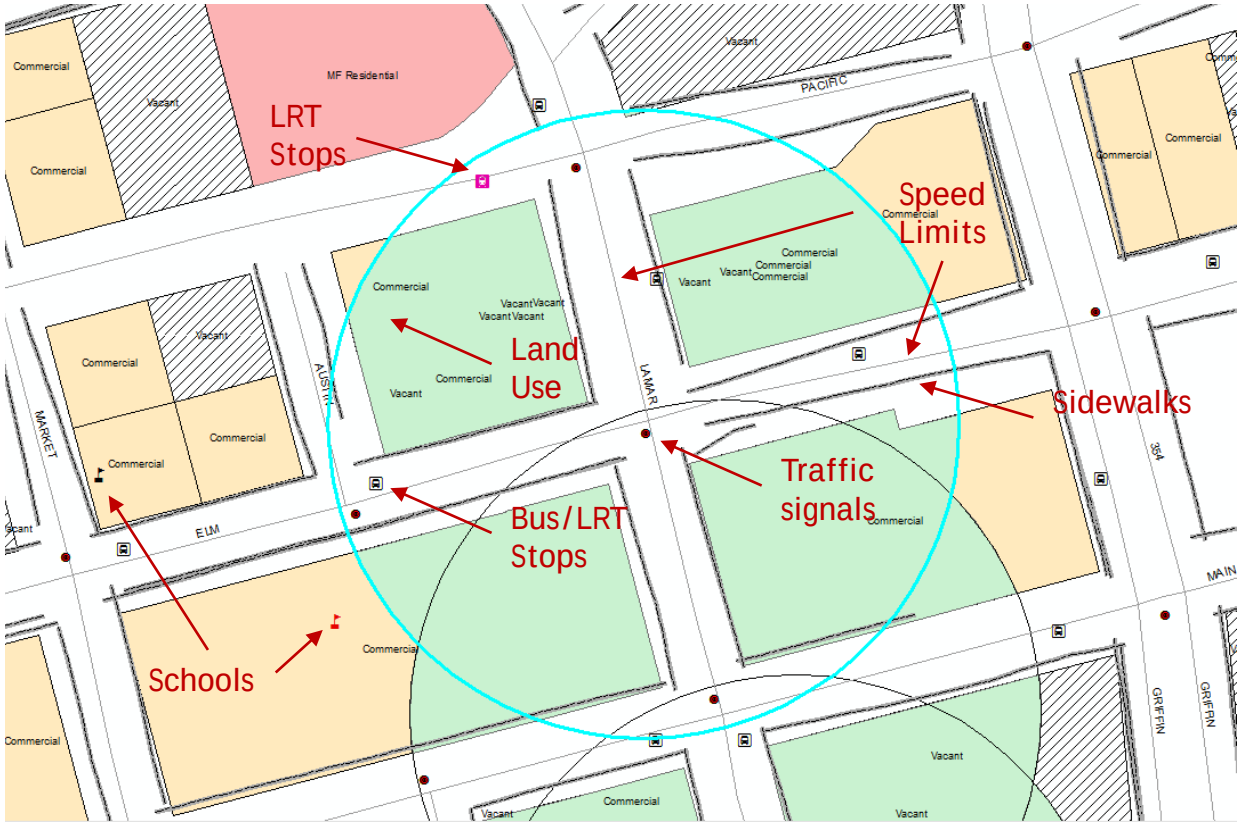


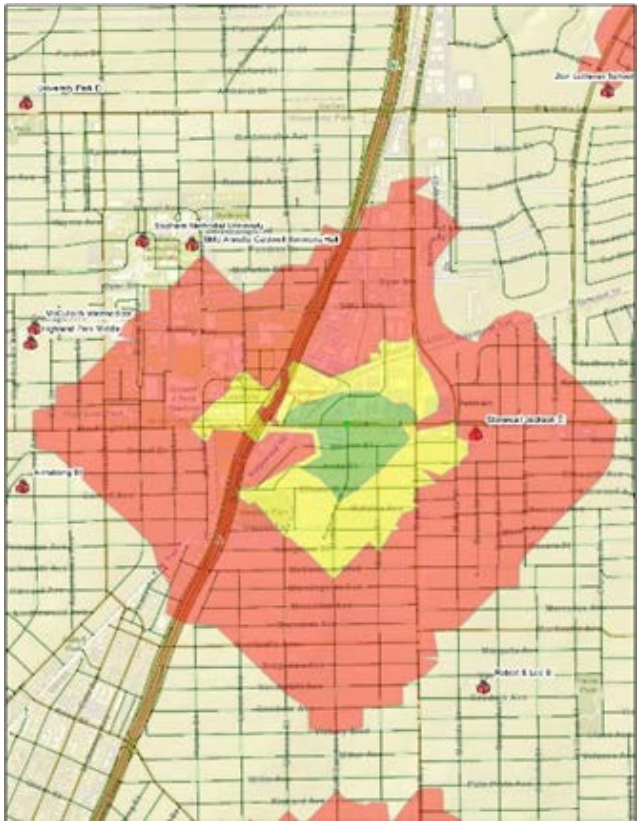
Dallas Freeway Ped. Crash Clusters

- 59 clusters (±600 ft.)
- IH30, St.Francis-Dilido
- #1 by Crash Frequency
- 10 crashes (1/year)
- TxDOT constructed Pedestrian Bridge ($2.25M)

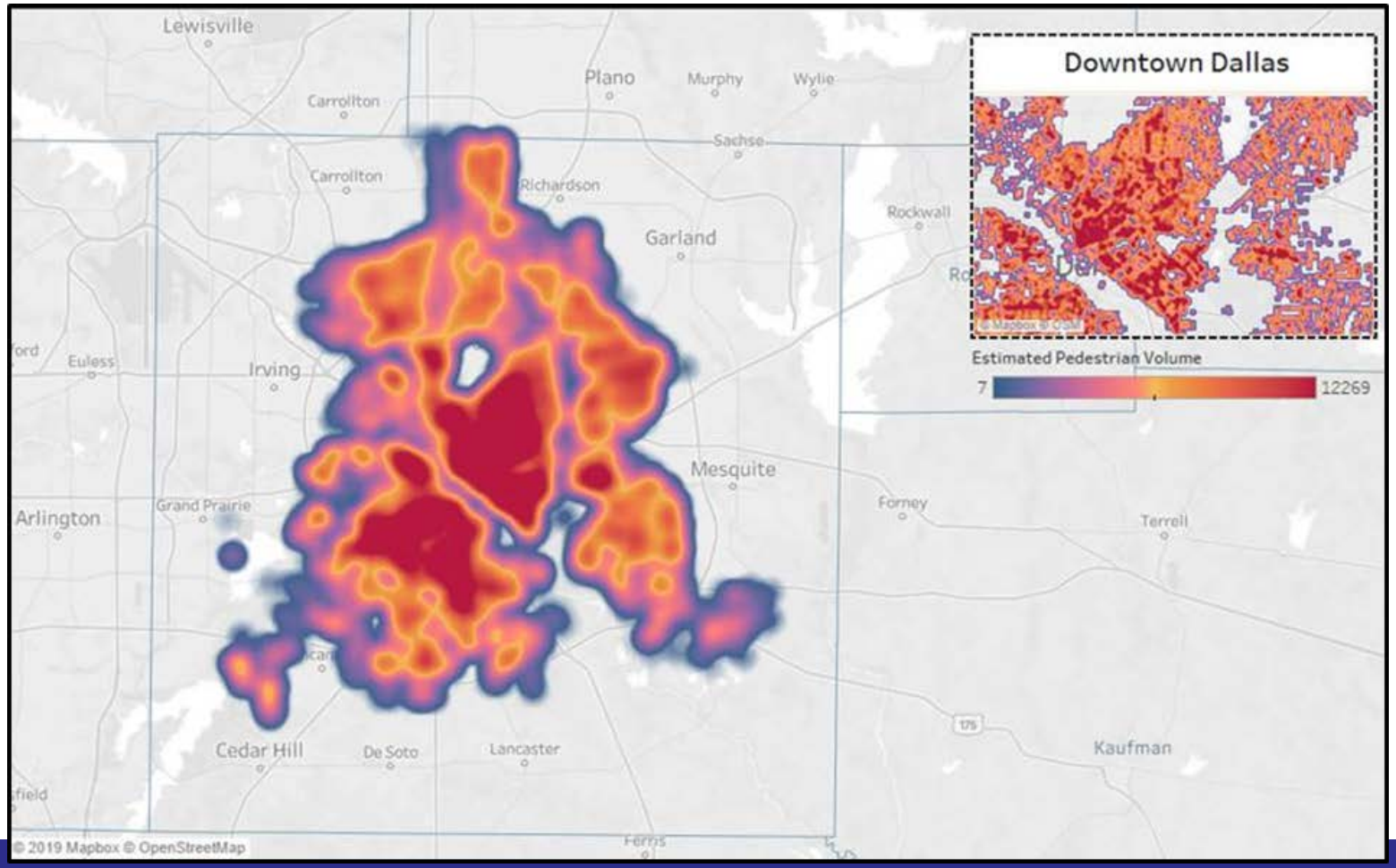


Estimating Pedestrian Exposure (Volume)





Daily Estimated Intersection Pedestrian Volumes



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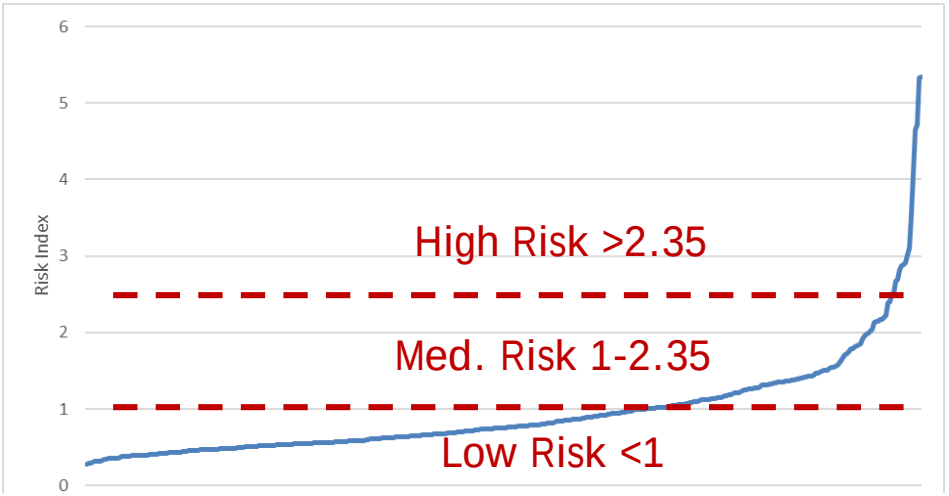
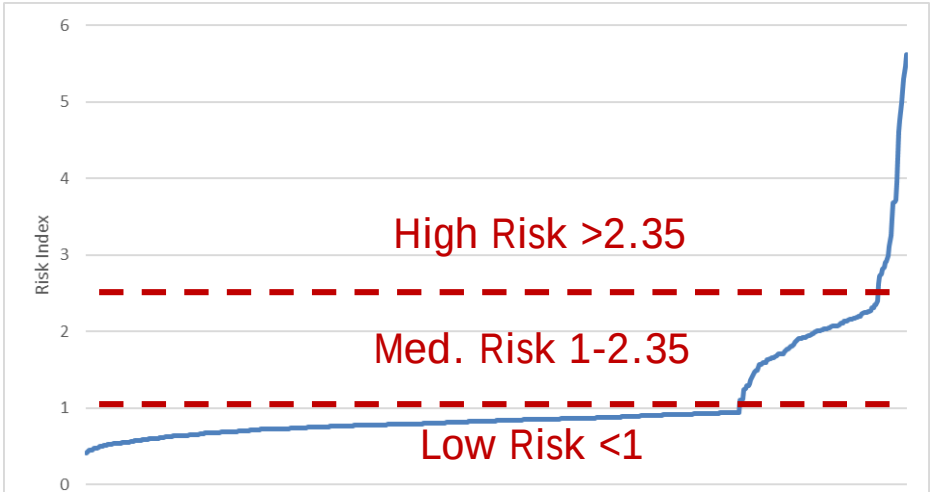
Safety Risk Index

Safety Risk Index = Expected (EB)/Predicted (SPF)



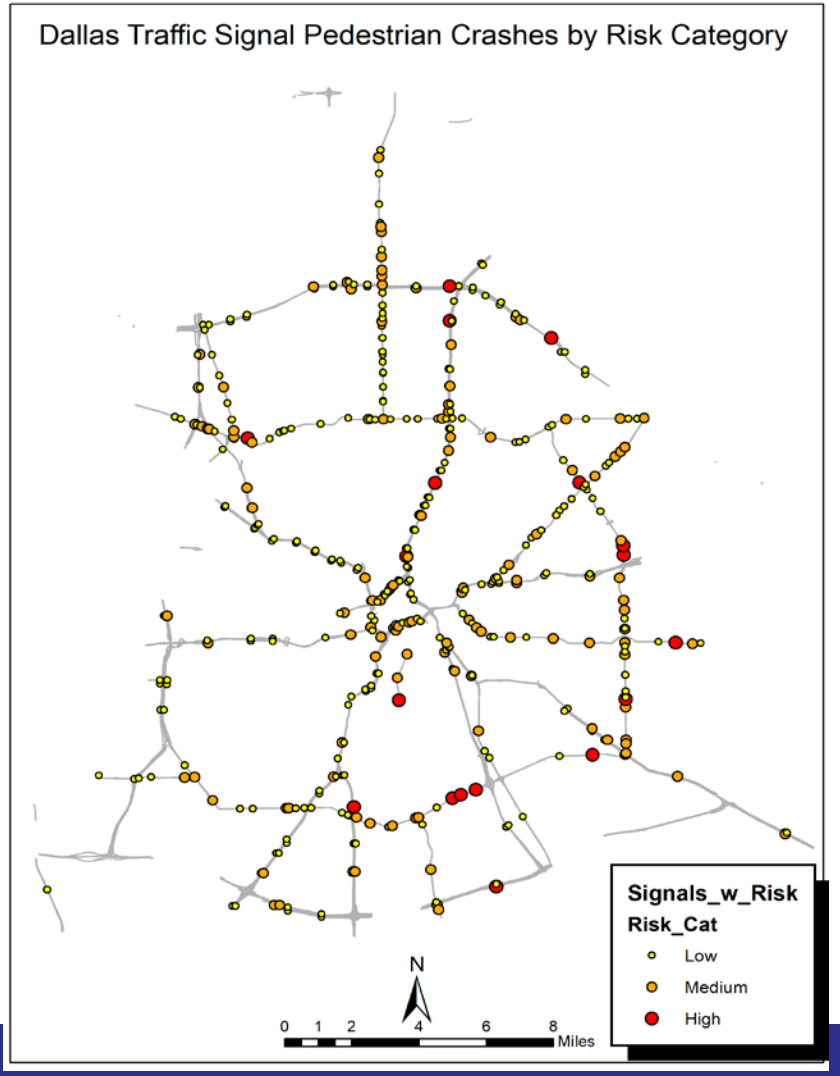


Signalized (On-System)

Stop-controlled (On-System)

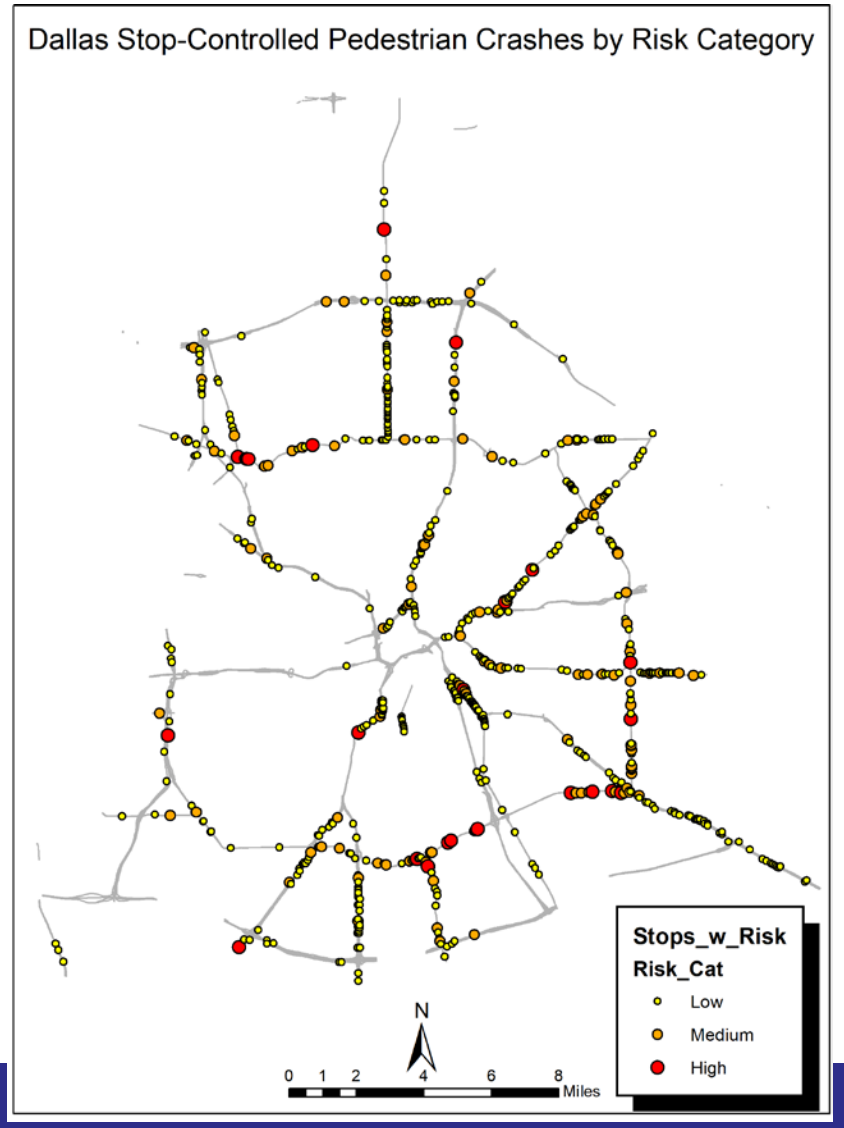
High Risk Dallas Signals (on system)

Street1	Street2	Risk Index
LBJ WBSR	Skillman	5.34
Corinth	Morrell	5.33
Buckner	John West	4.71
Great Trinity Forest	Jim Miller	4.65
COMMUNITY	NORTHWEST	4.09
Scyene	St Augustine	3.55
Bonnie View	Great Trinity Forest	3.11
Central SBSR	Lemmon	3.01
Bonnie View	LBJ EBSR	2.91
Great Trinity Forest	Wadsworth	2.89
Central NBSR	Mockingbird	2.87
Bonnie View	Ledbetter	2.82
Coit RD	IH 635 WB FR	2.70
BUCKNER	GROVECREST/MATTISON	2.67
Buckner	Chenault	2.51
FOREST LN	CENTRAL SBSR	2.51
Buckner	Poppy	2.40
ANN ARBOR	R L THORNTON NBSR	2.38



High Risk Dallas Stops (on system)

Street1	Street2	Risk Index
E LEDBETTER DR	CORRIGAN DR	5.62
W NORTHWEST HWY	STARLIGHT RD	5.47
E LEDBETTER DR	CORRIGAN AVE	5.31
S BUCKNER BLVD	NORVELL DR	5.15
GREAT TRINITY FOREST WAY	STONEPORT DR	4.98
S LANCASTER RD	ARDEN RD	4.77
GREAT TRINITY FOREST WAY	CRANFILL DR	4.62
HARRY HINES BLVD	STOREY LN	3.95
GREAT TRINITY FOREST WAY	S MURDEAUX LN	3.72
S CENTRAL SERV NB	JORDAN ST	3.70
N CENTRAL SERV NB	BONNER DR	3.68
W NORTHWEST HWY	KENDALE DR	3.49
GREAT TRINITY FOREST WAY	HILLBURN DR	3.25
GREAT TRINITY FOREST WAY	HILLBURN DR	3.12
PRESTON RD	BERRY TRL	2.99
EAST GRAND AVE	CORONADO AVE	2.92
W NORTHWEST HWY	STARLIGHT RD	2.90
E LEDBETTER DR	KILDARE AVE	2.84
S WALTON WALKER SERV NB	PREAKNESS LN	2.82
EAST GRAND AVE	PHILIP AVE	2.75
MARVIN D LOVE SERV SB	GLENNLYONS DR	2.73
GREAT TRINITY FOREST WAY	SATINWOOD DR	2.62
S BUCKNER BLVD	TILLMAN ST	2.40
S R L THORNTON SERV NB	E PAGE AVE	2.35



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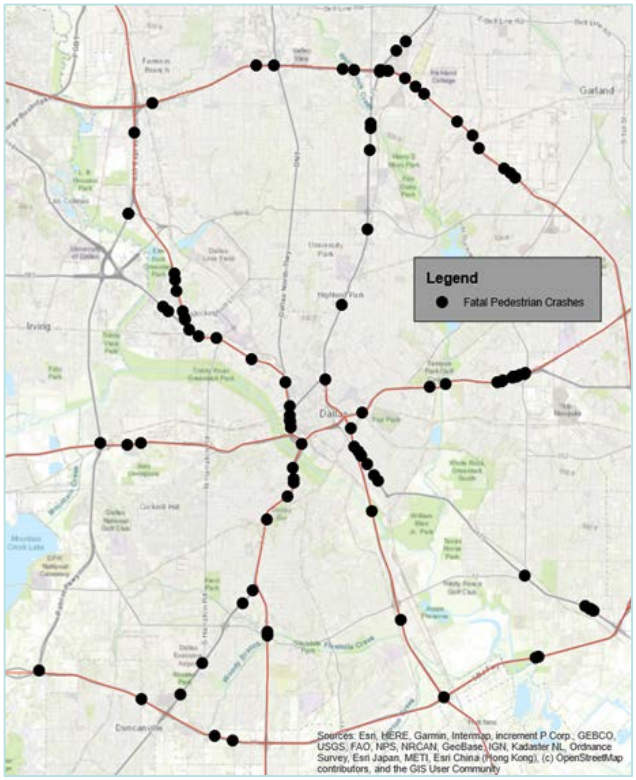
Applying Machine Learning to Pedestrian Crash Typing Process

- Crash databases contain insufficient details about ped/bike crashes
- Crash details are typically in crash narratives and diagrams
- Objective: develop framework for applying machine learning to classify ped crashes from the unstructured textual content
  - intended vs. unintended
  - driver at-fault or pedestrian at-fault
  - 55 crash types (in progress)

Applying Machine Learning to Crash Typing Process

Dallas Fatal (K) Pedestrian Crash Data

- 128 Freeway Ped. Fatal crashes, 2008-2017
- 101 crash narratives reviewed (25 missing + 2 not readable)
- 65 (51%) Intended vs.35 (27%) Unintended
- Unintended is defined as:
  - person struck and associated with a vehicle
  - a worker actively performing their duty at the scene



Applying Machine Learning to Crash Typing Process

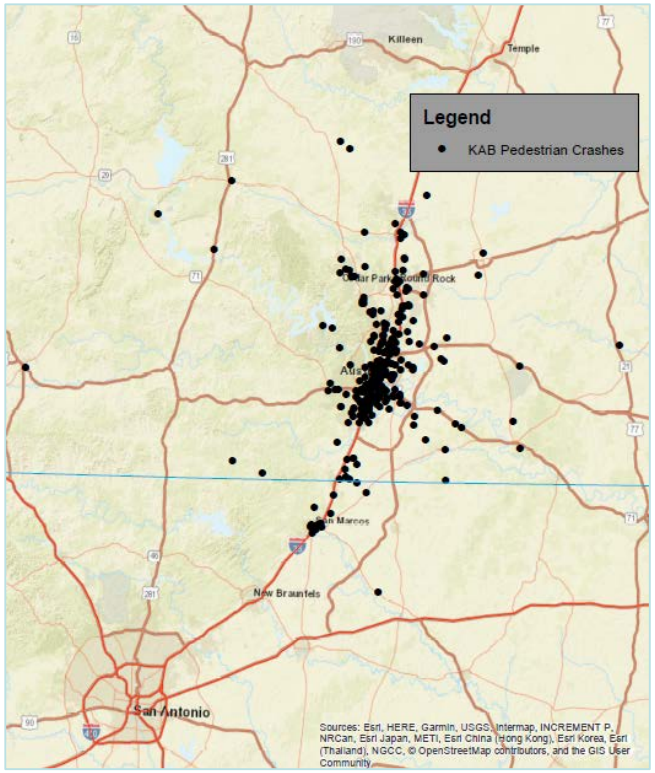
Dallas K Crash Data (Confusion Matrix)

Model	Intension Class (Observed)	Training (60 crashes)		Test (30 crashes)	
		Intended (Predicted)	Unintended (Predicted)	Intended (Predicted)	Unintended (Predicted)
SVM	Intended	26	14	10	6
	Unintended	8	12	6	8
RF	Intended	25	15	10	6
	Unintended	8	12	6	8
XGBoost	Intended	29	11	12	4
	Unintended	6	14	5	9

Applying Machine Learning to Crash Typing Process

Austin KAB Crash Data

- 295 KAB Ped crashes on all roadways, 2018
- 45% Motorist at-fault vs. 42% Ped at-fault
- At-fault Examples:
  - Motorist: ped crossing & struck by turning vehicle
  - Pedestrian: ped crossing & struck and vehicle was not turning or ped dashed or dart-out



Applying Machine Learning to Crash Typing Process

Austin KAB Crash Data (Confusion Matrix)

Model	At-Fault Class (Observed)	Training (205 crashes)		Test (90 crashes)	
		Motorist (Predicted)	Pedestrian (Predicted)	Motorist (Predicted)	Pedestrian (Predicted)
SVM	Motorist	70	35	31	16
	Pedestrian	44	56	22	21
RF	Motorist	68	37	30	17
	Pedestrian	46	54	22	21
XGBoost	Motorist	75	30	75	30
	Pedestrian	39	61	39	61

Applying Machine Learning to Crash Typing Process

- XGBoost technique performed best in classifying pedestrian crash types
- **Dallas K Crashes:** Intended vs. Unintended (accuracy up to 72% for training data and 70% for test data)
- **Austin KAB Crashes:** Pedestrian at-fault vs. Motorist at-fault (accuracy up to 66% for training data and 65% for test data)