Development of a Predictive Model for Automobile Collision Severity

Coursera Applied Data Science Capstone Project

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Contents

INTRODUCTION

CONVERTING DATA TO ACTION

- Data only useful if it can be converted to actions
- Automobile data readily available for analysis and interpretation
- Empower improved decision making to save lives

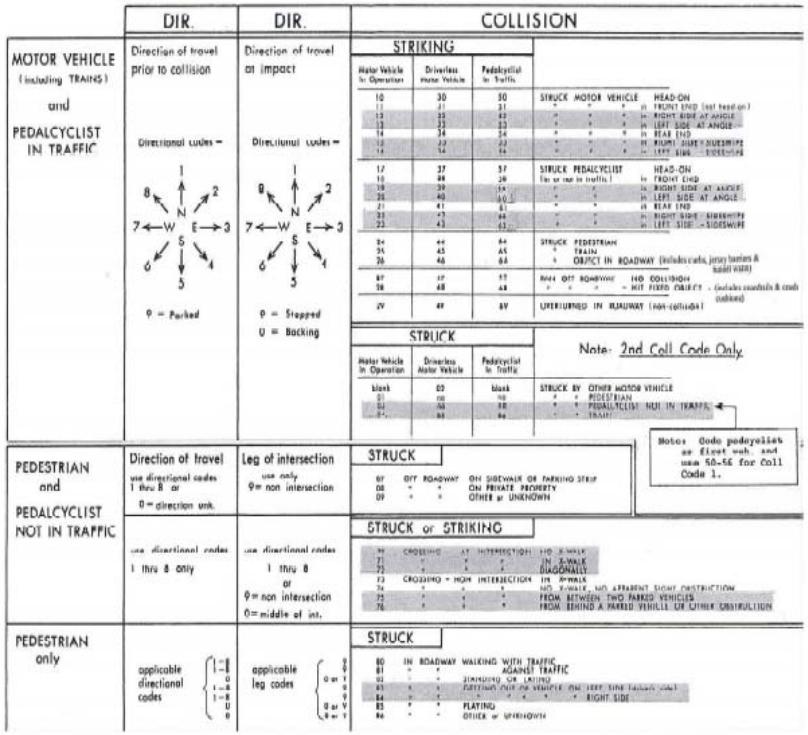
READY FOR INTEGRATION

- Real time data can be readily interpreted into risk
- Exciting results based on first analysis attempts
- Many examples of how business partners can use this technology

DATA

ArcGIS Metadata Form

SDOT Collision Code Matrix



COLLISION DATA

- Available from Seattle Department of Transportation (SDOT)
- Covers 2004 to 2020
  - Nearly 200,000 Records
- Many Attributes Available
  - Collision Details
  - Road and Weather Conditions
  - Geographic Information
  - Environmental Variables
  - Other Ancillary Information

METHODOLOGY 1

Collision data available, broken into injury vs. non-injury events. Nearly 40 associated attributes available for analysis, so it was necessary to determine what to use and what to omit.

Data to Exclude from Analysis

- Database organization fields and keys
- Geographic location data
- Collision details (damages, event descriptions)

Data to Include in Analysis

- Address Type
  - Alley, Block or Intersection
- Weather
  - Fog, Snow, Wind, Rain, etc.
- Road Conditions
  - Dry, Oil, Ice, Wet, Slush
- Light Conditions
  - Dawn, Daylight, Dusk, Dark
- Day of Week
  - Commuting and Traffic Congestion

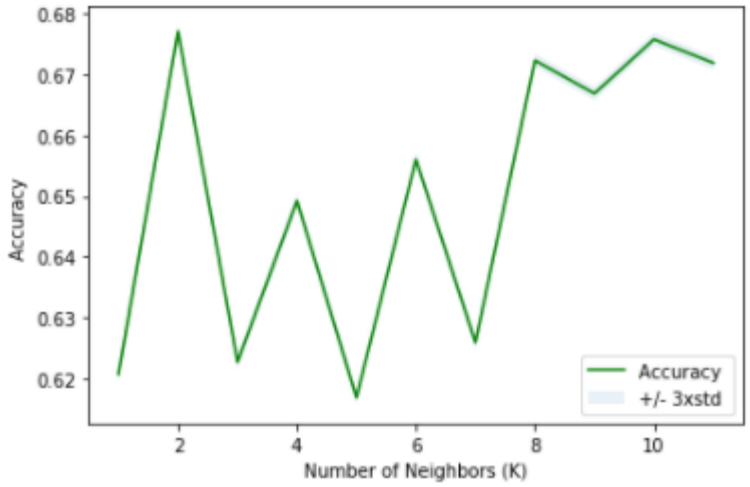
METHODOLOGY 2

DATA PREPARATION

- One hot encoding translation for categorical variables
- Scaled results to prevent outsized influences on prediction

SUPERVISED MACHINE LEARNING

- Multiple models considered:
  - Support Vector Machine (SVM)
  - K-Nearest Neighbor
  - Logistic Regression
  - Decision Tree



RESULTS

LIMITING TRAINING DATA SIZE

- Utilizing entire data set led to long processing times
- Limiting to 10% provided ample training data while keeping processing times reasonable

ACCURACY BY MACHINE LEARNING MODEL

- All four models able to provide predictions
- Lowest accuracy with Support Vector Machine
- Highest accuracy with Logistic Regression

Machine Learning Model	Test Set Accuracy
Support Vector Machine (SVM)	0.661
K-Nearest Neighbor (KNN)	0.676
Logistic Regression	0.701
Decision Tree	0.693

DISCUSSION

Promising Results Obtained	Machine Learning able to predict an injury collision with 70% accuracy.
Tool May Reduce Accident Risk by:	Monitoring subset of environmental factors from live sources
	Supplying data to processing algorithm for risk calculation
	Providing an alarm to driver when collision likelihood rises
Further Possibilities for Improvement	Determine addition data fields for improved accuracy
	Provide additional instructions for alternate safer routes

CONCLUSION

ACCURATE PREDICTIVE MODEL ACHIEVED

HIGHLIGHTS

- Model developed from 200,000 collision records
- 70% injury prediction accuracy with Logistic Regression model
- Processing times fast enough to process live data feeds

NEXT STEPS

- Identify live data source partners for software integration
- Identify hardware partners for application or hardware solution
- Improve public safety by integrating this solution