

AN EXPLORATORY INVESTIGATION OF CRASH SEVERITY OF AUTONOMOUS VEHICLES



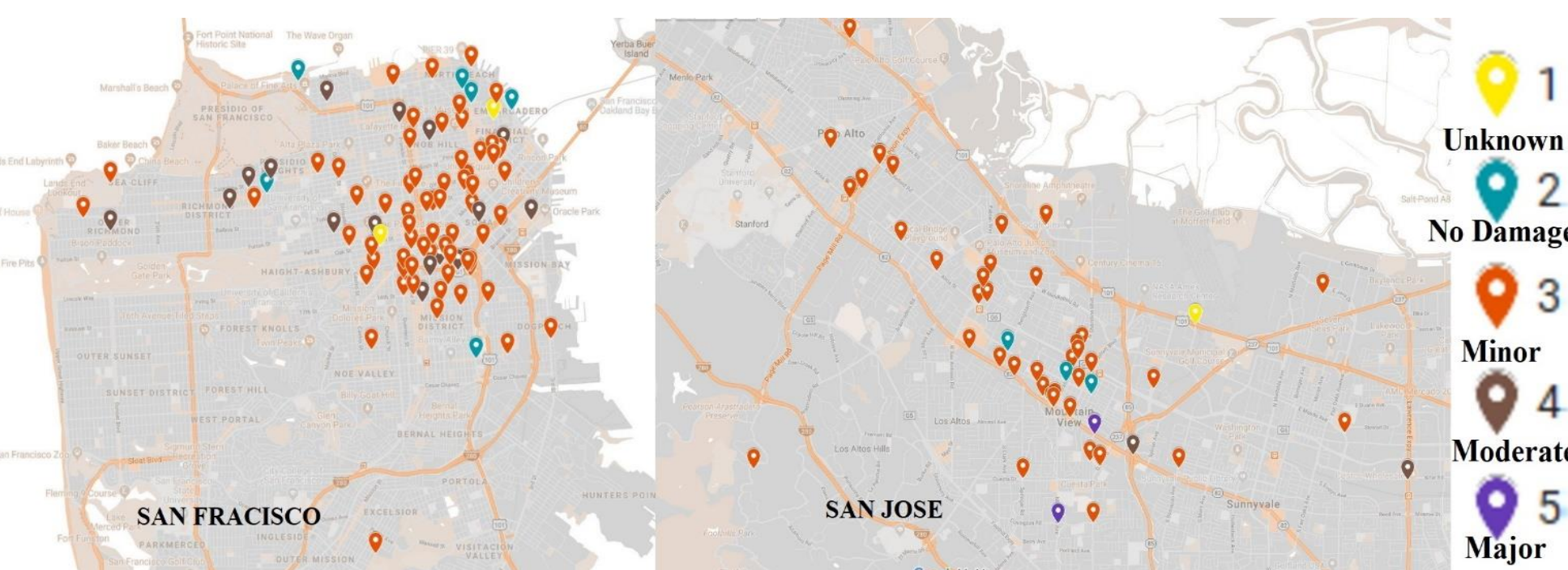
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Context

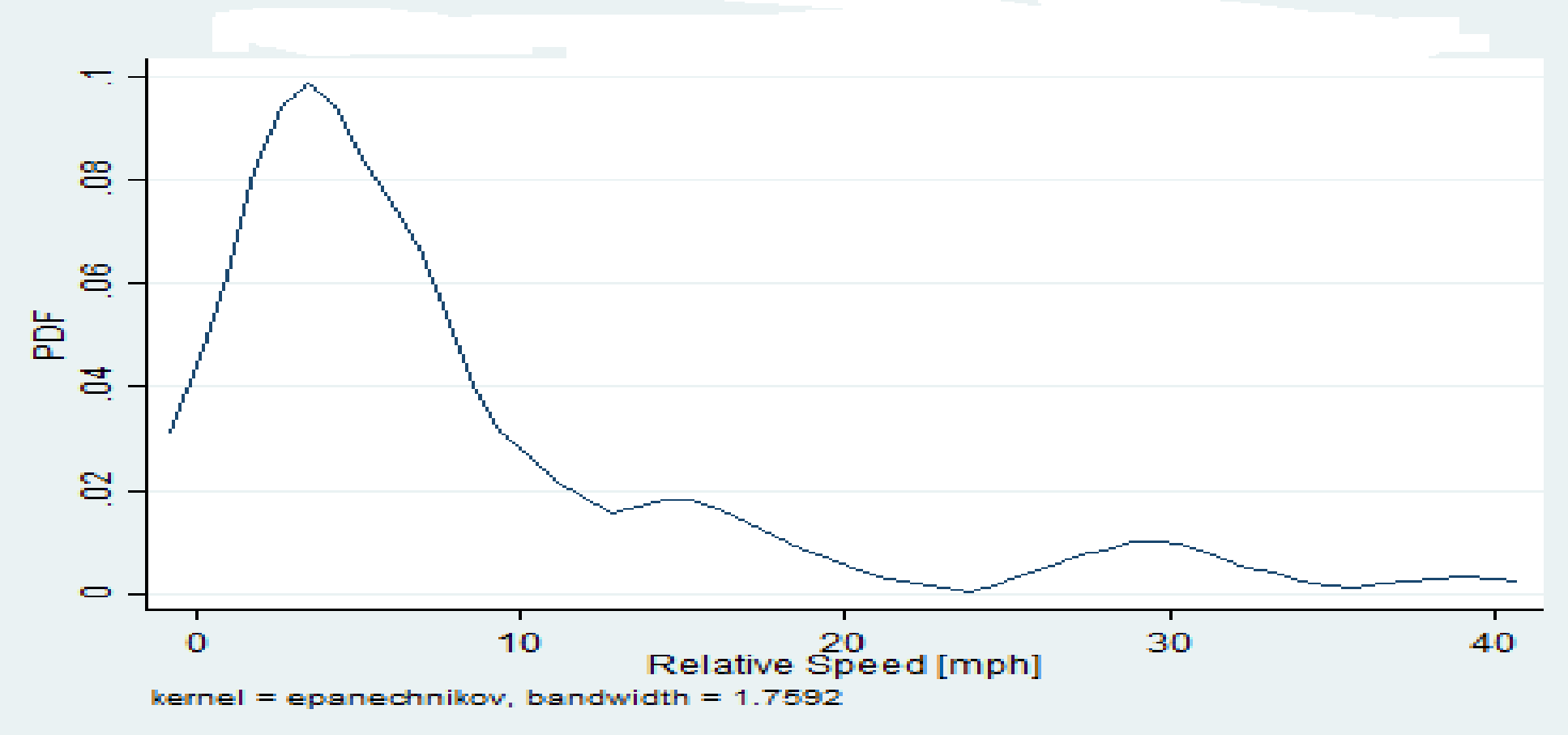
- Crash rate and crash severity constitutes the overall network safety.
- Autonomous Vehicles (AVs) are believed to mitigate crash frequency, however the repercussion of AVs on crash severity is ambiguous.
- There are unprecedented causes associated with AVs crashes.
- Crash severity model for AVs is developed and key issues associated with disengagements are assessed.
- Data inconsistency and implicit reporting protocols are identified and recommendation are provided for explicit reporting system.

Study Area and Data

- California Department of Motor Vehicle commissioned AV manufacturers to draft and publish reports on disengagements and crashes.



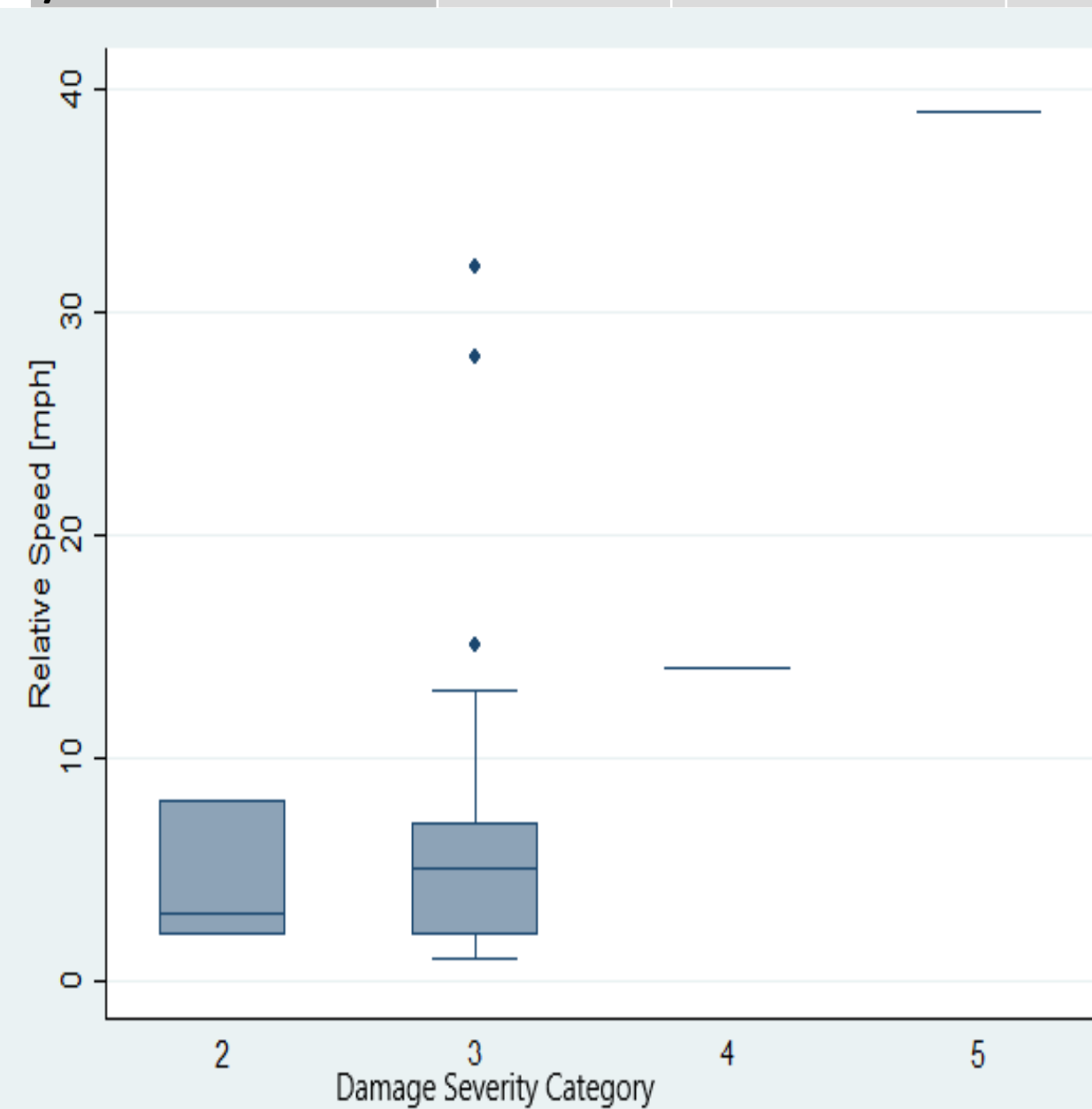
Crash



- Relative Speed during crash is generally less than 10mph indicating lower crash severity.

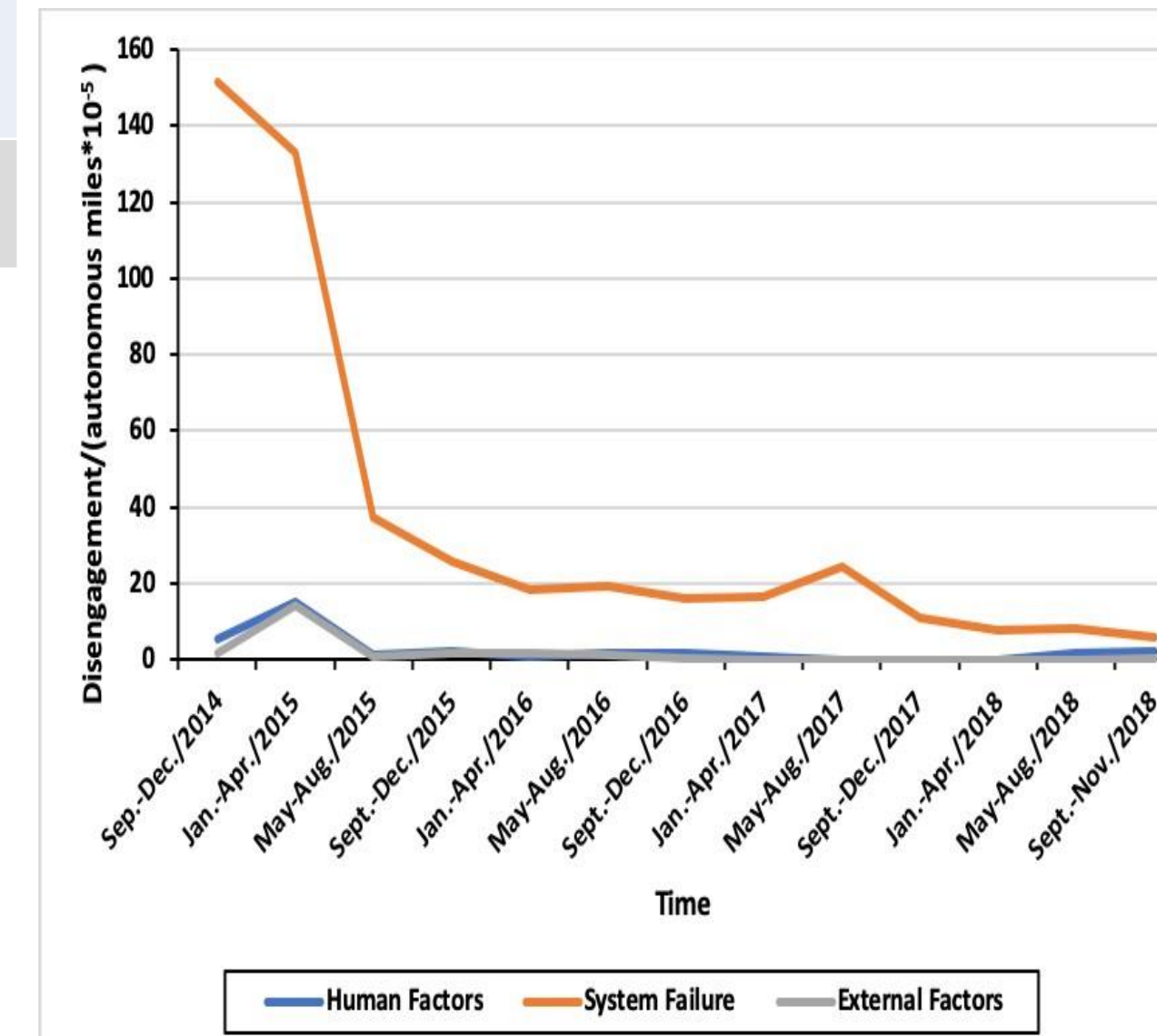
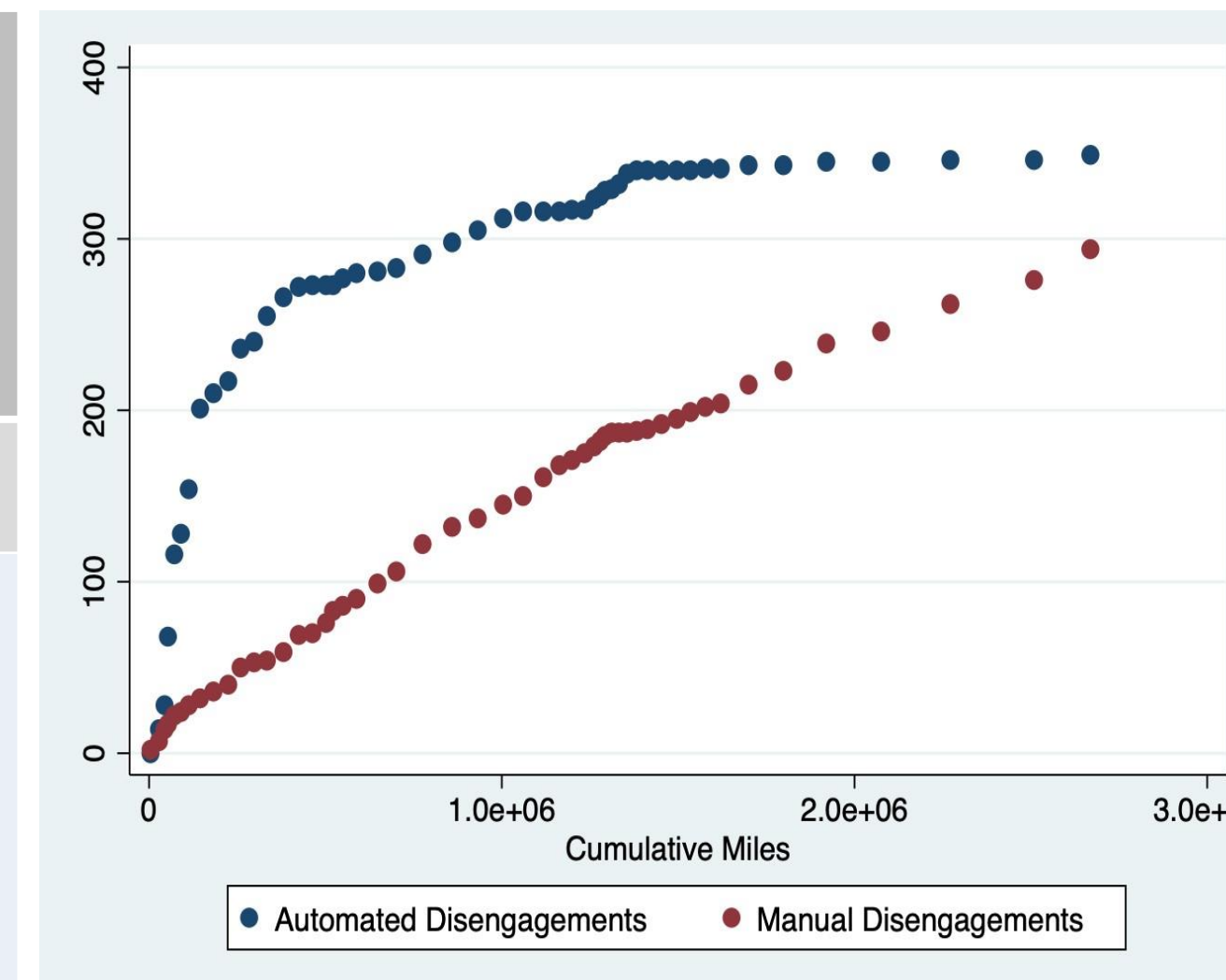
Crash Severity Model

Number of observations = 98 Ordered Logistic Regression			
Wald chi2(3) = 12.02			
Prob>chi2 = 0.099			
Pseudo R2 = 0.099			
Log pseudolikelihood = -67.037			
Crash AV damage severity	Odds Ratio	Robust Std. Error	P> z
signal	2.24	1.13	0.108
collosiontypenum			
2	0.18	0.13	0.016
3	0.22	0.16	0.044
Vehicletype			
1	0.09	0.09	0.019
2	1.58	1.30	0.577
3	0.59	0.49	0.530
4	0.37	0.46	0.421
/cut1	-4.19	0.90	
/cut2	0.26	0.76	



- Model is not well performing since all the explanatory variables are categorical and sample size corresponding to the categories is less.

Disengagements



- We see decrement in overall disengagements. Also, there is improvement in each cause category.
- The ambiguous terminology of manual and automated disengagements limits the potential to make explicit implications.

Discussion

- Since automated disengagement events are dropping and approaching to zero with time/experience, we can infer that the system performance of AV is improving, and the AV “brain” is able to handle driving tasks, which were intractable before. Additionally, the trend of manual disengagements implies no reduction in manual disengagement events implying no improvement in trust of humans on AVs. The underlying assumption is that manual and automated disengagements are mutually exclusive.

An alternate explanation for this datum is that with more experience (cumulative autonomous miles) with the system, drivers can anticipate the potential intractable situations and decide to exercise caution and hence disengages. Consequently, there is a decrease in automated disengagements, yet no inordinate improvement in AV technology. Reporting system should include the detailed description of disengagements for implicit implications. This implication is based on the conjecture that manual disengagements are subset of automated disengagements. Authors recommend CA DMV to include the disengagement cause, given that the crash occurred after a disengagement

- The crash models developed in this study encapsulates the factors that can escalate the AV damage severity. Vehicle type, signal and collision typology was found to significant variables.

- For the non-AV status in motion n rear-end crash, the odds of higher AV damage severity are 1.92 times greater, given the other variables are held constant in the model

- This loss of information by using discrete-time intervals can institute error in model estimation because of unobserved heterogeneity

- This study accompanying all the previous CA DMV employed studies have captured the driver-AV interaction, AV-conventional vehicle interaction, but AV-AV interaction is still a blind spot due to limited data points