講演番号	047

文献番号	20225047

Injury Severity Prediction based on Select Vehicle Category of Real-World Accidents Data

Susumu Ejima [1)] Tuskasa Goto [1)] Peng Zhang[2)] Kristen Cunningham[2)] Stewart Wang[2)]

1) SUBARU Corporation, 1-1 Subaru-cho, Ota-City, Gunma, 373-8555, Japan (E-mail: ejima.susumu@subaru.co.jp)

2) University of Michigan, International center for Automotive Medicine, 1150 W. Medical Center Dr. 3328 Med Sci-1 SPC 5677 Ann Arbor, MI 48109-5677, U.S.A.

KEY WORDS: **Safety, Occupant protection, Injury prediction,** AACN (C1)

With the evolution of telemetry technology in vehicles, Advanced Automatic Collision Notification (AACN), which detects occupants at risk of serious injury in the event of a crash and triages them to the trauma center quickly, may greatly improve their treatment.
An Injury Severity Prediction (ISP) algorithm for AACN was developed using a logistic regression model to predict the probability of sustaining an Injury Severity Score (ISS) 15+ injury. National Automotive Sampling System Crashworthiness Data System (NASS-CDS: 1999-2015) and model year 2000 or later were filtered for new case selection criteria, based on vehicle body type, to match Subaru vehicle category. This new proposed algorithm uses crash direction, change in velocity, multiple impacts, seat belt use, vehicle type, presence of any older occupant, and presence of any female occupant. Moreover, presence of the right-front passenger and its interaction with crash direction were considered, which affected risk prediction significantly especially in the side-impact crashes. Variable selection techniques were used to construct the final ISP algorithm with relevant features. In this paper, we presented results of two type of injury prediction algorithms, which do (ISP-R) consider the effect of a right-front passenger were proposed.
In order to evaluate model performance, five-fold cross-validation was performed within the training data (NASS-CDS 1999-2015). The area under the receiver operator characteristic curve (AUCs) was used as the metric to evaluate model performances, AUC was 0.862 with the ISP-R model for cross-validation. Delta-V, seat belt use, and crash direction were important predictors of serious injury, and moreover, the presence of right-front passenger was a significant injury risk modifier, especially for side impact crashes.

Table 1 Estimation of coefficients and their standard error and p-value for variables from the ISP-R model.

Parameters		Estimate	Std.Error	t value	Pr(>|t|)
Intercept		-16.559	1.642	-10.086	0.002
ln Delta-V (mph)		4.125	0.317	13.003	0.001
Direction of impact	Front	0.470	0.966	0.486	0.660
	Left	2.586	1.048	2.467	0.090
	Right	1.382	0.898	1.540	0.221
	Rear	0.000			
Belt use	Belted	-1.250	0.205	-6.101	0.009
	Unbelted	0.000			
Vehicle type	Utility	-0.459	0.150	-3.056	0.055
	Car	0.000			
Number of events	Multiple	0.391	0.173	2.256	0.109
	Single	0.000			
Presence of older	55 or greater	1.477	0.174	8.468	0.003
	under 55	0.000			
Presence of right-front passenger	Front	0.847	0.338	2.505	0.087
	Left	-0.326	0.328	-0.993	0.394
	Right	1.262	0.223	5.664	0.011
	Rear	0.648	1.134	0.571	0.608

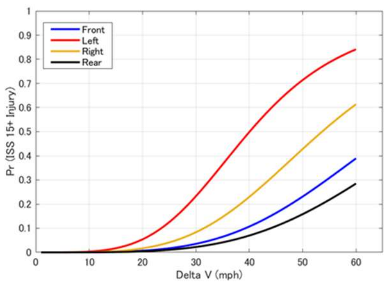
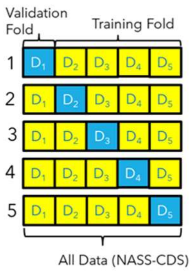


Figure 1 Result of risk prediction curve using ISP-R when there is only a driver. The figure showed the injury risk curve for four impact directions: front impact (blue), left impact (red), right impact (yellow), and rear impact (black).

Table 2 Sensitivity and specificity with the five-fold cross-validation with the ISP-R model.



Five-fold cross-validation

cutoffs	sensitivity	specificity
0.10	0.586	0.900
0.15	0.518	0.943
0.20	0.451	0.966
0.25	0.401	0.978
0.30	0.353	0.983

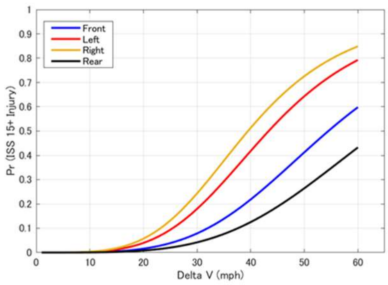


Figure 2 Result of risk prediction curve using ISP-R when there are both a driver and a right-front passenger. The figure showed the injury risk curve for four impact directions: front impact (blue), left impact (red), right impact (yellow), and rear impact (black).