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M5: The Miami Model for MVC Morbidity and Mortality

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Introduction

Motor vehicle collisions (MVC) account for 30-40,000 deaths and 29% of emergency department visits annually in the United States. We recently applied machine-learning tools for the first time to predict clinical outcomes following MVC.

Methods

We queried two prospectively collected databases maintained at the Jackson Memorial Hospital Ryder Trauma Center: i) The American College of Surgeons National Trauma Data Bank (local sample), and ii) the Ryder Trauma Center CARE database. De-identified case records were included for all patients who presented following automobile collisions (i.e. excluding motorcycle, bicycle, etc.) and were listed as vehicle occupants (i.e. excluding pedestrian hit by car). Patients were further categorized by mortality and hospital admission. A convolutional neural network (CNN) was trained to predict clinical outcomes and its performance was evaluated.

Table 1

	Acute Sample	Admitted Sample
Sample Size	17,088	16,287
Age (years)	36.2 ±18.4	37.2 ±19.4
Glasgow Coma Scale (GCS)	13.2 ±3.1	13.3 ±3.4
Injury Severity Score (ISS)	14.0 ±12.9	14.0 ±13.1
No. patients deceased	437 (2.6%)	1,070 (6.6%)
Time to admit (min)	---	555.3 ±426.6

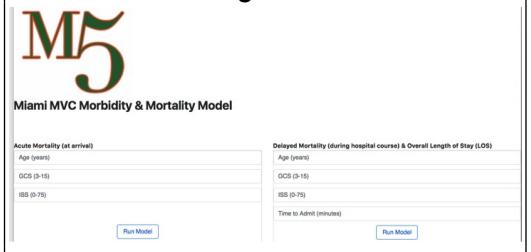
Sample characteristics

Table 2

Mortality	Acute	Delayed
AUROC	0.96	0.97
Sensitivity	0.97	0.92
Specificity	0.93	0.90
PPV	0.93	0.90
NPV	0.97	0.92
LOS	**Admission Sample**	**≤ 95th Percentile**
Mean absolute error	±4.23 days	±2.23 days

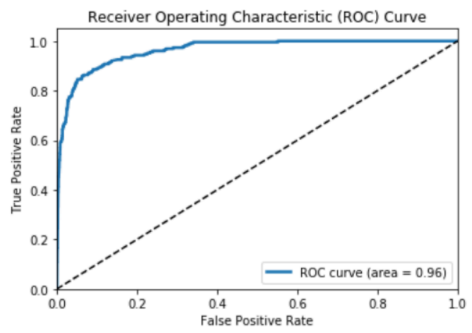
Model performance

Figure 1



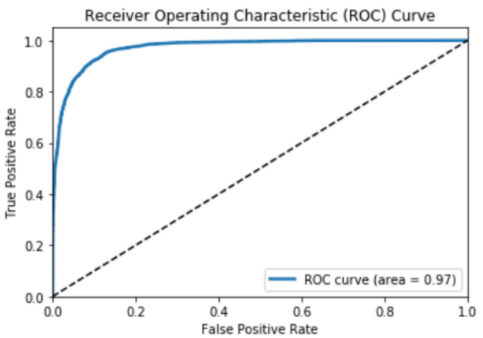
Web-Based Application

Figure 2



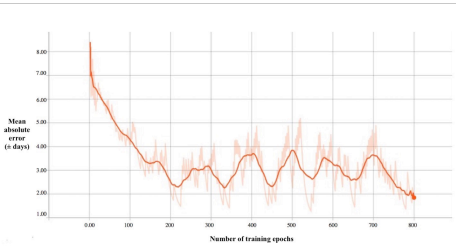
ROC curve for acute mortality model

Figure 3



ROC curve for delayed mortality model

Figure 4



Iterative mean absolute error for length of stay model

Conclusions

Our CNN-derived models predict clinical outcomes following MVC trauma with high accuracy. This demonstrates the first application of machine-learning to the prediction of MVC clinical outcomes.

Our web-based application is available to clinicians for free use at M5.med.miami.edu

References

1. Blincoe LJ MT, Zaloshnja E, Lawrence BA. The economic and societal impact of motor vehicle crashes, 2010 (revised). National Highway Traffic Safety Administration;2015. DOT HS 812 013.
2. Rating the severity of tissue damage. I. The abbreviated scale. Jama. 1971;215(2):277-280.
3. Baker SP, O'Neill B, Haddon W, Jr., Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. The Journal of trauma. 1974;14(3):187-196.

Acknowledgements

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