

From Regression Analysis to Deep Learning: Development of Improved Proxy Measures of State-Level Household Gun Ownership

The objectives of the study are 2-fold: (1) to provide the research community with accurate, easily obtainable proxy measures of state-level household gun ownership; and (2) to encourage broader adoption of advanced machine learning (ML) methods that go beyond the prevailing linear models in public health research.

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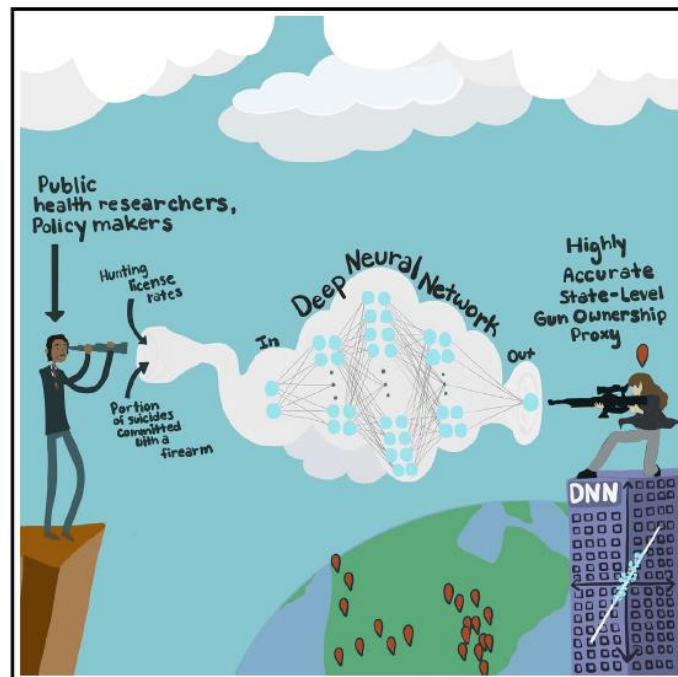
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Methods

Two significantly improved proxy measures for state-level household gun ownership were developed and validated. The first utilized traditional regression tools combining FS/S and state-level hunting license rates, and their statistical interaction. The second utilized an advanced machine learning tool known as Deep Neural Network (DNN).

Findings

- The DNN model outperformed all other models by a fair margin.
- The widely used FS/S proxy was found to be highly biased and inadequate.
- It is recommended that FS/S no longer be used to represent state-level gun ownership in firearm-related studies.



Discussion

The study findings provide the research community with two new proxy measures of state-level household gun ownership. These new proxies are easily obtainable and provide significant improvements over the existing ones in terms of accuracy, reduced bias, and correlation with the variable they represent. The demonstration of machine learning tools in firearms research can inspire broader adoption in other areas of public health.