Identifying the key predictors of electric vehicle adoption

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Introduction

Motivation

- Electric vehicles (EV) will require energy sources to shift from petroleum-based to the electricity grid
- Previous work has largely attempted to understand EV adoption from the user perspective
- This focus has neglected the built environment influence and regional adoption trends
- States and utilities need this understanding to manage the regional-level electricity grid

Research Question

What are the key predictors of electric vehicle sales at the regional level?

Research gaps addressed

- Regional study
- Diversity of models
- Included more independent variables

Data

Data was from all 50 US states from 2011-2018 for 400 observations. The data can be categorized by demographics (blue), vehicle characteristics (red), and context-related features (yellow).

Methods

- Used state EV sales as dependent variable
- Minimized predictive error through root mean squared error (RMSE) and adjusted R\(^2\)
- Employed an array of models to address the bias-variance tradeoff of machine learning (Figure 1)
- Compared these models by creating a “null model” -- the average value for all observations

Results: Key Predictors

13 of the 30 independent variables were determined to be strongly associated with EV sales

Column 1: The variables we hypothesized would be strongly associated

Column 2: Highlights variables that had not previously been found associated with EV sales

Column 3: The remaining influential variables.

Conclusions and Future Research

Conclusions

- No demographic variables show up as influential
- Built environment plays an important role in electric vehicle adoption
- States and utilities must consider the infrastructure makeup of the region in question when preparing for increased EV market penetration

Future Research

- If owner-occupied housing and renewable energy are both influential, could home solar installations be more indicative?
- Does the number of vehicles a household owns play a more important role? E.g. two or more vehicle households
- Can we capture sensitivity to travel costs more accurately with variable interactions?