

The Virtue of Transparency for Prediction

How to maximize the utility of data without overfitting

“Everything should be made as simple as possible, but no simpler.” This sentiment, typically attributed to Albert Einstein, nicely frames the concept of overfitting a data set. Data about the past is usually quite complicated because it reflects some legitimate patterns in addition to random noise. Finding a simpler explanation can separate the patterns from the noise. But for a given data set, how simple should we get?

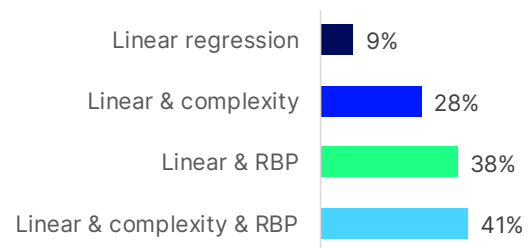
Economists and statisticians have always prized simple models with focused sets of predictive variables because they are less easily fooled by spurious relationships. On the other hand, machine learning (ML) research has found that with the right techniques, avoiding overfitting requires *more* complexity, not less. One such technique is to generate thousands, or even millions, of random transformations of the available data and then condense the results using regularized regression.

An alternative approach, called relevance-based prediction (RBP), identifies the blend of observations and variables that are most important for each prediction task. ML models need to be complex because they need to learn generalized rules that apply to every conceivable input. By contrast, RBP reasons through one task at a time, illustrating which data to focus on in each case.

It turns out that the high-complexity model and RBP identify much of the same information (see for example the summary in Exhibit 1, based on a regime-type simulation). This result is useful because it offers transparent insights into the workings of both approaches. Because RBP forms predictions as weighted averages of prior outcomes, we can take a new perspective on overfitting which is: how many observations are used to inform a given prediction, and how are they used?

Simplicity, then, applies not to the nature of the relationships we want to analyze, but to the method of how we do it. Transparency and interpretation bring great value to that process.

Exhibit 1: Out-of-sample R-squared of various sets of predictive components



This chart summarizes the result of simulated regime-type predictions from the paper cited below. RBP is relevance-based prediction, and complexity is the high-complexity model (HCM) using logistic transformations of variables.
Source: State Street Global Markets


For more on this topic, see our 2024 working paper: **“The Virtue of Transparency: How to Maximize the Utility of Data Without Overfitting”** by Megan Czasonis, Mark Kritzman, and David Turkington.

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