Less Complex Decision-Making in a Complex Business

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"If you cannot explain it simply, you don't understand it well enough." – Albert Einstein

I'm certainly not on Einstein's level of intelligence, but this quote applies to my calling to serve you at the intersection of science, education, and application. In a more roundabout way, it also applies to the part you play in producing beef. When I don't understand what I'm talking about well enough, the person/people I'm working with aren't interested in applying the concept. For you, it might be that you applied a new or different management concept that didn't produced the outcomes you expected.

The idea for this article topic comes from the book *Algorithms to Live By: The Computer Science of Human Decisions* (Christian and Griffiths; 2016, ISBN: 1627790365). It isn't a book written specifically for computer scientists, rather it explains how many of the thought processes and methods that computer scientists use in their work can be applied decision making in everyday life. I read it with cattle production in mind, looking for ideas that could be applied to decision making in beef cattle production. There were many such concepts in the book, but I chose the notion of "overfitting" because it helped me make sense of some complex decisions you face as a cattle producer.

With all that in mind, let me try to explain the concept of overfitting and how it can apply to the decisions you make in managing beef cattle. The simplest definition I can give you is that - overfitting is making a decision more difficult than it needs to be. A more precise explanation is that overfitting happens when we include too much detail from what we already know to making a decision that's success will be impacted by factors that we don't yet know.

Decisions are essentially predictions. We try to predict what will happen in the future, then chose a path that will put us in the best place for the future reality we predicted. How do we make the predictions that inform our decisions? We use our past experiences (i.e. data). Some decisions don't seem that important, so we just use our intuition – go with our gut feeling – without even thinking about data. However, when the decision has major consequences on the future, we pore over all the data we can find.

Modeling is the term scientists apply to using data from previous observations to predict outcomes that might result from different decisions. Overfitting a model happens when the data in the model is too specific and cannot account for future factors we haven't yet seen. In essence, overfitting a model in research is similar to overthinking a management decision in beef cattle production. You could use every bit of data you've collected about your cow herd and previous market trends to make a specific decision about genetics, but those are things we experienced in the past and they don't account for environmental and market changes that might occur in the future.

As if all that wasn't difficult enough, the nature of beef cattle production makes decision making, and the threat of overfitting, even more complex. The outcomes from many of the decisions you make won't be realized until far into the future. When a commercial cow/calf producer purchases a new bull and turns it out with the cows for that first breeding season, they don't really know if it was the right decision until a year and a half later; even longer if the resulting calves aren't sold at weaning. The timeline for evaluating a decision gets even longer when you consider replacement heifers that are

retained from that calf crop, or longer still for the seedstock producer evaluating the mating that produced the bull that the commercial producer bought!

It quickly becomes obvious that many environmental and market factors that influence success in beef production can change in the time between when a decision is made and the outcomes from that decision are felt. So, we naturally want to use as much data as possible to get those decisions right. But, the important thing to remember to avoid overfitting our model (i.e. overthinking the decision) is that the data we use to make those decisions occurred in the past and do not necessarily predict the future.

Does trying to stay away from overthinking a decision – overfitting our model – mean that we should disregard all data and past experiences? No. Certainly not. There is a balance to be stricken, a sweet spot to be found, for using data and experience to make cattle management decisions. Computer scientists try to find that sweet spot by putting mechanisms into their models that detect and automatically stop overfitting. Basically, the mechanism can determine if their model is so specific that it will make the predictions wrong more often. Interestingly, one of the more famous ways to do this in computer science is a statistical method called a Lasso (but it's an acronym, not a lariat).

To avoid that trap Einstein's warned about, let's wrap up by thinking about a way we can avoid overthinking decisions in cattle management. What could be your Lasso for making sure your future cow herd and calf crop have as much value as possible even when the market and environment change. My best suggestion is to eliminate unproductive cows, even if they didn't produce as a direct result of a decision you made. That means selling cows that don't wean a calf each year, and ideally finding that out as soon as possible (pregnancy checking).

It can be difficult and there are hundreds of excuses for not selling an open cow, especially if it seems to be our fault she didn't breed. However, staying committed to culling unproductive cows shows us the bad decisions by taking into account the data we didn't have when we made that decision. It also points out the cattle that can withstand our decision making (good or bad) and keeps us honest to not overfitting or model for future decisions (overthinking future decisions).