Prompt

How are the models that we've used in this course so far (and in this specialization more broadly) based on the process of induction?

Generalized Linear Models and Nonparametric Regression are based on induction in that they aim to generalize patterns from specific examples (training data) to make predictions about new, unseen cases. As the introduction states, induction involves "drawing general rules from specific examples—rules that effectively account for past cases, but also apply to future, as yet unseen cases, too."

Both GLMs and nonparametric regression learn relationships between variables from a set of training examples, with the goal of capturing generalizable patterns rather than simply memorizing the training data. They then use these learned patterns to make predictions on new data points. This process of going from specific examples to general rules that can be applied to new cases is the essence of induction in machine learning.

Prompt

"The fact that machine learning is 'evidence-based' by no means ensures that it will lead to accurate, reliable, or fair decisions." Provide 2-3 examples of this claim.

a) Historical bias in training data: The introduction mentions that "Our historical examples of the relevant outcomes will almost always reflect historical prejudices against certain social groups, prevailing cultural stereotypes, and existing demographic inequalities." For example, a hiring model trained on historical hiring data may perpetuate past biases against women or minorities in certain fields.

b) Feedback loops: The text discusses how predictive policing algorithms can create self-fulfilling prophecies. If an algorithm predicts higher crime in certain areas, leading to increased policing there, it may result in more arrests in those areas, which then reinforces the algorithm's predictions in future iterations.

c) Proxy variables: Even if protected attributes like race are excluded, other variables can serve as proxies. The text gives an example that age at which someone starts programming correlates with gender, so using this seemingly neutral variable could still lead to gender bias in hiring for programming jobs.

Prompt

Do you believe that Amazon's same-day delivery system mention on page 3-4 is unfair or unjust? Why or why not?

There are arguments on both sides, but I believe this system raises fairness concerns. While Amazon claims the system is based on efficiency and cost considerations, not race, the stark racial disparities in service availability are troubling. The text notes that in many cities, white residents were more than twice as likely as Black residents to live in qualifying neighborhoods.

This perpetuates existing inequalities, as predominantly white neighborhoods get better service. Even if not intentionally discriminatory, the system's effects contribute to systemic racial disparities. Given the history of racial discrimination and segregation in the US, a system that provides significantly different levels of service along racial lines is problematic, even if race isn't an explicit factor.

Prompt

What is the machine learning loop? Do you think that the machine learning loop, given in figure 1, applies to statistical modeling? Justify your answer.

Yes, I believe the machine learning loop described in Figure 1 largely applies to statistical modeling as well. Both machine learning and traditional statistical modeling involve:

1. Measurement: Collecting and preparing data

2. Learning: Fitting a model to the data

3. Action: Using the model to make predictions or decisions

4. Feedback: Evaluating model performance and potentially updating it

The key difference is that machine learning often emphasizes the iterative nature of this process more, with frequent model updates based on new data and feedback. Traditional statistical modeling might involve less frequent updates. However, the overall process is similar.

Both approaches face similar challenges in ensuring that the data accurately represents the real world, that the model generalizes well, and that actions taken based on the model are appropriate and fair. The potential for feedback loops affecting future data and predictions also applies to both machine learning and statistical modeling.