

Overreacting to a Black Box

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Abstract

We investigate how a decision maker overreacts to unexpected recommendations in the absence of knowledge about the generation process of these recommendations. We impose four axioms on the updating of a decision maker's beliefs and characterize the updating rule that describes such behavior. We call this updating rule the contraction-overreaction rule, and it is represented in the following functional form : For belief p and recommendation R , posterior belief p_R becomes

$$p_R = \begin{cases} \varepsilon(p, R)p + (1 - \varepsilon(p, R))\rho(R) & \text{if } d(p, R) < d_R^* \\ \rho(R) & \text{otherwise} \end{cases}.$$

Here, $\varepsilon(p, R) \in [0, 1]$ represents the weighting on p , $\rho(R)$ is the fixed point, $d(p, R)$ is the distance between p and R , and $d_R^* \in (0, \infty]$ is the threshold. It dictates that if the recommendation deviates significantly from the decision maker's prior belief, she perceives it as unexpected and overreacts to it. This updating rule captures the phenomenon of overreaction to unexpected information, well-known anomaly commonly observed in belief revision in a simple manner. The contraction-overreaction rule serves as a generalization of the contraction rule introduced by Ke, Wu, and Zhao (2023)¹. Moreover, we characterize some special cases and generalization of the contraction-overreaction rule to analyze more diverse belief revision processes from an axiomatic perspective.

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¹Shaowei Ke, Brian Wu, and Chen Zhao, Learning from a black box, 2023, working paper