Article

Maximum Entropy and Probability Kinematics Constrained by Conditionals

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Abstract: Two open questions of inductive reasoning are solved: (1) does the principle of maximum entropy (PME) give a solution to the obverse Majerník problem; and (2) is Wagner correct when he claims that Jeffrey's updating principle (JUP) contradicts PME? Majerník shows that PME provides unique and plausible marginal probabilities, given conditional probabilities. The obverse problem posed here is whether PME also provides such conditional probabilities, given certain marginal probabilities. The theorem developed to solve the obverse Majerník problem demonstrates that in the special case introduced by Wagner PME does not contradict JUP, but elegantly generalizes it and offers a more integrated approach to probability updating.

Keywords: probability update; Jeffrey conditioning; principle of maximum entropy; formal epistemology; conditionals; probability kinematics

1. Introduction

Jeffrey conditioning is a method of update (recommended first by Richard Jeffrey in [1]) which generalizes standard conditioning and operates in probability kinematics where evidence is uncertain ($P(E) \neq 1$). Sometimes, when we reason inductively, outcomes that are observed have entailment relationships with partitions of the possibility space that pose challenges that Jeffrey conditioning cannot meet. As we will see, it is not difficult to resolve these challenges by generalizing Jeffrey conditioning. There are claims in the literature that the principle of maximum entropy, from now on PME, conflicts with this generalization. I will show under which conditions this conflict obtains. Since proponents of