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New Axioms for Probability and Likelihood Ratio Measures

Vincenzo Crupi, Nick Chater, and
Katya Tentori

ABSTRACT

Probability ratio and likelihood ratio measures of inductive support and related notions have appeared as theoretical tools for probabilistic approaches in the philosophy of science, the psychology of reasoning, and artificial intelligence. In an effort of conceptual clarification, several authors have pursued axiomatic foundations for these two families of measures. Such results have been criticized, however, as relying on unduly demanding or poorly motivated mathematical assumptions. We provide two novel theorems showing that probability ratio and likelihood ratio measures can be axiomatized in a way that overcomes these difficulties.

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1 Introduction

In what follows, we will denote the quantity below as the probability ratio:

$$\frac{P(h|e)}{P(h)}$$

To ensure mathematical definiteness, we will assume throughout that h and e are contingent statements and P is a regular probability function (so that $0 < P(h)$, $P(e) < 1$).

From Keynes ([1921], pp. 165ff) to Kuipers ([2000], pp. 49ff), the probability ratio, or strictly increasing functions of it, have often been said to measure the degree of inductive support or confirmation that evidence e provides to hypothesis h . Similarly, the probability ratio has been employed to characterize the strength of inductive arguments in the psychological study of human