Matthew properties for incremental confirmation and the weak law of likelihood

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A Bayesian confirmation measure expresses the degree to which evidence E confirms hypothesis H in terms of the probabilistic relations between E and H. In particular, an *incremental* measure $c(H,E)$ is a function of $p(H|E)$ and $p(H)$ such that $c(H,E)$ increases both when $p(H|E)$ increases and when $p(H)$ decreases.

Bayesian theorists have proposed and defended several incremental measures, characterized by different, and partially incompatible, formal properties. In the last few years, such properties have been systematically investigated, in order to identify the *structural* conditions characterizing specific (classes of) incremental measures (cf. Crupi *et al*. 2010). In this paper, we focus on two interesting structural conditions known as the weak law of likelihood (Fitelson 2007) and the Matthew property for confirmation (Festa 2012): for short, WLL and M. Given the evidential sentence E, and two hypotheses H_1 and H_2 — such that $0 < p(E), p(H_1), P(H_2) < 1$ — WLL and M can be stated as follows:

(WLL) If $p(E|H_1) = p(E|H_2)$ and $p(E|\neg H_1) < p(E|\neg H_2)$, then $c(H_1,E) > c(H_2,E)$.

(M) (i) If $p(E|H_1) = p(E|H_2) > p(E)$ and $p(H_1) > P(H_2)$ then $c(H_1,E) > c(H_2,E)$.
(ii) If $p(E|H_1) = p(E|H_2) < p(E)$ and $p(H_1) > P(H_2)$ then $c(H_1,E) < c(H_2,E)$.

After discussing and motivating these two conditions, we proceed as follows.

First, we prove that, although WLL and M are inspired by very different intuitive motivations, they are in fact, quite surprisingly, logically equivalent. Moreover, the proof of this theorem leads to some further, interesting results.

In particular, we introduce two new structural conditions for incremental confirmation by "reversing" WLL and M, i.e., by replacing any occurrence of ">" and "<" in the consequents of WLL and M with "<" and ">", respectively. It turns out that the reversed conditions, called RWLL and RM, are also logically equivalent.

Finally, we discuss in details the plausibility of RM and RWLL both as requirements for the intuitive notion of confirmation and as structural conditions for incremental measures. In particular, we show that none of the "old" incremental measure (proposed before 2007, cf. Crupi *et al*. 2010) satisfy RM and RWLL; still, it is perfectly possible to identify several (classes of) incremental measures satisfying such conditions. Moreover, we suggest that measures of this kind capture some important intuitions concerning confirmation, that makes them highly plausible in a number of interesting cognitive contexts.

References

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