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Jed A. Duersch* (jaduers@sandia.gov) and **Thomas A. Catanach** (tacatan@sandia.gov).

A Generalized Theory of Information to Improve Training and Predictions. Preliminary report.

We present a theoretical framework in which present belief serves a critical role in how we measure information gained by a past change in belief. Thus, as evidence grows, information assessed in a previous belief update evolves as we reevaluate its importance. This framework allows us to reconstruct all information measures that admit an expectation-based interpretation from first principles and rigorously examine emergent properties. Moreover, this theory yields a new measure of information; we can compute the information contained in a model prediction in the view of additional evidence. We examine implications of this theory with three applications. (Received September 17, 2019)