Irrational Exuberance: Correcting Bias in Probability Estimates

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Abstract: Excess Certainty Adjusted Probability" (ECAP)
Nowadays automated algorithms are routinely used to generate probability estimates, often in real time, for a variety of different events. However, even unbiased probability estimators can provide systematically incorrect estimates, especially in situations where large numbers of probability estimates have been generated. There is a need for an approach to adjust the estimates to account for selection bias. We adopt an empirical Bayes framework and show that a variant of Tweedie's formula can be used to implement the adjustment. Our approach, named "Excess Certainty Adjusted Probability" (ECAP), works particularly well in settings where a large number of probability estimates have been observed. ECAP does not need to make any assumptions about the distribution of the underlying true probabilities. Instead, it relies on estimating the marginal distribution of the corresponding probability estimates, a feasible task in the increasingly common situation where a large number of estimates is observed. We will discuss the theoretical and empirical evidence that the ECAP estimates are generally significantly more accurate than the original ones.