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*Grounding Algorithms in Principled Mathematics: A Perspective from Industry.*

When mathematicians enter industry, how do they differ from engineers or computer scientists? This talk discusses algorithms, developed in more applied fields, that have subsequently been recast in more principled mathematical forms. We examine the problems of *data association* and *entity resolution*. For these problems efficient algorithms have been developed that select solutions from a combinatorially vast state space. With adequate testing and parameter selection, they perform well in practice. But algorithms cannot answer the natural question, “What is the posterior probability of the computed solution given the observed evidence?” We demonstrate the unreasonable effectiveness of providing these problems the rigorous, probabilistic basis necessary to answer this question. Among the benefits are (a) corrections to previously *ad hoc* formulas, (b) confidence estimates, and (c) the structural understanding necessary to generalize the algorithm. In particular, we show how the mathematically grounded approach allows us to generalize the data association problem from  $\mathbb{R}^n$  to more general spaces. (Received September 22, 2015)