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# DSEA - A Data Mining Approach to Unfolding

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Obtaining energy spectra of incident particles such as neutrinos or gamma-rays is a common challenge in neutrino- and Air-Cherenkov astronomy, as the particle's energy cannot be observed directly but has to be inferred from other observables e.g. energy losses of secondary particles utilized for detection. The task is further made difficult by the fact that the production of secondaries, e.g. in a neutrino-nucleon interaction is governed by stochastical processes. Mathematically this corresponds to an inverse problem, which is described by the Fredholm integral equation of the first kind. Several algorithms for solving inverse problems exist, which are, however, somewhat limited, for example in the number of input variables or in the sense that only the unfolded distribution is returned and information on individual events is lost.
We present the Dortmund Spectrum Estimation Algorithm (DSEA), which aims at overcoming the afore mentioned obstacles by treating the inverse problem as a multinominal classification task. Within DSEA the final spectrum is obtained by summing the class-confidences of the individual events. DSEA, therefore, offers the advantage that any learning algorithm can be used as long as it returns the confidences of the individual classes. This results in a modular and highly flexible algorithm that can easily be tailored to a problem at hand. To avoid a potential bias on the class distribution used for the training of the learner, DSEA can be used iteratively using a uniform class-distribution as input.

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