

# Energy Methods in Computer Sciences

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## Abstract

The advent of mainframes and the development of *high-level* programming languages and tools reduces greatly the amount of labor needed to construct computer programs, by allowing us to *communicate* with computers in a much more *natural* fashion. However, mathematical constructs dependent on *continuous quantities* that are regulated by differential principles such as Partial Differential Equations still pose major computational challenges and are purposely avoided in favor of *discrete* approaches such as cellular automata or relaxation. *Energy Based Methods* (EBM) offer more than just a middle ground between totally discrete and totally continuous models: (1) a more natural approach to continuous (differentiable) behavior that is compliant with the discrete mindset of computers; (2) greatly reduce algorithm time-complexity, and (3) are much easier to analyze. During this talk, I will present the common features of EBM, and three examples will be analyzed in three different computer sciences: image processing, computer simulation, and machine learning.

**Keywords**— Computer Sciences, Scientific Paradigm, Energy Based Methods, Lagrangian methods, Eulerian methods