Completeness in differential approximation classes

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Abstract

We study completeness in differential approximability classes. In differential approximation, the quality of an approximation algorithm is the measure of both how far is the solution computed from a worst one and how close is it to an optimal one. The main classes considered are DAPX, the differential counterpart of APX, including the NP optimization problems approximable in polynomial time within constant differential approximation ratio and the DGLO, the differential counterpart of GLO, including problems for which their local optima guarantee constant differential approximation ratio. We define natural approximation preserving reductions and prove completeness results for the class of the NP optimization problems (class NPO), as well as for DAPX and for a natural subclass of DGLO. We also define class 0-APX of the NPO problems that are not differentially approximable within any ratio strictly greater than 0 unless P = NP. This class is very natural for differential approximation, although has no sense for the standard one. Finally, we prove the existence of hard problems for a subclass of DPTAS, the differential counterpart of PTAS, the class of NPO problems solvable by polynomial time differential approximation schemata.