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Exact, Heuristic and Metaheuristic Methods for Confidentiality Protection by Controlled Tabular Adjustment

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Abstract—Government agencies and commercial organizations that report data face the task of representing the data meaningfully while simultaneously protecting the confidentiality of critical data components. The challenge is to organize and disseminate data in a form that prevents these components from being unmasked by corporate espionage, or falling prey to efforts to penetrate the security of the information underlying the data. Unscrupulous data investigators could use unprotected data sources to infer sensitive, personal data about individuals. Besides harming individuals, these types of disclosures can drastically affect the willingness of future respondents to provide valuable data. Controlled tabular adjustment is a recently developed approach for protecting sensitive information by imposing a special form of statistical disclosure limitation on tabular data. The underlying model gives rise to a mixed integer linear programming problem involving both continuous and discrete (zero-one) variables. In this paper we develop new hybrid heuristics and a new meta-heuristic learning approach for solving this model, and compare their performance to previous heuristics and to an exact algorithm in the ILOG-CPLEX software. Our new approaches are based on partitioning the problem into its discrete and continuous components, and first creating a hybrid that reduces the number of binary variables through a grouping procedure that combines an exact mathematical programming model with constructive heuristics. Finally, we introduce a new metaheuristic learning method that significantly improves the quality of solutions obtained.

Keywords—Confidentiality, Mixed integer, Optimization, Metaheuristics, Adaptive learning, Mathematical programming, Evolutionary computation

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