


Solving a Business Process Optimization Issue With a Genetic Algorithm Coupled With Multi-Criteria Decision Analysis Method

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ABSTRACT

The addressed issue in the present work revolves around the area of business process management in general and in particular optimization. The problem involves the generation of optimized business process designs from a business process model in a multi-criteria optimization environment by appealing an evolutionary algorithm. Thus, the main contribution is to analyze the characteristics of using a multi-criteria decision-analysis method within a genetic algorithm in an issue of business process optimization. The experimental results clearly demonstrated that using a multi-criteria decision-analysis method helps considerably the production of qualitatively interesting alternative solutions in a reasonable period time regard-ing the problem complexity, which ultimately assists the decision maker to perform improved decision making

KEYWORDS

Business Process, Genetic Algorithm, Multi-Criteria Decision-Analysis Method, Multi-Objective Optimization

INTRODUCTION

By working on business process optimization (BPO) area, it would be wise to set out a few definitions. First off, a business process (BP) can be defined as a set of tasks that when properly connected perform a business operation, e.g. a product or a service which satisfied the customer and added value for the enterprise (Mahammed & Benslimane, 2018).

Optimization principal aim is to find the best possible solution to a problem within a set of constraints (Coello et al, 2006). With a single objective to optimize, the aim is finding the “global optimum”. With several conflicted objectives to optimize simultaneously, at least two, so-called “multi-objective optimization” which leads to a set of solutions. Usually meta-heuristics can solve such problems and by using evolutionary algorithms (EA) primarily (Coello et al, 2007). Due to their ability to deal with a set of solutions simultaneously in various kinds problems, EA became much

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recommended. Which inevitably leads to the concept of evolutionary multi-objective optimization, in the 80s (Schaffer, 1986).

So, why there is a need to optimize business processes? Enterprises from different horizons have a habit of using information technology to hasten existent business processes without applying any change. Such conduct can lead to ineffective processes that do not integrate up-to-date automated procedure steps. Many authors (Vergidis et al., 2015; Mahammed & Besnlimane, 2016) suggested that optimizing business processes is about improving performance, achieving maximum results using efficient data and parameters, in a reasonable duration and cost.

The main purpose of business process optimization is to provide a set of solutions according to a number of functions regarding to a set of criteria. However, it is difficult for the leader of an enterprise to differentiate or choose wisely among these solutions.

At this level, a multi-criteria decision analysis method (MCDA) often took part (Köksalan et al, 2011). Since the 60s, MCDA methods have been an active research area by producing many applied and theoretical research (Roy, 2005). For example, in (Abdel-Basset et al., 2018), to help a decision maker to select the appropriate cloud services which can fulfill their requirements, a neutrosophic multi-criteria decision analysis approach based on neutrosophic analytic hierarchy process has been used to estimate the quality of cloud services. So, MCDA methods purpose is to designate a preferable proposed solution, classify solutions in a small number of categories, and/or rank a set of solutions in a subjective preference order (Mardani, et al, 2015).

This paper aims to propose a business process optimization approach showing how an enterprise is able to achieve durable and effective process optimization, based on evolutionary algorithm using several criteria coupled with a multicriteria decision analysis method to a better decision-making. Concretely, it focuses on seeking the benefits of adding decision-making techniques in a well-defined multi-objective optimization problem of business process designs using specific evolutionary algorithms i.e. genetic algorithm (GA). The outcome is an approach capable to produce a set of solutions i.e. what authors chose to call business process designs generated from a business process model. Solutions are classified in categories and therefore helping the decision-maker to choose what to do, being mindful that the aim is to minimizing cost and duration of selected solutions.

The proposed approach utilizes a MCDA method with an EA to generate optimized business process designs in a multi-objective optimization environment and thus, tries to prevent stagnation while improving convergence rate. The efficiency of the proposed approach is illustrated with a set of test scenario from Internet industry by identify, select and use online directories and dataset of web services.

The rest of the paper is organized as follows. Section 2 presents a current state-of-the-art on BPO domain in an evolutionary computing context. Section 3 introduces the used evolutionary algorithm and the chosen MCDA method within the approach to optimize business process. Section 4 presents experimental details and results. Finally, the paper is summarized and concluded in section 5 and future work are talked about.

RELATED WORK

For more than three decades, many researches proposed different approaches to improve the quality (diversity) and the quantity (number of solutions) of solutions in a business process optimization using evolutionary algorithms in general, and NSGAII (Non-dominated Sorting Genetic Algorithm II) (Deb et al, 2000) among others. The present state-of-the-art present the work using NSGAII.

It all started with the work of (Hofacker and Vetschera, 2001). The authors worked on how to composing each business process design in a correct way to guarantee their high performance by focusing on the resource's allocation to activities. (Vergidis et al, 2006) and (Vergidis and Tiwari, 2008) presented major work in BPO using evolutionary algorithms. They proposed an effective approach for automated multi-objective optimization of business process designs with multiples evolutionary

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