The Applications of Intelligent Optimization Algorithms in Sentiment Analysis: A Deep and Systematic Study

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Abstract

It has been demonstrated that optimization algorithms is a method that can handle a variety of NP-hard (Non-deterministic Polynomial time) computational issues. It is becoming more and more popular for resolving various optimization issues. Today there is growing interest in intelligence methods for sentiment analysis to provide a quantifiable assessment of "positivity" or "negativity" about thoughts or social comments as a result of the World Wide Web's rapid expansion and the prevalence of online collaborative platforms. But the procedure of sentiment analysis and evaluation faces several difficulties. These issues are addressed by intelligent sentiment analysis, which automatically distinguishes between positive and negative user reviews. Hence, nature-inspired intelligent sentiment analysis algorithms are recently becoming an emerging research topic for developing new systems, as nature is an excellent source of inspiration. But as far as we know, there is no attempt to investigate the applications of nature-inspired intelligent sentiment analysis algorithms in the literature. In order to cover this research gap, this study presents a comprehensive literature evaluation. It gathers, explores, understands, and analyses the efforts and trends in a well-structured manner. We review a wide range of articles from various journals, conferences, book chapters, etc., to explain the current state of the art on these important algorithms as well as a comparative analysis of these algorithms. In contrast to previous reviews, we take a systematic strategy to locate, collect empirical data, interpret findings, critically assess, and integrate all relevant and excellent studies to address particular research issues about the specified research domain. The results showed that intelligent optimization algorithms bring significant accuracy gains. Also, these algorithms can converge quickly and produce better results in terms of complexity.

Keywords: Evolutionary algorithms · Entropy · Sentiment analysis · Entropy · Intelligent computing · Particle swarm optimization · Multi-objective optimization · Metaheuristic optimization algorithms

Introduction

Metaheuristic-based optimization algorithms utilize an easy and powerful approach to tackle issues related to optimization [1,2]. With a set of problem-independent techniques and the ability to comprehend higher-level algorithmic frameworks, meta-heuristics can be used to create optimized approaches [3,4]. Metaheuristic can be defined as a method to get a "good enough" solution in "small enough" computing time. Meta-heuristic algorithms give a better trade-off between exploration (global optima) as well as exploitation (local optima), along with solution quality and computing time [5,6]. Meta-heuristic algorithms are more dependable and effective than precise approaches because they can be adjusted to the demands of real-time optimization problems, produce better solutions with less computation time, and are not problem-specific, approximate, or deterministic [7,8]. Swarm intelligence, as a well-known subset of metaheuristics, is a wide range of techniques that

work based on artificial intelligence inspired by the cooperative behavior of basic organisms found in the wild. Its idea came from observations of the group behavior of various species, including birds, fish, bees, bacteria, ants, squirrels, and more [9]. Swarm intelligence algorithms are frequently employed in optimization issues. Optimization techniques could be applied to the feature selection problem to create the best possible feature set. Swarm intelligence techniques are employed in feature subset selection to decrease the feature subsets' computational complexity and dimensionality, improving classification accuracy [10]. However, population diversity is quickly lost when a standard swarm intelligence algorithm encounter challenging multi-peak problems, which causes the algorithm to prematurely converge. Dimension entropy is used to address this issue as a measure of population diversity. Entropy is a concept in thermodynamics. In 1948, Shannon put forward the concept [11]. The concept is that one can gauge how uncertain an information system is by calculating the probabilities of numerous separate, random discrete events. In an information system, information entropy is at its least when only one event occurs and at its maximum when the chance of occurring several discrete events is the same [12].

The World Wide Web (www) has recently become a great source of user-generated content. Twitter, Facebook, Google Plus, and many social media are available where people freely share their thoughts and feelings [13,14]. They do this through messaging or emojis, pictures, and videos. Undoubtedly, any decision-making process may benefit greatly from this constantly expanding subjective knowledge. Intelligent sentiment analysis was established to automate such data processing [15,16]. The systematic detection, extraction, quantification, and analysis of affective states and subjective data is known as intelligent sentiment analysis. It uses biometrics, computational linguistics, natural language processing, and text analysis. It is a method of expressing an individual's feelings or ideas in text form, which may be categorized as

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