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Advanced RIME architecture for global optimization and feature selection

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Abstract

The article introduces an innovative approach to global optimization and feature selection (FS) using the RIME algorithm, inspired by RIME-ice formation. The RIME algorithm employs a soft-RIME search strategy and a hard-RIME puncture mechanism, along with an improved positive greedy selection mechanism, to resist getting trapped in local optima and enhance its overall search capabilities. The article also introduces Binary modified RIME (mRIME), a binary adaptation of the RIME algorithm to address the unique challenges posed by FS problems, which typically involve binary search spaces. Four different types of transfer functions (TFs) were selected for FS issues, and their efficacy was investigated for global optimization using CEC2011 and CEC2017 and FS tasks related to disease diagnosis. The results of the proposed mRIME were tested on ten reliable optimization algorithms. The advanced RIME architecture demonstrated superior performance in global optimization and FS tasks, providing an effective solution to complex optimization problems in various domains.

Keywords: Feature selection, RIME, Optimization, Metaheuristic, Transfer function

Introduction

The pursuit of optimal solutions within the expansive and intricate realms of global optimization problems is a critical and central endeavor across a multitude of scientific and engineering domains [1,2]. These domains, ranging from computer science and operations research to various branches of engineering and applied sciences, are continually faced with challenges that are high-dimensional and multifaceted. The inherent complexity and diversity of problems within these domains necessitate the development and implementation of innovative, sophisticated, and efficient algorithms. These algorithms must be capable of navigating through the vast landscapes of high-dimensional spaces, exploring a myriad of potential solutions, and ultimately converging to solutions that are optimal or near-optimal.

Global optimization problems are characterized by their extensive search spaces and the presence of numerous local optima, making the task of finding the global optimum a highly non-trivial endeavor. The challenges posed by these problems are further compounded by the increasing dimensionality and complexity of the search spaces, requiring algorithms