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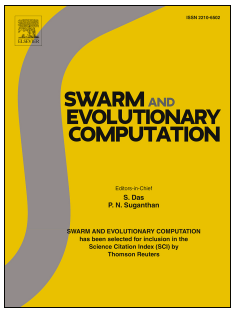

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Coral Reef Optimization with Substrate Layers for Medical Image Registration

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Abstract

In medical imaging there is a special interest in relating information from different images frequently used for diagnosis or treatment. Image registration (IR) involves the transformation of different sets of image data having a shared content into a common coordinate system. The estimation of the optimal transformation is modeled either as a combinatorial or a numerical optimization problem. Since traditional IR methods are constrained by several limitations, other optimization methods have been recently proposed to overcome such shortcomings. In this contribution, we consider the use of a recently proposed and high performance bio-inspired meta-heuristic: the Coral Reef Optimization Algorithm with Substrate Layers (CRO-SL). We adapt the algorithm to the real-coding IR problem variant following both feature-based and intensity-based designs, and perform two thorough experimental studies. Such studies focus on both mono-modal and inter-modal scenarios where the images suffer different types of 3D affine transformations to validate our proposal. The new proposal is benchmarked with state-of-the-art evolutionary and non-evolutionary IR methods. The results show that CRO-SL is a very competitive approach in terms of its robustness, accuracy, and efficiency.

Key words: Image Registration, Medical Imaging, Coral Reef Optimization, Nature-inspired Algorithm, Swarm Intelligence

1. Introduction

Image analysis, understanding, and visualization are essential tasks in medical and scientific applications. Many of these applications require the comparison, integration, or fusion of visual information acquired from different imaging devices, at different times, or distinct viewpoints. In particular, medical images are used for diagnosis and disease monitoring, intervention and treatment planning, assisted surgery, comparison of

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