# Preface

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Bio-inspired computing (BIC) takes inspiration from natural phenomena such as connectionism, evolution, or emergent and social behaviors. BIC approaches offer powerful methods to solve hard problems of social and economic interest. Since the first edition, in 2005, the International Work-Conference on the Interplay between Natural and Artificial Computation (IWINAC), funded by Prof. José Mira, paid special attention to BIC applications and methodologies through a series of special sessions held over subsequent editions.

This special issue collects extended versions of selected papers from IWINAC 2022 edition, held in Puerto de la Cruz, Tenerife, from May 31 to June 3. Previous conferences were held in Almería (2019), A Coruña (2017), Elche, Alicante (2015), Mallorca (2013), La Palma (2011), Santiago de Compostela (2009), La Manga del Mar Menor, Murcia (2007) and Las Palmas de Gran Canaria (2005).

From the 122 papers accepted for the IWINAC 2022 conference, 9 submissions were selected which match the topic of the special issue, namely "Bio-inspired computing approaches for problem solving". The submitted extended versions were revised by two expert reviewers each and 7 of them were finally accepted. These papers describe recent advances in the application of BIC approaches such as swarm intelligence, evolutionary algorithms, and neural networks for dealing with classic and emerging scientific and industrial problems such as workflow scheduling in cloud computing, compilation of quantum circuits, shop scheduling, travelling salesman problem, protein structure prediction, and business insolvency prediction.

The contributions are shortly summarized below.

## 1 Precise makespan optimization via hybrid genetic algorithm for scientific workflow scheduling problem

The authors deal with workflow scheduling in cloud computing environments. They propose an evaluation model that considers communication costs that are often neglected in the literature. To solve this problem, they propose a Genetic Algorithm, which is compared to a well-known heuristic. With the new model, they obtain results much closer to that from the real environment, especially in the case of heterogeneous architectures.

## 2 Solving quantum circuit compilation problem variants through genetic algorithms

In this work, the problem of mapping quantum gates to qubits of a given quantum hardware, for a quantum algorithm in the circuits model, is solved by means of a Genetic Algorithm. In addition to the classic feasibility restrictions, namely sequential constraints between some quantum gates and the fact that two quantum gates cannot operate simultaneously on the same qubit, the authors consider crosstalk constraints. Moreover, they deal with the problem of qubit initialization. The proposed GA outperforms previous approaches on some benchmarks.

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## 3 Fast elitist ABC for makespan optimisation in Interval JSP

The authors address a variant of the Job Shop Scheduling Problem with makespan minimization where uncertainty in task durations is taken into account and modeled with intervals. A novel Artificial Bee Colony algorithm is proposed, which includes the integration of a Local Search phase to better exploit promising areas of the search space. The results of the new approach are competitive with those obtained with previous methods in the literature, but they take less runtime. The addition of Local Search improves the results even further, outperforming the best-known ones from the literature.

## 4 Protein structure prediction with energy minimization and deep learning approaches

This paper discusses the advantages and problems of two alternatives for protein structure prediction: on one hand the recent approaches based on deep learning, which have significantly improved prediction results for a wide variety of proteins and, on the other hand, methods based on protein conformational energy minimization. In the latter case a memetic algorithm is considered, combining Differential Evolution and the traditional fragment replacement technique in the field.

## 5 Evolving ensembles of heuristics for the travelling salesman problem

The authors use ensembles of heuristics for the Travelling Salesman Problem (TSP), which raises the problem of building ensembles from a given set of heuristic rules. First, the authors use Genetic Programming to build a set of heuristics, and then construct ensembles by combining these heuristics using a Genetic Algorithm. The experimental study shows that the performance of ensembles justifies the time invested when compared to using individual heuristics.

## 6 Neighbourhood search for energy minimisation in flexible job shops under fuzziness

This paper deals with the flexible job shop scheduling problem, one of the most challenging problems in the scheduling literature with many practical applications, by considering energy objectives and uncertainty in the operation durations, which is modeled by fuzzy numbers. The main contribution is the proposal and formal analysis of some local search algorithms oriented at energy minimization. These algorithms are embedded into a memetic algorithm showcasing better performance than previous methods.

## 7 Evolutionary feature selection approaches for insolvency business prediction with genetic programming

The authors use different feature selection methods, based on evolutionary algorithms, in the field of business failure prediction and test the capability of Genetic Programming (GP) as an appropriate classifier in this field. Moreover, GP is also used as a feature selector. When using GP as a classifier method, the proposed selection method with GP stands out from the rest, which provides an added value to the use of GP in this field, in addition to the interpretability of GP prediction models.

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