Bio-Inspired Computing for Information Retrieval Applications

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Preface

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Section 1: Evolutionary Computation in Information Retrieval

Chapter 1
An Innovative Multi-Stage Multi-Dimensional Multiple-Inhomogeneous Melody Search Algorithm: Symphony Orchestra Search Algorithm (SOSA)

Mohammad Kiani-Moghaddam, Shahid Beheshti University Tehran, IRAN,
Mojtaba Shivaie, Shahid Beheshti University Tehran, IRAN,

During the past decades the state-of-the-art, as far as optimization techniques are concerned, is focused on algorithms inspired by physical phenomena, such as the genetic algorithms. Though these algorithms are quite useful in solving complex mathematical problems, an innovative strategy to enhance performance of the music-inspired algorithms is presented in Chapter 1. This strategy uses multiple-inhomogeneous music players and three different well-organized stages for improvisation. This chapter proposes an innovative symphony orchestra search algorithm (SOSA) to solve large-scale non-linear non-convex optimization problems. The strength of the newly proposed algorithm enhances its superiority in comparison with other music-inspired algorithms. The performance of the algorithm is analyzed with network expansion planning (NEP) problem.

Chapter 2
Performance Analysis of Classifiers on Filter based Feature Selection Approaches on microarray data

Arunkumar Chinnaswamy, Amrita School of Engineering, India
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Machine learning is an artificial intelligence technique that provides computers with the ability to learn without being explicitly programmed. It focuses on the development of computer programs that can change when exposed to new data. Chapter 2 troughs light on feature selection in machine learning. This chapter discusses the filter based feature selection methods such as information gain and correlation coefficient. Since after feature selection, the selected genes are subjected to various classification problems such as Naïve Bayes, Bagging, Random Forest, J48 and Decision Stump. Experimental results show that the filter based approaches reduce the number of gene expression levels effectively and thereby has a reduced feature subset that produces higher classification accuracy compared to other classification techniques.

Chapter 3
Bio-inspired Algorithms for Text Summarization-A Review

Rasmita Rautray, Siksha O Anusandhan University, India
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Bio-inspired computing is loosely knits together subfields related to the topics of connectionism, social behaviour and emergence. Briefly it is the use of computers to model the living phenomena, and simultaneously study the life to improve the usage of computers. Bio-inspired algorithms have gained a significant popularity to handle hard real world and complex optimization problem. The scope and growth of Bio Inspired algorithms explore new application areas and computing opportunities. Chapter 3 presents a review to bring a better understanding and to motivate the research on bio-inspired algorithms based text summarization.

Chapter 4
Issues and Challenges in Web Crawling for Information Extraction
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Anirban Mitra, VITAM Berhampur, India
Swagata Dey, MITS, Rayagada, India

Information retrieval is the tracing and recovery of specific information from stored data. Web information retrieval is a challenging area of recent research as enormous data are being collected, gathered, and generated every day. Computational biology and bio inspired techniques are part of a larger revolution that is increasing the processing, storage and retrieving of data in major way. This larger revolution is being driven by the generation and use of information in all forms and in enormous quantities and requires the development of intelligent systems for gathering, storing and accessing information. Chapter 4 describes the concepts, design and implementation of a distributed web crawler that runs on a network of workstations and has been used for web information extraction. It needs to scale several hundred pages per second, is resilient against system crashes and other events, and is capable to adapt various crawling applications.

Section 2: Bio and Nature Inspired Computing and Information Retrieval

Chapter 5
Swarm based Clustering for Gene Expression Data
P.K. Nizar Banu, B. S. Abdur Rahman University, India
S Andrews Samraj, Mahendra Engineering College, India

Clustering is one of the most important techniques, which group genes of similar expression pattern into a small number of meaningful homogeneous groups or clusters. Gene expression data has certain special characteristics and is a challenging research problem. There are many applications for clustering gene expression data. Hard clustering allows a gene to get placed in exactly one cluster and converges in local optima. Soft clustering approach allows gene to get placed in all the clusters with some membership values. As the hard clustering approach converges in local optimum, an evolutionary computation technique like swarm clustering is required to find the global optimum solution. Chapter 5 studies swarm clustering techniques and evaluation measures for clustering gene expression data.

Chapter 6
Significance of Biologically Inspired Optimization Techniques In Real-time Applications
Sushruta Mishra, C. V. Raman College of Engineering, India
The techniques inspired from the nature based evolution and aggregated nature of social colonies have been promising and shown excellence in handling complicated optimization problems thereby gaining huge popularity recently. These methodologies can be used as an effective problem solving tool thereby acting as an optimizing agent. The recent advances in swarm optimization, evolutionary methods and its applications are discussed in Chapter 6.

Chapter 7
Classification of faults in power transmission systems using modern techniques - An overview
Avagaddi Prasad, VIT University, India
J Belwin Edward, VIT University, India
K Ravi, VIT University, India
Power system constitutes a major part of the electrical system relating in the present world. Deficiency in power system causes a ton of inconvenience for the maintenance of the system. So transmission system needs a proper protection scheme to ensure continuous power supply to the consumers. The countless extent of power systems and applications requires the improvement in suitable techniques for the fault classification in power transmission systems. This Chapter 7 analyzes the technical literature pertaining to classification in connection with fault classification in power transmission system.

Chapter 8
Generating efficient techniques for Information Extraction and Processing using cellular automata
Subrata Paul, VITAM Berhampur, India
Anirban Mitra, VITAM Berhampur, India
Cellular automaton has proved to be very efficient in carrying out arbitrary information processing. A significant application lies in unifying the information processing. But, in this case the structures used in conventional computer languages are largely inappropriate. The definite organization of computer memory into named areas, stacks, and so on, is not suitable for cellular automata in which processing elements are not distinguished from memory elements. Rather it can be assumed that the data could be represented by an object like a graph, on which transformations can be performed in parallel. Fundamentals of cellular automata and its applications in information processing are discussed in Chapter 8.

Section 3: Human Centric and Behavior Based Computing

Chapter 9
A Novel hybrid Genetic Algorithm for Unconstrained and Constrained function Optimization
Rajashree Mishra, KIIT University, India
Kedar Nath Das, NIT Silchar, India
During the past decade academic and industrial communities are highly interested in evolutionary techniques for solving optimization problems. Genetic Algorithm (GA) has proved its robustness in solving all most all types of optimization problems. To improve the performance of GA, several modifications have already been done within GA. Recently GA has
been hybridized with many other nature-inspired algorithms. As such Bacterial Foraging Optimization (BFO) is popular bio inspired algorithm based on the foraging behavior of E. coli bacteria. Many researchers took active interest in hybridizing GA with BFO. Motivated by such popular hybridization of GA, an attempt has been made in this chapter to hybridize GA with BFO in a novel fashion. The Chemo-taxis step of BFO plays a major role in BFO. So an attempt has been made to hybridize Chemo-tactic step with GA cycle and the algorithm is named as Chemo-inspired Genetic Algorithm (CGA). It has been applied on benchmark functions and real life application problem to prove its efficacy.

Chapter 10
Gene Expression Programming

Baddrud Zaman Laskar, NIT Silchar, India
Swanirbhar Majumder, NERIST, India

Gene expression programming is a descendant of genetic algorithm and genetic programming. The advantage is that it takes both the optimization and search technique based on genetics and natural selection. It is gaining popularity because it has to some extent eradicated the limitations of both while keeping the advantages. It is still a new technique not much explored. Chapter 10 discusses elaborately on GEP. In addition, it also discuss various research work done in different fields using GEP as a tool followed up by GEP architectures.

Chapter 11
Bio-inspired Techniques in Rehabilitation Engineering for Control of Assistive Devices

Geethanjali Purushothaman, VIT University, India

The intelligent control of assistive devices is possible from bio-signals to find the user’s intention. The goal of the user intention recognition system is to develop computational methods for decoding the acquired bio-signal data. Pattern recognition system is one of the methods of accomplishing the objective. Bio-inspired techniques in higher level control of assistive device are in progress. Most literatures, demonstrates the application using signals and not much definite study describes the various bio-inspiring computation involved to develop the control of assistive devices in real-time. This Chapter 11 presents various bio-inspiring techniques used in interfacing devices for identification of information from the user intends.

Chapter 12
Bioinspired algorithms in solving three dimensional protein structure prediction problems

Raghunath Satpathy, MITS Rayagada, India

Proteins play a vital molecular role in all living organisms and it is difficult to predict the protein structure. The 3D structure prediction of proteins is very much important in biology and this leads to the discovery of different useful drugs, enzymes, and currently this is considered as an important research domain. The prediction of proteins is related to identification of its tertiary structure. From the computational point of view, different models have been developed along with certain efficient optimization methods to predict the protein structure. Chapter 12 basically discusses the key features of recently developed different types of bio-inspired computational algorithms, applied in protein structure prediction problems.