



# CBIC 2017

PROGRAM OF THE

XIII BRAZILIAN CONGRESS ON

COMPUTATIONAL INTELLIGENCE

Niterói (RJ) Brazil 30.10—01.11.2017

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# CBIC 2017

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XIII Brazilian Congress on  
Computational Intelligence

CONFERENCE PROGRAM

Nayat Sánchez Pi  
Program Chair



## Preface

The Brazilian Congress on Computational Intelligence (*Congresso Brasileiro de Inteligência Computacional*, CBIC) is a bi-annual conference organized by the Brazilian Society of Computational Intelligence (SBIC, formerly SBRN). Since 2015, it also counts with the support of the Brazilian Association of Computational Intelligence (ABRICOM).

XIII Brazilian Congress on Computational Intelligence (CBIC 2017) takes place at the Hotel H Niterói, in Niterói, Rio de Janeiro, Brazil, from 30 October to 1 November 2017.

CBIC 2017 aims to provide a high-level international forum for scientists, researchers, engineers, professionals and educators to disseminate their latest research results and exchange views of the future research directions in the area of computational intelligence.

CBIC activities are organized as keynote talks given by top-level scientists of the area, tutorials chosen in after an open call, technical sessions where peer-reviewed academic papers are presented, and focus-area workshops.

Topics of interest of CBIC were organized in three main tracks:

- Evolutionary, swarm and nature-inspired computation: genetic algorithms, evolutionary multi-objective optimization, estimation of distribution algorithms, genetic programming, artificial immune systems, swarm intelligence, collective intelligence, evolvable hardware, bio-inspired methods, collective intelligence, multi-criteria decision making, etc.
- Neural and machine learning systems: artificial neural networks, deep learning, machine learning, molecular and quantum computing, complex networks, reinforcement learning, hybrid systems, etc.
- Fuzzy and stochastic reasoning: fuzzy systems, fuzzy control and decision making, uncertainty analysis, rough sets, fractals, multi-agent systems, game theory, etc.

In this edition of CBIC, we have the pleasure of having highly relevant researchers as invited keynote speakers, a very interesting set of tutorials and workshops as well as many top-level technical papers.

We would like to take this opportunity to thank all the volunteers, invited speakers, members of the organizing committee, reviewers, colleagues and participants for their contributions that made CBIC 2017 a reference conference in the area of computational intelligence.

Welcome to CBIC 2017 and the beautiful city of Niterói!

October 2017

Nayat Sánchez Pi and Luis Martí  
Program and General Chairs  
CBIC 2017

# Organization

CBIC is a bi-annual conference coordinated by the Brazilian Society of Computational Intelligence (SBIC, formerly SBRN). Since 2015, it also counts with the support of the Brazilian Association of Computational Intelligence (ABRICOM).

This edition of CBIC is jointly organized by the Institute of Computing of the Federal Fluminense University, Niterói, Brazil and the Institute of Mathematics and Statistics of the Rio de Janeiro State University, Rio de Janeiro, Brazil.

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- Brazilian Society of Computational Intelligence (SBIC), Brazil.
- Brazilian Association of Computational Intelligence (ABRICOM), Brazil.
- Federal Fluminense University (UFF), Brazil.
- Rio de Janeiro State University (UERJ), Brazil.
- French Institute for Research in Computer Science and Automation (INRIA), France.



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## Program at Glance

OCTOBER 30, 2017			
	Auditorium	Room Baia	Room Itaipu
8:30–9:00	Registration		
9:00–10:00	Keynote: D. Al-Jumeily		
10:00–10:30	Coffee break		
10:30–12:30	Neural Networks I	Genetic Algorithms	Fuzzy Systems
12:30–14:00	Lunch (on your own)		
14:00–15:30	Tutorial Cidiney Silva	Tutorial Heitor Lopes	
15:30–16:00	Coffee break		
16:00–18:00	Neural RWA	EMO	Nature-Inspired Comp.
OCTOBER 31, 2017			
	Auditorium	Room Baia	Room Itaipu
8:30–9:00	Registration		
9:00–10:00	Keynote: M. Schoenauer		
10:00–10:30	Coffee break		
10:30–12:30	Deep Learning	Swarm Intelligence	Machine Learning I
12:30–14:00	Lunch (on your own)		
14:00–15:30	Tutorial Cristina Nader	Tutorial Jorge Pires	
15:30–16:00	Coffee break		
16:00–18:00	C.I. and Smart Cities	C.I. and Biomathematics	
19:30–21:30	Gala Cocktail and Dinner at Bistrô MAC		
NOVEMBER 1, 2017			
	Auditorium	Room Baia	Room Itaipu
8:30–9:00	Registration		
9:00–10:00	Keynote: J. M. Molina		
10:00–10:30	Coffee break		
10:30–12:30	Neural Networks II	Evolutionary Applications	Machine Learning II
12:30–14:00	Lunch (on your own)		
14:00–15:30	Tutorial Ana Cristina Bicharra Garcia	Tutorial Celso Camilo	
15:30–16:00	Coffee break		
16:00–17:00	Conference Closing		



**Part I**

**Keynote Speakers**



**Prof. Dhiya Al-Jumeily**

***Applications of Artificial Intelligence in Healthcare and Medicine***

**Professor of Software Engineering / Associate Dean,  
Faculty of Engineering and Technology,  
Liverpool John Moores University**

Applied Computing is the practice of embedding the realisation of Computer Science's latest technological advancements into industrial, business, and scientific intelligent solutions. Applied Computing stretches to a variety of fields, requiring an extensive knowledge of the specialised subject area and in many cases large teams of trained individuals to put into production. Applied Artificial Intelligence is considered as one of the major fields of Applied Computing. Artificial Intelligence has been introduced as an important tool in the implementation of Health, Business, Education, Entertainment, Tourism and more centred solutions as real world applications. The acceleration of technological change, especially the rise of mass computational availability in the late 20th Century, has led to the emergence of process and task frameworks that leverage and depend upon technological solutions. Subsequently, the use and acceptance of technology on a wide scale has opened up a new and expanding space of possibilities, allowing us to address many problems that were previously considered intractable, including the redefining the roles of many experts. Meanwhile, the long standing challenge of human healthcare has become a natural domain of interest for the incorporation of such advances in technology, since successful solutions in health translate into healthier populations and improve the quality of life of individuals. In general, the drive towards such technology rich applications, for the purpose of exploring new solution spaces, has been accompanied by an increasing rise in the need to effectively synthesis and manipulate information problems. The healthcare domain is no exception to this phenomenon.

The theme of Artificial Intelligence transcends computing. However, computing is perhaps a field at the forefront of exploring intelligence for the purpose of practical benefits to human society. It is arguable, though informative, to consider the dawn of computational intelligence as a consequence of the ideas of Alan Turing and the progression of computation from fixed immutable programs, manifested in hardware configurations, to entirely software based representations which provide the necessary potential and flexibility for self-modification and reflexivity as considered to be necessary conditions of intelligence. It is recognised that Turing was a key driving force in the paradigm shift from hardware driven designs in computing to the realisation that computation is in fact universal and can be represented by a machine capable of spanning the space of all possible computations, without the need for specialist hardware realisations for each and every class of task considered. The transcendence of computation from explicit hardware to universal machines parallels developments such as that of the wheel and the shift in thinking experienced during the industrial revolution. Such developments however point to another important consideration, that perhaps

the uniquely human processes of thought and intelligence may not be exclusively locked into the biological substrate, and may instead be contained and cultivated independently using modern computational platforms as a suitable carrier. In this talk we explore the intersection of data science, big data, and the role of AI in healthcare/medicine, providing a background to problem domains, considering the progress so far, assessing the potential of such approaches, and exploring possible future directions.

**Prof. Marc Schoenauer**

*Adaptation in Artificial Systems: lessons from Evolution Strategies applied to Deep Learning*

**Directeur de Recherche, TAU Team,  
INRIA-Saclay/LRI/Université Paris-Saclay.**

Comparison to random behavior can help monitor and automatically control an optimization process, as demonstrated more than 20 years ago by the CMA-ES algorithm (Covariance Matrix Adaptation Evolution Strategy), today recognized as one of the best performing Black Box continuous optimizer. The first part of the talk will first survey CMA-ES adaptation mechanism, but will also provide evidence that the hyperparameters that control CMA-ES covariance matrix adaptation could in turn be tuned to the problem at hand, presenting EPM-CMA-ES, a Per Instance Algorithm Configuration for CMA-ES that won the GECCO Black-Box Optimization Competition last July.

The second part of the talk will introduce S-ALERA, yet another optimizer for Deep Learning: Based on a similar principle of comparison with a random walk, ALERA (Agnostic LEarning Rate Adaptation) gracefully increases or decreases the learning rate of Stochastic Gradient Descent. However, whereas allowing the learning rate to also increase can indeed speed-up the optimization, it makes the algorithm more prone to catastrophic events. A statistical test using Page-Hinkley change point detection is hence added, in order to detect such events, and then cool down the optimization process. The resulting algorithm (SALERA – Safe ALERA) compares favorably to the state-of-the-art on standard benchmarks, while limiting the risks of dramatic explosions.

**Prof. José Manuel Molina López**

*Data Fusion and Computational Intelligence*

**Full Professor, Group of Applied Artificial Intelligence,  
Departamento de Informática, Universidad Carlos III de Madrid.**

Nowadays, Information Fusion systems addressing real-world problems must face a complex design process to allow the satisfaction of requirements for the selected application. In general, advanced IF systems are required to show robust,



context-sensitive behavior, and efficient performance in real time. System designer must handle different sources of knowledge besides the specific sensor data to accomplish these objectives: information models and reasoning strategies to process data, and context knowledge about a priori relationships between entities and environment or constraints over the system output. To solve complex and real-world problems, computational intelligence techniques could be a good approach for solving these kind of problems. In this conference, we cover the application of hybrid systems in data fusion solutions with sensor data and high-level representations of situations, adaptation mechanisms or distributed collaborative techniques. Computational Intelligence methods can be useful in complex or specific designs, where features such as learning, reasoning, coordinated interaction, etc., are necessary to deal with dynamic situations whose characteristics cannot be precisely predicted during design time. The development of computation intelligence techniques brings new opportunities to improve classical sensor fusion systems. This is especially applicable in new domains requiring a high degree of customized sensor fusion, many demanding also from robust solutions to operate in a operational conditions, usually dealing with wrong data, unpredicted behaviors, constraints, etc. In these cases, a representation of domain knowledge and appropriate heuristics can be the only way to develop acceptable solutions, combining the use of classical fusion techniques with higher level criteria to drive the system behavior.



**Part II**  
**Tutorials**



## **Cristina Nader Vasconcelos — *Convolutional Neural Networks: from Neocognitron to ResNet***

The tutorial will cover fundamentals of deep convolutional neural networks and its evolution from Fukushimas Neocognitron to modern ResNet. Sample code and APIs will be presented.

### **Mini-bio(s)**

Cristina Nader Vasconcelos is an Assistant Professor at the Fluminense Federal University. She received her Masters and PhD in Informatics by PUC-Rio and her bachelor degree in Computer Science from the Federal University of Rio de Janeiro. Her area of expertise includes different areas of visual computing such as Computer Graphics, Image Processing, Computer Vision and Generic Processing in GPU. From 2010 to now, her research focus on Pattern Recognition and more recently in particular Deep Learning.

## **Ana Cristina Bicharra Garcia and Mark Klein — *Crowd Computing: From Human Computation to Collective Intelligence***

Crowd computing - systems where crowds (of people) and clouds (of computers) work together to make better decisions than any could make individually - exploded onto the scene in the last decade or so with such startling success stories as Wikipedia, Linux, Mechanical Turk, Google search, Galaxy Zoo, Sermo, Slashdot, SeeClickFix, Fold.it and hundreds of others, with profound and still emerging impacts on everything from science and education to entertainment, business, and government. This phenomenon is many-sided, ranging from human computation (where humans act as subroutines, performing simple micro-tasks to support some larger computation) to collective intelligence (where computers support communities in making decisions about our species most complex and pressing problems). This tutorial will help participants:

- understand what makes crowd computing so potentially powerful be familiar with the key types of crowd computing technology, including their strengths and weaknesses
- identify promising directions for future research in this area.

### **Mini-bio(s)**

ACBG is a Full Professor at Departamento de Informática Aplicada, UNIRIO. She was a professor at UFF from 1994-2017. She did her master and PhD studies at Stanford University. She was a visiting scholar at Stanford in 2002 and at MIT in 2013. She advised 8 PhDs and 30 Masters students. She founded and coordinated until 2017 the ADDlabs, a research lab in artificial intelligence.

MK is a Principal Research Scientist at the MIT Center for Collective Intelligence, as well as an Visiting Researcher at the University of Zurich. His

research focuses on understanding how computer technology can help groups, especially large ones, make better decisions about complex problems. He has made contributions in the areas of computer-supported conflict management for collaborative design, design rationale capture, business process re-design, exception handling in workflow and multi-agent systems, service discovery, negotiation algorithms, emergent dysfunctions in distributed systems and, more recently, collective intelligence systems to help people collaboratively solve complex problems like global warming.

### **Cidiney Silva — *A Hybrid Method for Forecasting in Smart Grids Scope***

Smart Grids emerge as the next technological breakthrough to be achieved for systems of power generation, transmission and distribution. In a Smart Grid, the boundaries between generation and consumption/distribution are blurred. Therefore loading forecasting and generation forecasting processes are significantly different from the ones for established/legacy power systems. This tutorial turns to the study of forecasting methods in the scope of Smart Grids and how these methods are applicable in their intelligent behavior. It is imperative to have a consistent framework for short-term prediction meeting operating characteristics of Smart Grids. ARMA-like traditional models of time series prediction has been applied in Electric Power Systems, such as SARIMA and SARFIMA. To improve the accuracy of these methods, hybrid methods will be developed integrating fuzzy logic to SARIMA and SARFIMA models. The proposed models are based on the technique of Fuzzy Time Series (FTS). The proposed models meet the need for methods that rely less on strong stationarity assumptions and are parsimonious in its parameters, even though it deals with stochastic long memory processes. In this tutorial, proposed algorithmic solutions will be shown and analyzed, mainly in the form of hybrid SARFIMA methods and Fuzzy Time Series (SARFIMAFTS). This framework has been applied successfully to many important problems instances from large national power load curves to mini-grids. After the presentation of this framework and its results, a round table will be carried out with a number of exponents in this research area.

#### **Mini-bio(s)**

Electrical Engineer working on projects to expand and improve the National Interconnected System coordinating projects in hydroelectric plants (1.4 GW+) and substations of 500 kV, 345 kV and 138 kV. Product Engineer during 5+ years in the durable goods industry. Lean Six Sigma Green Belt by General Electric. Graduated from the Federal University of Minas Gerais in Electrical Engineering with certification in Process Control. I have obtained by the same institution the titles of Master of Engineering (2011) and Doctor of Engineering (2016). As well as Carlos Drummond de Andrade, my path has been being from Itabira to the Marvelous City!

## Jorge Guerra Pires — *A Crash Course in Biomathematics*

The tutorial is organized in the following modules:

- Module 1: getting to know biomathematics- On this module, aiming at people not familiar with biomathematics, we shall shortly present several paradigms and ideas. Starting point: <https://www.youtube.com/watch?v=O4J7eAJX1B0>.
- Module 2: Discussions and example with Matlab - On this module and the upcoming one, we shall present examples with the aim at giving rise to discussions. Starting point: <https://www.youtube.com/watch?v=Mk7f2hUblWE>
- Module 3: Discussions and example with Matlab - continuation of module 2
- Module 4: prospective on computational intelligence and biomathematics - On this module we close the tutorial with a selection of problems and issues in on what touches biomathematics and computational intelligence: starting points: Pires (2012, 2014, 2017).

### Mini-bio(s)

I have a bachelor in engineering by the Federal University of Ouro Preto, my master of science in a double-diploma scheme (Erasmus programme) by the University of LAquila/Gdansk University of Technology, in mathematical engineering/technical physics, and my PhD by the University of LAquila in Information Engineering (ICT). I have been working on computational intelligence since my bachelor, I have started a master by UFRJ in CI, and I have started to work on biomathematics at University of LAquila. Since then, I have attended to several events in biomathematics, mainly systems biology, and computational intelligence (my main interest is artificial neural networks). My main interest is teaching/working with biologists and medical doctors, as I did in my PhD, and intend to keep doing so.

## Celso Gonçalves Camilo Junior — *Search-based Software Engineering*

Este tutorial terá duas fases. Sendo a primeira para introduzir a teoria e algumas aplicações (50 minutos), e a segunda para as demonstrações (40 minutos). Sendo assim, inicialmente serão apresentadas as atividades da Engenharia de Software que podem ser modeladas como problemas de busca e otimização. Posteriormente, as complexidades de alguns desses problemas serão mostradas e, por fim na fase 1, alguns modelos e métodos aplicados em alguns trabalhos serão discutidos. Já na fase 2, pretende-se, inicialmente, apresentar vídeos de execuções e resultados de meta-heurísticas para diferentes problemas abordados na SBSE. Por fim, será feita uma demonstração, ao vivo, da execução de um método em um benchmark da área de SBSE.

**Mini-bio(s)**

Graduado em Ciência da Computação, tem mestrado e doutorado em Inteligência Artificial e concluiu o pós-doutorado em Search-based Software Engineering. Foi professor visitante na Carnegie Mellon University (EUA) em 2015-2016. Atualmente, é professor no Instituto de Informática da Universidade Federal de Goiás. Além disso, é revisor de diversos eventos e periódicos científicos. Tem mais de 40 trabalhos científicos publicados em veículos internacionais e nacionais, 7 Patentes/Registros, e várias orientações de trabalhos de graduação, mestrado e doutorado. Tem experiência na área de Inteligência Computacional, atuando principalmente nos seguintes temas: Metaheurísticas, Algoritmos Evolucionários e Redes Neurais. Entre as áreas de aplicação, destacam-se: Saúde (Câncer), Redes Sociais, Teste de Software, Engenharia de Software Baseada em Busca e Reparo Automatizado de Software.

**Heitor Silvério Lopes — *Programação Genética: Fundamentos e Aplicações***

A Programação Genética (PG) é um método de computação evolucionária largamente utilizado para problemas interessantes do mundo-real. Basicamente, PG evolui uma população de programas (usualmente representados como árvores complexas), e cada elemento da população representa uma possível solução para um problema de otimização. Há muitas classes de problemas onde PG pode ser aplicada com sucesso, tais como mineração de dados, reconhecimento de padrões, jogos e estratégias de aprendizado. Neste tutorial serão apresentados os fundamentos de PG de uma forma acessível, tal que a audiência inclui tanto alunos de graduação como de pós-graduação. Ao longo do tutorial, diversas aplicações reais serão apresentadas de modo a ilustrar a aplicabilidade de PG.

**Mini-bio(s)**

Professor Titular do Depto. de Eletrônica da UTFPR. Graduação em Engenharia Eletrônica, Mestrado em Engenharia Biomédica, Doutorado em Engenharia Elétrica/Sistemas de Informação, Pós-doutorado na University of Tennessee.



## Part III

# Technical Sessions



## Neural Networks I

Auditorium — October 30, 2017; 10:30–12:30

Session chair: **Guilherme Barreto**

31 **Offer Categorization for Price Comparison Websites: Word Embedding Approaches**

Rodolpho Rosa Da Silva, Eraldo Fernandes, Eduardo Motta, Eduardo Akira, Rodrigo Guarino, Leandro Alvim

39 **CML-Simplex: uma abordagem de programação linear para classificadores incrementais de margem larga**

Juan Fonseca-galindo, Luiz Brambirra Torres, Gustavo Lacerda, Antonio Braga

41 **Agrupamento de Fornos de Redução de Alumínio Utilizando Self Organizing Map para Extração de Conhecimento**

Alan Souza, Flávia Lima, Fábio Soares, Roberto Oliveira

50 **Monitoramento de epidemia de dengue na Amazônia usando redes neurais arti**

Wilson Silva, Renato Frances

71 **Efficient Selection of Data Samples for Fault Classification by the Clustering of the SOM**

Diego Perdigão, Guilherme Barreto, Cláudio Marques De Sá Medeiros

77 **Mapeamento da cinemática inversa de manipuladores robóticos usando RNAs configuradas em paralelo aplicado a um manipulador de 5 GDL controlado pela placa Intel<sup>®</sup> Galileo Gen 2**

Ricardo Nunes, Suely Mantovani

83 **Reconhecimento do piscar intencional com perceptron multicamadas para aplicação em interfaces cérebro-computador**

Bruno Oliva, Francisco Javier Roperó Pélaez

## Genetic Algorithms

Room Baia — October 30, 2017; 10:30–12:30

Session chair: **Helio Barbosa**

- 13 **Aplicando Programação Genética na Geração de Classificadores de Sentimento**  
Airton Bordin Junior, Celso Camilo Junior, Nadia Felix Silva, Thierson Rosa
- 30 **An Adaptive Pursuit Genetic Algorithm for Solving Job-Shop Scheduling Problems**  
Guilherme Ferreira, Heder Bernardino
- 32 **Modelagem de Carga em Sistemas de Distribuição de Energia Elétrica no Brasil via Algoritmo Genético**  
Josue Fernando Leal Granados, Mateus Antunes Oliveira Leite, João Antônio De Vasconcelos
- 61 **Proposta de método de microagregação para controle estatístico de sigilo através de algoritmo genético de chaves aleatórias viciadas**  
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**Part IV**

**Workshops**





## Computational Intelligence and Smart Cities

Cities' constant evolution has been driven human beings footsteps. Allied to the advancement of machines, cities are evolving into a new paradigm, being called Smart Cities. This evolution, closely related to devices equipped with high-performance computational skills, is happening in urban and rural areas. Besides promoting a decentralization of the current system, the new cities open doors for different autonomous agents to optimize their own interests. In this context, combinatorial optimization plays a fundamental role for more precise, efficient and balanced decision making. In addition, interaction with citizens is not overlooked, new tools contribute to society by promoting a more participatory economy and development. This call invites researchers to submit papers related to the above-described topics. Check the conference website for more information.

### Workshop organizer(s)

- Vitor Nazário Coelho (IC/UFF).
- Igor Machado Coelho (DICC/UERJ).
- Luiz Satoru Ochi (IC/UFF).
- Thays Aparecida de Oliveira (ETIC/Univ. Pompeu Fabra).

## Computational Intelligence and Biomathematics

Biomathematics can be seen as a broad scientific area including areas such as biomechanics/systemic biology and systems biology. On the other hand, computational intelligence can be seen as a broad scientific area including artificial neural networks and evolutionary computing. On this workshop, we shall see what is biomathematics and its ramifications, e.g. systems biology, and how they can be supported by methodologies from computational intelligence, e.g. in parameters estimations and patterns search (e.g., in gene expression).

### Workshop organizer(s)

- Jorge Guerra Pires (BISMA/UNIVAQ)
- Antinisca Di Marco (BISMA/UNIVAQ)
- Francesco Masedu (BISMA/UNIVAQ)
- Agnaldo Reis (DECAT/UFOP)

Invited collaborators: Robert Smith?, Roberto Maggio, Pasquale Palumbo, Adriana Dawes, Elissa Schwartz, Alessandro Borri and Marco Nobile.



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