SPECIAL ISSUE: SOFT COMPUTING FOR SWARM ROBOTICS: NEW TRENDS AND APPLICATIONS

Swarm Intelligence (SI) refers to the complex collective behavior of self-organized and decentralized systems, typically composed of a (spatially distributed and often large) population of individuals, or agents. These agents interact among them and with the environment in different but simple and local ways, coordinating their actions, and making the swarm inherently robust, effective, and flexible. A plethora of application scenarios have hitherto resorted to SI when addressing optimization, inference and prediction tasks. Among them, *Swarm robotics* (SR) refers to the application of SI methods to scenarios where the population of agents is embodied by physical or simulated robotic devices. The focus of SR is to thoroughly analyze how a swarm comprised of relatively simple physically embodied robots can be controlled to collectively accomplish different kind of goals that are out of the common capabilities of a single robot. Algorithms and methods relying on SR have been so far exceled over a wide range of complex real-world problems, such as localization, mining, disaster rescue missions, agricultural foraging or scenery mapping problems. The interests in SR form a popular topic that lays at the core of many research activities and contributions in the literature. This special issue aims at disseminating the latest findings and research achievements in the areas of SI and SR, with an intention to balance between theoretical research ideas and their practicability as well as industrial applicability. To this end, scholars and practitioners from academia and industrial fields are invited to submit high-quality original contributions to this special issue.

TOPICS

Topics of interest include, but are not limited to:

- Recent advances on Soft Computing methods for Robotics, with an emphasis on those inspired by processes and behaviors typically observed in Nature
- Novel applications of Swarm Robotics, with a priority on real-world scenarios.
- Hybridization of Swarm Intelligence techniques, with applications to robotics or autonomous complex systems.
- New synergies between Swarm Intelligence and Swarm Robotics.
- Coordination and control of Swarm Robotic Systems.
- Adaptive Soft Computing methods.
- Applications of Swarm Intelligence for collaborative positioning and route optimization in robotic swarms.
- Distributed inference in Swarm Robotics.
- Self-organization in robotics enabled by Swarm Intelligence.
- Distributed Swarm Robotic systems.

IMPORTANT DATES

- **June 1, 2018:** Call for papers.
- **August 1, 2018:** Deadline for Initial Paper Submission.
- **November 1, 2018:** Notification of First Round Decision.
- **December 15, 2018:** Deadline for Revised Paper Submission.
- **February 15, 2018:** Final acceptance decision.
- **June 1, 2019:** Target publication date.

GUEST EDITORS

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SUBMISSION AND REVIEW OF PAPERS

Submitted papers should be original and are not be under consideration elsewhere for publication. The authors should follow the journal guidelines, regarding the manuscript content and its format when preparing their manuscripts. All papers will be reviewed by at least three independent reviewers for their suitability in terms of technical novelty, scientific rigor, scope, and relevance to this special issue.

EXTENDED SUMMARY

Special Issue: Soft Computing for Swarm Robotics: New Trends and Applications

Swarm Intelligence (SI) refers to the complex collective behavior of self-organized and decentralized systems, typically composed of a (spatially distributed and often large) population of individuals, or agents. These agents interact among them and with the environment in different but simple and local ways, coordinating their actions, and making the swarm inherently robust, effective, and flexible.

Furthermore, SI is a generic concept referring to a general set of algorithms widely used in academia and industry for solving complex problems. Usually, SI based algorithms are inspired by nature phenomena, such as the behavioral patterns of bats, fireflies, corals, bees or cuckoos, as well as the mechanisms behind genetic inheritance, musical composition and bacterial foraging, among many others.

A plethora of application scenarios have hitherto resorted to SI when addressing optimization, inference and prediction tasks. Among them, *Swarm robotics* (SR) refers to the application of SI methods to scenarios where the population of agents is embodied by physical or simulated robotic devices. The focus of SR is to thoroughly analyze how a swarm comprised of relatively simple physically embodied robots can be controlled to collectively accomplish different kind of goals that are out of the common capabilities of a single robot. Some of the main advantages of using SR systems are:

- *Robustness*: due to the distributed nature of the swarm, the failure of a single robot does not unchain the failure of the global population of robots.
- *Scalability*: the addition of new individuals (robots) to the swarm does not require reprogramming the entire population, nor does penalize the overall computational efficiency of the swarm when undertaking the task at hand.
- *Parallelization*: complex control is achieved through simple yet concurrently held interactions between the swarm members.

Algorithms and methods relying on Swarm Robotics have been so far exceled over a wide range of complex real-world problems, such as localization, mining, disaster rescue missions, agricultural foraging or scenery mapping problems. The interests in SR form a popular topic that lays at the core of many research activities and contributions in the literature.

This special issue aims at disseminating the latest findings and research achievements in the areas of Swarm Intelligence and Swarm Robotics, with an intention to balance between theoretical research ideas and their practicability as well as industrial applicability. To this end, scholars and practitioners from academia and industrial fields are invited to submit high-quality original contributions to this special issue. Topics of interest include, but are not limited to:

- Recent advances on Soft Computing methods for Robotics, with an emphasis on those inspired by processes and behaviors typically observed in Nature, such as Particle Swarm Optimization, Bat Algorithm, Cuckoo Search, Ant Colony Optimization, Artificial Bee Colony, Firefly Algorithm and others.
- Novel applications of Swarm Robotics, with a priority on real-world scenarios.
- Hybridization of Swarm Intelligence and Soft Computing techniques, with applications to robotics and autonomous complex systems.
- New synergies between Swarm Intelligence and Swarm Robotics.
- Coordination and control of Swarm Robotic Systems.
- Adaptive Soft Computing methods.

- Applications of Swarm Intelligence for collaborative positioning and route optimization in robotic swarms.
- Distributed inference in Swarm Robotics.
- Self-organization in robotics enabled by Swarm Intelligence.
- Distributed Swarm Robotic systems.

Guest Editors:

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Brief Biographies of Guest Editors:

Dr. Eneko Osaba works at TECNALIA as researcher in the ICT/OPTIMA area. He received the B.S. and M.S. degrees in computer sciences from the University of Deusto, Spain, in 2010 and 2011, respectively. He obtained his Ph.D. degree on Artificial Intelligence in 2015 in the same university, being the recipient of a Basque Government doctoral grant. He has participated in the development of more than 50 papers, having 16 of them JCR Impact factor. He has performed several stays in universities of United Kingdom, Italy and Malta. He served as a member of the program and/or organizing committee in more than 10 international conferences, and he is member of the editorial board of the International Journal of Artificial Intelligence. He is an Individual Ambassador for ORCID since February 2017.

Prof. Dr. Javier Del Ser received his first PhD in Telecommunication Engineering (Cum Laude) from the University of Navarra, Spain, in 2006, and a second PhD in Computational Intelligence (Summa Cum Laude) from the University of Alcala, Spain, in 2013. He is currently a principal researcher in data analytics and optimization at TECNALIA (Spain), a visiting fellow at the Basque Centre for Applied Mathematics (BCAM) and a part-time lecturer at the University of the Basque Country (UPV/EHU). His research interests gravitate on the use of descriptive, prescriptive and predictive algorithms for data mining and optimization in a diverse range of application fields such as Energy, Transport, Telecommunications, Health and Industry, among others. In these fields he has published more than 190 articles, co-supervised 6 Ph.D. theses, edited 4 books, co-authored 6 patents and participated/led more than 35 research projects. He is a senior member of the IEEE.

Prof. Dr. Andres Iglesias works at the Department of Information Science, Faculty of Sciences, Toho University (Funabashi, Japan) and at the Department of Applied Mathematics & Computational Sciences, University of Cantabria (Spain), where he was head of department (2008-12), post-graduate studies

coordinator (2005-12), and currently leads the *Computer Graphics & Geometric Modeling* research group. Author of about 200 international papers (with journal papers in Q1 quartile in 15 categories of JCR-SCI) and 14 books (Elsevier, Springer-Verlag, IEEE CS Press, Thomson Publishers). Chairman and organizer of about 50 international conferences and workshops. Steering committee member and program committee member in more than 200 international conferences. Editorial board member of several international journals. Reviewer of more than 400 conference papers in more than 130 conferences and more than 130 journal (mostly JCR-SCI) papers. Scientific expert evaluator of projects for National Science Foundation (USA), the 7th Framework Programme (European Union) and other national and regional public research agencies. Committee Member of the IFIP Technical Committee 5 - Information Technology Applications, Workgroup 5.10 - Computer Graphics and Virtual Worlds.

Prof. Dr. Xin-She Yang is Reader in modelling and optimization at Middlesex University and an elected Bye-Fellow of Downing College at Cambridge University. Yang received his DPhil in applied mathematics from the University of Oxford. With more than 200 publications and more than 15 books, his research interests include nature-inspired computation, swarm intelligence, modelling and optimization. He is the chair of the Task Force on Business Intelligence and Knowledge Management of the IEEE Computational Intelligence Society. He is listed as a highly cited researcher by Thomson Reuters/Clarivate Analytics in both 2016 and 2017.

Potential experts that will be invited for submitt contribution

- **Iztok Jr. Fister,** University of Maribor, Slovenia.
- **Francisco Luna,** University of Malaga, Spain.
- **Zong Woo Geem,** Department of Energy IT, Gachon University, South Korea.
- **Ali Sadollah,** Sharif University of Technology, Iran.
- **Radu-Emil Precup,** Politehnica University of Timisoara, Romania.
- **Swagatam Das,** Indian Statistical Institute, Kolkata, India
- **Erol Sahin,** Middle East technical University, Ankara, Turkey
- **Gianni A. Di Caro,** Carnegie Mellon University (CMU), USA
- **A. E. Eiben,** VU University Amsterdam, Netherlands
- **David Camacho,** Autonomous University of Madrid, Spain.
- **Marco Dorigo,** Université Libre de Bruxelles, Belgium
- **Eliseo Ferrante,** KU Leuven, Belgium
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