Report on the visit of IEEE Computational Intelligence Society Distinguished Lecturer Professor Sanaz Mostaghim to the Rio de Janeiro Chapter

Due to the social distancing measures imposed by the COVID-19 pandemic, the Rio de Janeiro received Professor Sanaz Mostaghim lecture via Zoom Meetings. Details on this event are presented below.

- **Distinguished Lecture**

Date: September 22th, 2020, 2:00 PM to 03:30 PM (Rio de Janeiro time)

Organizer: Harold Dias de Mello Junior (Chair of the IEEE CIS Rio de Janeiro Chapter)

Location: remote meeting (via Zoom)

Title: Recent Advances in Swarm Intelligence and Swarm Robotics

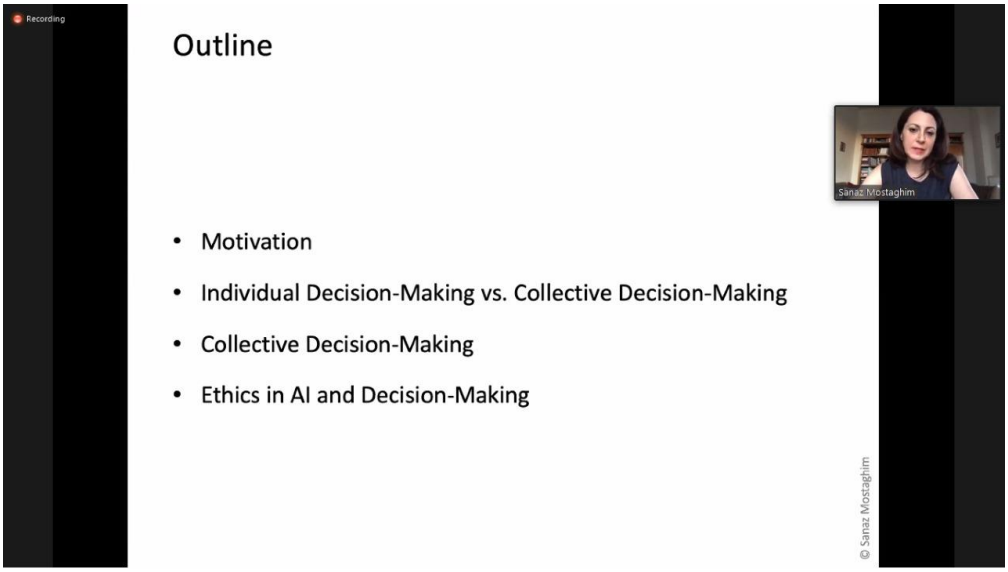
Abstract: In the past decades, we witnessed a large improvement of autonomous systems. Today, such systems are everywhere and enable us to handle complex problems in industrial and scientific applications. However, they also pose new challenges for the development of algorithms to design and control them. One challenge concerns the large amount of such systems which are able to communicate with each other and hence produce a large complex system. Looking at nature, biological systems solve complex tasks using decentralized and simple structures. In this talk, we aim to give an overview into such nature-inspired algorithms such swarm intelligence and describe their applications in autonomous systems. Swarm intelligence is a collective learning process which can lead to a self-organized system of simple individuals, which together create a global emergent behavior.

Such systems can adapt very well to changes in the environment and produce flexible and at the same time robust behaviour. One advanced application of swarm intelligence is in the area of swarm robotics in which simple small robots can collectively learn to achieve some predefined complex tasks. In this talk, the algorithms of swarm intelligence are presented, analyzed, and compared. The following topics will be covered:

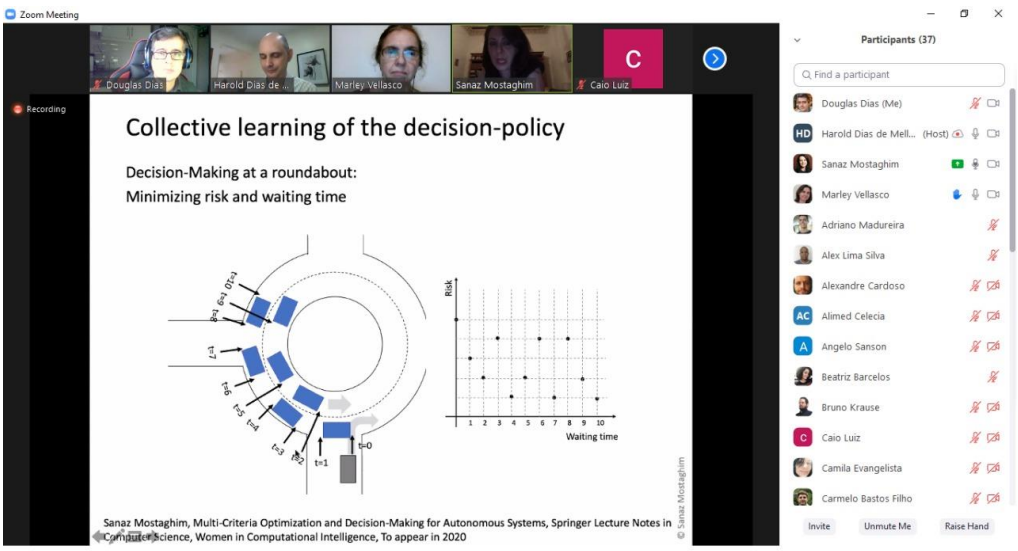
- Fundamentals of swarm intelligence algorithms and optimization
- Collective learning and decision-making
- Collective perception algorithms
- Control mechanisms for self-organized systems using the environment (isomorphic and non-isomorphic transformations
- Swarm and evolutionary robotics

Description: This event was announced on the Rio Chapter's Website: https://r9.ieee.org/rdj-cis/cis-distinguished-lectures-program-recent-advances-in-swarm-intelligence-and-swarm-robotics-sep-22th-2020-2-pm-brt/

and posted on twitter of the IEEE student branch of UERJ:
https://www.instagram.com/p/CFQB8oKpMDF/
Previously, all Chapter members have been notified by email.
The event was also published on the group of the Brazilian Computational Intelligence Society and even on international lists.
A pre-registration was made on the Rio Chapter's Website. We had 70 registrations approved. However, due to technical problems, the lecture was attended by up 38 attendees, including undergraduate and Ph.D. students. It was a tremendous and inspiring lecture. The hour-long talk was very well received and gave rise to many participants' questions, with about 30 minutes of detailed answers by DL Sanaz. The Rio de Janeiro Chapter kindly thanks to professor Sanaz and IEEE CIS DL Program. Some photos of the meeting are included below.



Professor Sanaz starting his talk



Zoom Meeting

Douglas Dias | Harold Dias ... | Marley Vellas... | Sanaz Mostaghim | Vinicius Prata | Carmelo Bast...

Recording

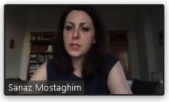
Intelligent behaviors for technical systems

Using Swarm Intelligence and Evolutionary Robotics:

2004: SwarmBots, M. Dorigo and team
2008: ...
2014: Swarm of 1024 robots forms shapes on its own, R. Nagpal and team
2015: Collective Decision Making, M. Dorigo and team
2016: ...

Recording

Game of life

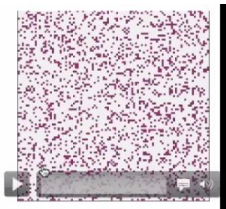


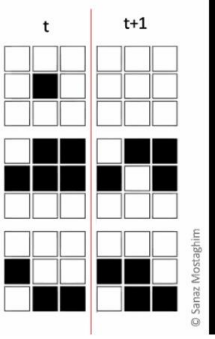
Published in *Scientific American:*
Martin Gardner, "Mathematical Games" column: mathematician John Conway's "Game of Life", October 1970.

Grid of Binary elements on a two-dimensional plane with 8 neighbors.

Rules:

1. If an occupied cell has fewer than two neighbors in the "on" state, then that cell dies of loneliness – it will be dead
2. If it has more than three neighbors in the "on" state, it will die of overcrowding
3. If the cell is unoccupied and has exactly three alive neighbors, it will be born in the next iteration





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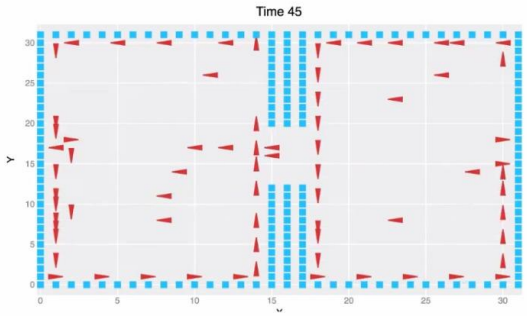
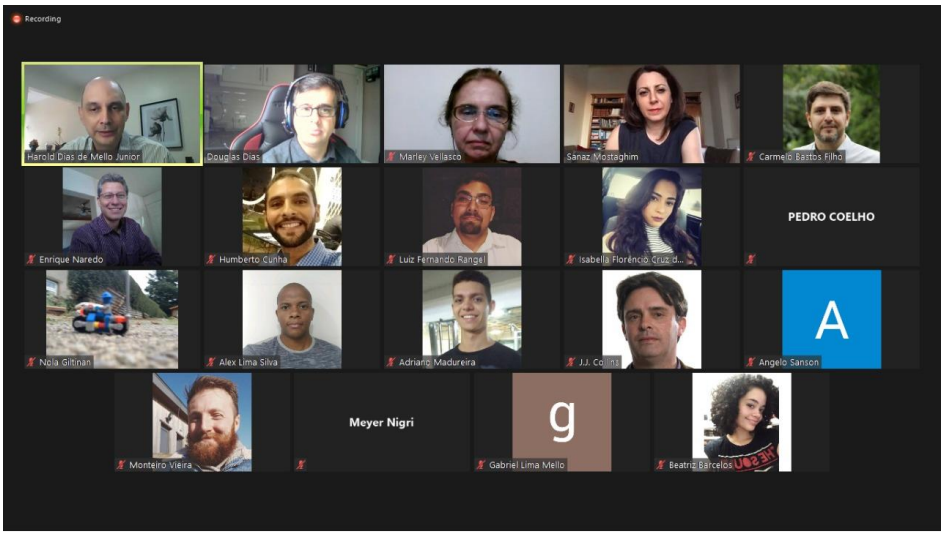
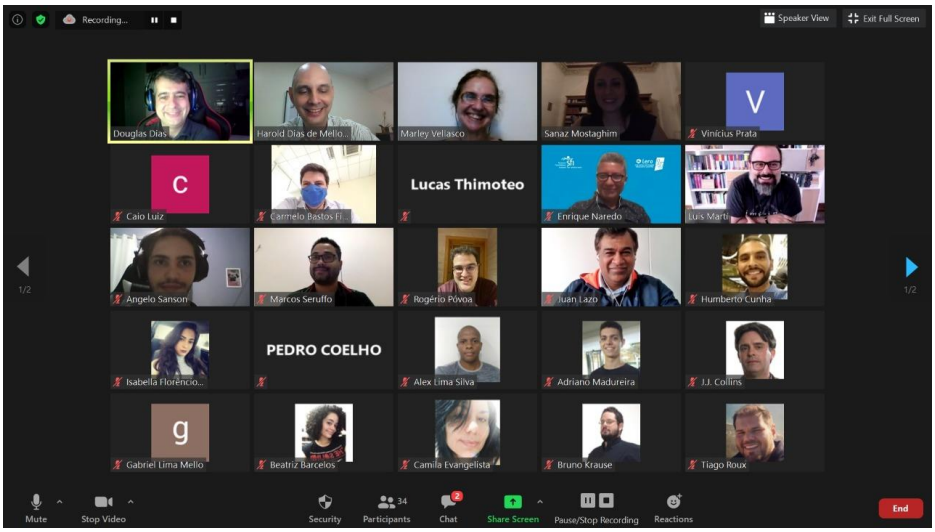
Recording

Based on Hidden Markov Models



Dominik Fischer, Larissa Albantakis and Sanaz Mostaghim, How cognitive and environmental constraints influence the reliability of simulated animats in groups, PLoS ONE 15(2): e0228879, February 2020
Dominik Fischer, Larissa Albantakis and Sanaz Mostaghim, How swarm size during evolution impacts the behavior, generalizability, and brain complexity of animats performing a spatial navigation task, In the Proceedings of the ACM GECCO, 2018





Printscreen at the end of the Professor Sanaz talk