



## Editorial Notes for Topical Collection on Robotica 2019

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Robotics inspires and motivates people worldwide, with several advances experimented by researchers who constantly discover new techniques and applications. It is currently one of the top 10 research areas, with several cutting-edge applications such as completely autonomous robots and drones on Mars, autonomous cars and unmanned surface vehicles (USV), and a new generation of service robots. Robotics topics have gained much attention, being widely addressed in academic undergraduate and graduate programs, and with several high-level events and journals in this interesting subject.

The joint event Latin American Robotics Symposium Brazil (LARS 2019), Brazilian Robotics Symposium (SBR 2019), and Workshop of Robotics in Education (WRE 2019) is a forum dedicated to disseminating discoveries in Robotics, bringing together researchers from all over Latin America, and worldwide. The event was promoted by the Brazilian Computer Society and IEEE RAS Chapter “South Brazil. It and was organized and supported by the Center for Computational Science (C3) of Universidade Federal do Rio Grande (FURG), Rio Grande, Brazil (XVI LARS and XI SBR) and by the Natalnet Associate Labs of Universidade Federal do Rio Grande do Norte (X WRE) with proceedings published online at IEEE Xplore(<https://ieeexplore.ieee.org/xpl/conhome/8995608/proceeding>).

This topical collection of the Journal of Intelligent & Robotic Systems (JINT) compiles the best publications of LARS-SBR-WRE 2019. Conference authors were invited to submit extended and modified manuscripts of the published versions of the conference. All papers went through an in-depth peer review that the Guest Editors coordinated. We treated each submission as a new one, going through new rules from those that these papers were submitted in the original Symposium. Only high-quality versions that collaborated with robotics state-of-art and presented at least 70% of dissimilarity to the original published version were accepted. The final manuscripts are high-quality publications that comprise the best results from the Latin America Robotics Symposium in 2019, covering a broad range of robotics research fields. Therefore, this special issue of JINT presents state of the art on works from theory to methodologies and applications. The eleven published papers cover different research topics, including social navigation and path planning, soft and bio-inspired robots, deep reinforcement learning for robots cognition and motion, robot perception, robotics learning, programming, curriculum, and the diversity of robotics and computing with a specific paper about woman in robotics.

The first work evaluates the navigation stack using Robot Operating System (ROS) for social navigation. The results show a better social navigation of Home Environment Robot Assistant (HERA) with a robot platform that has been developed by FEI University Center. Various parameters combination are evaluated in the work as the type of environments and obstacles, if using local or global planning algorithms and cost maps. Also, it deals with people in static, dynamic, and interactive ways. The study observed safety aspects, the precision of estimated time and space, and also other aspects as smooth performed trajectory and if the robot is respecting the personal space of humans.

Our second work proposes a rhythmic mechanism for activating soft multi-legged robots. Authors develop an application based on Scheduling by Multiple Edge Reversal (SMER) for the activation of soft legs, as a technique to be applied to the multi-legged robots case. They also

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implement a soft device that has been tested as the robot's legs in order to evaluate the proposed application. Using the SMER technique, they design a logic controller for this device. The functionality of the proposed strategy has been assessed using image processing techniques, demanding limited resources.

The next paper deals with humanoid robot soccer player behaviors by way of using Deep Reinforcement Learning (DRL). It investigates the use of DRL models to devise basic and complex skills acquisition in humanoid robot soccer environments. The robot decides on which discrete action should be performed, such as walk forward, turn to the left or kick the ball, as it interacts with the environment. For that, the model based on Dueling Double DQN (DD-DQN) algorithm is trained based on images acquired by a camera mounted on the robot.

The following manuscript presents results of a work done on the assessment of robotic and autonomous systems perception robustness. Image distortion is evaluated using state-of-the-art robotic vision models. An evaluation framework is proposed that emulates poor image exposure conditions, low-range image sensors, lossy compression, and noise types that are common in robotic vision. A rigorous evaluation framework for the robustness of several high-level image recognition models is introduced by the authors and they investigate their performance under distinct image distortions. By using the proposed framework, the authors obtain a detailed evaluation of various traditional image distortions, as the ones typically found in robotics and automated systems pipelines, thus providing insights and guidance for further developments. The impacts of the image distortions on the segmentation task are addressed due to the task's important role in autonomous navigation, obstacle avoidance, and object picking, between other robotics tasks.

The fifth article provides a comparison between two path planning algorithms, the dynamic visibility graph A-Star (DVG + A\*) and the rapidly "exploring random trees (RRT), when applied in high dimension and dynamic environments. Specifically, the RoboCup small sized league is the chosen environment. Two different perspectives are devised for comparison and evaluation of the algorithms. The first considers the computational time, path length, and path safety in a static environment. The second considers the accumulated computational time, the number of several recalculated paths, total navigation time, and the number of collisions in the dynamic environment.

Then, it follows a manuscript on humanoid robot running motions learning, where the authors use a symmetry incentive through the proximal policy optimization (PPO) approach. The main contribution of this work is a methodology based on deep reinforcement learning (DRL) that is developed for learning the running skills of the humanoid robot, without any prior knowledge. This approach is applied

in the RoboCup 3D Soccer Simulation (Soccer 3D) application domain.

The following work is about ball detection with machine learning in a robot soccer domain. A comparison is made between several neural network architectures using constrained hardware scenarios. With this, authors analyse the average precision and inference time of multiple object detection systems. Open implementations of the MobileNetV2 and MobileNetV3 models are trained with different underlying architectures, which are achieved by changing their input and width multipliers. YOLOv3, TinyYOLOv3 YOLOv4, and TinyYOLOv4 are also trained in an annotated image dataset that is created by way of captured images using a mobile robot.

Then, a work in Agricultural Robotics introduces a sprayer device using machine vision for nozzle control. Authors propose a precision agriculture system that is modular in order to automate the sprayer devices, thus optimizing the application of pesticides by way of a robotic system. Basically, each individual nozzle is switched on/off based on features that are provided by the vision system. This system uses low-cost electronics such as Arduino boards, solenoid valves, pressure and flow sensors, smartphones, a webcam, and a Raspberry Pi.

Entering the Robotics in Education (RE) domain, the next paper introduces a complete methodology with only three steps to the learning of robotics, to be used with kids of the K-12 system. The methodology named EDUROSC-Kids that includes a curriculum proposal is implemented and tested in order to guide projects to either use it in robotics learning itself or to learning other topics with robotics. The EDUROSC-Kids curriculum is the main novelty, with a new set of methods, with guidelines and strategies, for application in educational robotics. Several tools are included to organize the learning topics of robotics for children, with the desired outcomes during the teaching-learning process. They also present an experimental evaluation that verifies the importance of devising such a study plan and assessment methodology, because of the iterative nature of the learning process, which could improve the final results.

Yet in the RE domain, the penultimate manuscript introduces the sBotics framework, which is a gamified simulation platform for educational robotics. The software has been broadly used in pandemic time for allowing the execution of competitions on the K-12 levels, by more than 5 thousand students including RoboCup-Junior Rescue Line. The tool is also validated as a learning framework, which includes a more complete environment for teaching and programming skills acquisition designed for teachers and K-12 students. A gamified approach is adopted for the framework implementation, with the simulated environment developed in the Unity game engine. The main novelty is its ease of use combined with the flexibility to create a variety of scenarios

with endless learning potential, contrasting to evaluations where no alternatives with such characteristics that were found for the K-12 range, which is the target. Robot programs are treated as games affected by a realistic disturbance model, which acts in the robotic system and environment variables, making it suitable for robotics testing in the sim-2real paradigm.

Finally, the last paper explores the diversity of robotics and computing. It is about evaluation on a robotics and programming project targeted for women, using a framework developed with machine learning and data visualization. Authors conduct a systematic review on works involving the development of projects aimed at the engagement of girls as students or as teachers/professionals initially within the context of STEAM. This is extended specifically to a case study with woman in robotics in order to evaluate the engagement of female teachers and students, in a medium-sized city in the interior of the southeastern region of Brazil.

As guest editors, we would like to present our gratitude to all reviewers for their contributions and valuable suggestions

given to improve the paper's quality. And, many thanks to the authors for their efforts in submitting a substantially improved paper and for addressing all the changes suggested by reviewers for moving up their paper quality. To this end, we came up with an interesting topical collection that we expect will be of broad interest to the Robotics community. Special thanks to Marie Veth Chua, the Journal's Editorial Office assistant, in the name of all the Springer staff, which worked hard for making the publication of this topical collection a reality. Finally, our not less special thanks to Prof. Kimon Valavanis, our outstanding Editor in Chief, for all of the support given on this topical collection.

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