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Guest Editorial

Special Issue on Visual Servoing

Robots able to imitate human beings have been at the core of stories of science fiction as well as dreams of inventors since long time. Visual servoing has received great attention in recent years as it enables robotic systems to imitate humans in positioning tasks by exploiting artificial vision. Indeed, visual servoing has numerous and various applications, such as industrial manufacture, surveillance, vehicles control, operations in dangerous environments, motion control, and surgery.

Pioneering visual servoing approaches focused their attention on simple images features and control laws in order to result in low computational complexities and hence being suitable for real-time applications. Recently, developments in system hardware and optimization algorithms make efficient and viable the exploitation of sophisticated techniques in visual servoing, thus allowing to consider complex scenarios and derive powerful solutions in many applications.

For instance, selecting and tracking of complex visual features allow visual servoing to be used in common environments. Also, multi-constraint design and performance optimization plays a key role to obtain flexible and efficient applications. Then, ensuring robustness with respect to unavoidable uncertainties such as image noise and model errors is essential in order to achieve reliability. In addition to this, the speed of imaging is nowadays such that vision becomes a possible alternative for the use of encoders in fast motion systems, thereby enabling to look where accuracy is required.

The aim of this Special Issue has been to identify and discuss the latest advances in the area of visual servoing. Twelve papers have been accepted, which provide a significant overview of the main problems and solutions. In particular, the contributions [1-4] address issues related to image processing, scene estimation, and robot localization. Then, the contributions [5-8] deal with adaptive, constrained, and optimal robot control. Lastly, the contributions [9-12] consider visual servoing with manipulators and mobile robots.

We would like to conclude this guest editorial by thanking the Editor-in-Chief of Mechatronics for giving us the opportunity to organize and realize this Special Issue. We also would like to thank all the authors that have responded to our invitation in order to contribute to the Special Issue. Finally and especially, we would like to thank all the reviewers that kindly have given us some of their time, providing comments and suggestions in order to publish high-quality papers.

Yours sincerely,

Graziano Chesi, Koichi Hashimoto, Domenico Prattichizzo

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Papers accepted in the Special Issue:

1. X. Gao, D. You, S. Katayama, "Infrared Image Recognition for Seam Tracking Monitoring during Fiber Laser Welding"
2. A. Dani, N. R. Fischer, Z. Kan, W. E. Dixon, "Globally Exponentially Stable Observer for Vision-based Range Estimation"
3. H. Wang, Y.-H. Liu, W. Chen, "Visual tracking of robots in uncalibrated environments"
4. G. Mariottini, S. Scheggi, F. Morbidi, D. Prattichizzo, "Planar mirrors for image-based robot localization and 3-D reconstruction"
5. N.R. Gans, G. Hu, J. Shen, Y. Zhang, W. E. Dixon, "Adaptive Visual Servo Control to Simultaneously Stabilize Image and Pose Error"
6. X. Gratal, J. Romero, J. Bohg, D. Kragic, "Visual Servoing on Unknown Objects"
7. S. S. Mehta, V. Jayaraman, T. F. Burks, W. E. Dixon, "Teach by Zooming: A Unified Approach to Visual Servo Control"
8. E. Nematollahi, A. Vakanski, F. Janabi-Sharifi, "A Second-Order Conic Optimization-based Method for Visual Servoing"
9. M. Jaradat, M. Al-Fandi, M. Nasr, "Automatic Control for a Miniature Manipulator Based on 3D Vision Servo of Soft Objects"
10. J. M. Toibero, B. Morales, F. Roberti, R. Carelli, "Passivity based visual servoing of mobile robots with dynamics compensation"
11. J. M. Toibero, V. Andaluz, R. Carelli, L. Salinas, F. Roberti, "Visual Control with Adaptive Dynamical Compensation for 3D Target Tracking by Mobile Manipulators"
12. R. Janssen, J. de Best, R. de Molengraft, "The Design of a Semi-Automated Football Table"