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Optimization for Autonomous Robotic Construction by Visual Guidance through Machine Learning

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Abstract : Network transfer of information and performance customization is now a viable method of digital industrial production in the era of Industry 4.0. Robot platforms and network platforms have grown more important in digital design and construction. The pressing need for novel building techniques is driven by the growing labor scarcity problem and increased awareness of construction safety. Robotic approaches in construction research are regarded as an extension of operational and production tools. Several technological theories related to robot autonomous recognition, which include high-performance computing, physical system modeling, extensive sensor coordination, and dataset deep learning, have not been explored using intelligent construction. Relevant transdisciplinary theory and practice research still has specific gaps. Optimizing high-performance computing and autonomous recognition visual guidance technologies improves the robot's grasp of the scene and capacity for autonomous operation. Intelligent vision guidance technology for industrial robots has a serious issue with camera calibration, and the use of intelligent visual guiding and identification technologies for industrial robots in industrial production has strict accuracy requirements. It can be considered that visual recognition systems have challenges with precision issues. In such a situation, it will directly impact the effectiveness and standard of industrial production, necessitating a strengthening of the visual guiding study on positioning precision in recognition technology. To best facilitate the handling of complicated components, an approach for the visual recognition of parts utilizing machine learning algorithms is proposed. This study will identify the position of target components by detecting the information at the boundary and corner of a dense point cloud and determining the aspect ratio in accordance with the guidelines for the modularization of building components. To collect and use components, operational processing systems assign them to the same coordinate system based on their locations and postures. The RGB image's inclination detection and the depth image's verification will be used to determine the component's present posture. Finally, a virtual environment model for the robot's obstacle-avoidance route will be constructed using the point cloud information.

Keywords : robotic construction, robotic assembly, visual guidance, machine learning
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