Continuous mobile robot localization by using structured light and a geometric map

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Abstract:
A mobile robot needs to know its position and orientation with accuracy in order to decide the control actions that permit it to finish the entrusted tasks successfully. To obtain this information, dead-reckoning-based systems have been used, and more recently inertial navigation systems. However, these systems have some errors that grow bigger as time goes by, therefore a moment comes when the information provided is useless. Because of this, there should be a periodic process that updates the robot position and orientation of the vehicle. The process to determine the robot position and orientation by using information originated from the external sensors is defined as the mobile robot relocalization. It is obvious that the greater the frequency of this process, the better the knowledge of its position the robot will have, and therefore its movements will be better directed to the point it must reach. The algorithm to achieve this can be classified in two large groups: relocalization through an a priori map of the environment and relocalization through the detection of landmarks present in that environment. The algorithm presented in the paper belongs to the first case. The sensor used is a combination of a laser diode and a CCD camera. The sensorial information is modeled as straight lines that will be matched with an a priori map of the environment. With this, the position of the mobile robot is estimated. The matching process is accomplished within an extended Kalman filter. The algorithm is able to work in real time, and it actualizes the position of the robot in a continuous way.