Neural Motion Controller for Robots Daisy and Ester

Zbyněk Winkler[1], Jiří Iša, Jakub Krchák

Charles University, Faculty of Mathematics and Physics,
Department of Software Engineering,
Malostranské nám. 25, 118 00 Praha 1, Czech Republic

[1] e-mail: zbynek.winkler@mff.cuni.cz

Abstract

In this paper, we present a novel adaptive strategy for robust motion control of differentially steered robots. The strategy employs an artificial neural network to drive the robots' wheels and an innovative algorithm to compute the velocities for the wheels. Given the required velocities of the wheels the controller calculates the amount of power needed to move towards a set direction. In this sense, our approach differs from previous ones as it directly computes the required powers for the motors.

Most traditional controllers either assume a relatively simple system behavior (e.g. linear) or require complicated settings of vague constants to work properly. Therefore a simple adaptive solution to this problem would be very important for a reliable control of mobile robots.

Neural controller employed in our experiments was based on a multi-layer feed-forward neural network of the back-propagation type. This kind of neural networks is adapted by supervised training requiring a set of input/target output samples. Trained networks are characterized by a relatively high robustness and efficient performance even for previously unknown data patterns (good generalization).
Results of extensive experiments performed so far have shown that the new proposed controller can steer efficiently both our robots Daisy and Ester even at speeds of up to 1 m/sec. Daisy and Ester were originally built for the Eurobot 2004 competition and their architecture was very different – very high versus very low acceleration, tracked versus wheeled vehicle etc. Despite these huge differences both of them were able to follow the prescribed path and avoid collisions reliably.