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Neural network modelling for steering control of an automated guided logistic train

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Abstract: The logistic train is a modern intralogistics transport system that consists of a tractor and towed trailers. It bases on the concept of a milk-runner which collects or supplies a defined number of delivery points with a precise amount of material at a given point of time on a pre-planned route. There exist numerous designs of trailers and tractors what makes the estimation of the train trajectory and required transportation corridor a complex task. It is also difficult to achieve the same trajectory for a manually operated train for multiple train runs. The problem complicates if there are multiple towed trailers or dynamic drive on slippery ground are present. One solution to this problem is to replace the driver with an automated steering system. This paper presents a dynamic model of a logistic train, based on the Lagrange formalism, which is controlled by artificial neural networks. The artificial neural network algorithm provides the most appropriate tractor steering input parameters for a given transportation area. The input parameters are the torques applied to the tractor wheels, and they are determined by the algorithm based on the data collected during the train run. These data include: distance of each unit to the obstacle (e.g. wall), information about the occurrence of a collision, distance travelled by the tractor. The result of integration of the dynamic model developed in Mathematica and the neural network modelled in Python is presented in a graphic form. The modelled algorithm ensures a collision-free ride of the train.

Keywords: logistic train, vehicle, neural network, dynamic model