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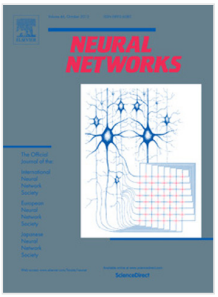

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A Time-Delay Neural Network for Solving Time-Dependent Shortest Path Problem

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Abstract— This paper concerns the time-dependent shortest path problem, which is difficult to come up global optimal solution by means of classical shortest path approaches such as Dijkstra, and pulse-coupled neural network (PCNN). In this study, we propose a time-delay neural network (TDNN) framework that comes with the globally optimal solution when solving the time-dependent shortest path problem. The underlying idea of TDNN comes from the following mechanism: the shortest path depends on the earliest auto-wave (from start node) that arrives at the destination node. In the design of TDNN, each node on a network are considered as a neuron, which comes in the form of two units: time-window unit and auto-wave unit. Time-window unit is used to generate auto-wave in each time window, while auto-wave unit is exploited here to update the state of auto-wave. Whether or not an auto-wave leaves a node (neuron) depends on the state of auto-wave. The evaluation of the performance of the proposed approach was carried out based on online public Cordeau instances and New York Road instances. The proposed TDNN was also compared with the quality of classical approaches such as Dijkstra and PCNN.

Index Terms— time-delay neural network (TDNN), time-dependent shortest path problem, auto-wave neural network