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# Column selection by machine learning in exact branch-and-price algorithms

Guy Desaulniers<sup>\*†1</sup>, Mouad Morabit<sup>1</sup>, and Andrea Lodi<sup>2</sup>

<sup>1</sup>Polytechnique Montreal and GERAD – Canada

<sup>2</sup>Polytechnique Montreal, GERAD, CERC in Data science for real-time decision making – Canada

## Abstract

Branch-and-price is the leading solution methodology for several classes of vehicle routing and crew scheduling problems. For certain problems where the restricted master problem (RMP) consumes a large proportion of the total computational time, it is important to add a limited number of columns to the RMP at each iteration. These columns are usually selected based on their reduced cost. In this paper, we propose a new selection procedure that relies on a machine learning tool which relies on a graph convolutional network. This tool tries to identify the generated columns that would take a positive value in the solution to the RMP if all columns were added. The columns identified as such are added to the RMP, together with a small subset of the remaining ones. Preliminary tests on some vehicle and crew scheduling problems show that speedups of up to 40% of the computational time can be achieved.

**Keywords:** Branch, and, price, machine learning, column selection, vehicle routing, crew scheduling

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\*Speaker

†Corresponding author: [guy.desaulniers@gerad.ca](mailto:guy.desaulniers@gerad.ca)