

A Recommender System for Train Routing: When Concatenating Two Minimum Length Paths Is Not the Minimum Length Path

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Abstract

Two different track gauges coexist in the Spanish railway network: 1,668 millimeters and the ‘standard gauge’ (1,435 millimeters), used in the new high-speed lines (the 1,000 millimeters network is not considered as there is no compatible rolling stock). The problems derived from the coexistence of two gauges are partially surpassed by the development of rolling stock that can run on both kinds of tracks. Appropriate devices, called ‘cambiadores de ancho’ (gauge changers), have been installed at certain junctions. Moreover, there are certain sections of the railway network with three rails (double gauge sections). Regarding electrification, there are two different electrification systems: 3 KV DC and 25 KV AC. *Renfe* (Spain’s government railway operator) owns some classes of bivoltage locomotives and multiple units as well as one class of hybrid multiple units. Let us underline that these railway vehicles have different performances according to the way they are working. Finally, there are four different families of signaling systems (with subfamilies): ASFA, LZB, EBICAB, ETCS. Some trains from *Renfe*’s rolling stock incorporate a variety of signaling equipment aboard. This diversity makes very hard to estimate for a train the optimal route from a particular station to another one, and unintuitive situations arise. Indeed, it is not suitable for finding the optimal route in the Spanish infrastructure through classical approaches for this problem based on using a graph whose nodes represent stations, and edges represent the railway sections between stations.

References

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