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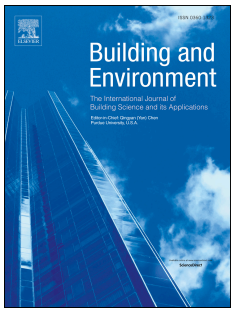


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# Predictive Models for Assessing the Passive Solar and Daylight Potential of Neighborhood Designs: A Comparative Proof-of-Concept Study

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**Abstract**

Despite recent developments, neighborhood-scale performance assessment at the early-design phase is seldom carried out in practice, notably due to high computational complexity, time requirement, and perceived need for expert knowledge, ultimately limiting the integration of such a task into the design process. In this paper, we introduce a predictive modeling approach to rapidly obtain an estimate of the performance of early-design phase neighborhood projects, from simple geometry- and irradiation-based parameters. The performance criteria considered are the passive solar and daylight potential, respectively quantified by the energy need for space heating and cooling (given certain assumptions) and the spatial daylight autonomy at the ground-floor level. Two predictive models, or metamodels, are developed following distinct techniques: a multiple linear regression function and a Gaussian Processes regression model. These are developed from a reference dataset acquired through the parametric modeling and simulation of neighborhood design variants. When tested on designs provided by professionals, the metamodels with the highest accuracy within the compared types (MLR versus GPs) portray a prediction error below 10% in 87% (respectively 60%) of the cases for the passive solar (resp. daylight) potential. Results show this approach to be a promising alternative to running detailed simulations when comparing early-design variants.

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