

Street-Scale Solar Access and PV Suitability in Historic Urban Areas

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Abstract

Historic urban areas are characterized by narrow streets, dense building fabrics, complex shading, and conservation constraints, which create substantial spatial and seasonal variation in solar access. This study develops a street-scale framework for evaluating solar access and photovoltaic (PV) suitability using an existing street-view semantic-segmentation dataset. Sky regions extracted by DeepLabv3+ are transformed into hemispherical projections to calculate the sky view factor (SVF), while direction-corrected street-view masks are combined with solar trajectories to estimate radiation on four representative seasonal dates. Results indicate a mean SVF of 0.304 and strong spatial clustering, with higher solar access mainly found along peripheral streets and intersections and lower values concentrated in dense internal alleys. Building function is also significantly associated with annual-equivalent solar radiation. Building on these findings, the study integrates seasonal variability, spatial diagnostics, and building-function information into a two-dimensional PV suitability typology. By treating street-view recognition as a reusable data-acquisition layer rather than the primary innovation, the proposed approach provides a planning-oriented method for identifying solar resource potential, comparing seasonal performance, and supporting context-sensitive PV deployment in historic urban environments under conservation constraints.