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An investigation into road trees' root systems through geostatistical analysis of GPR data

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Street trees are a critical asset for the urban environment due to the variety of environmental and social benefits provided [1]. However, the conflicting coexistence of tree root systems with the built environment, especially with road infrastructure, frequently results in extensive damage, such as the uplifting and cracking of sidewalks and curbs, endangering pedestrians, cyclists, and road drivers' safety.

Within this context, ground penetrating radar (GPR) is gaining recognition as an accurate non-destructive testing (NDT) method for tree roots' assessment and mapping [2]. Nevertheless, the investigation methods developed so far are often inadequate for application on street trees, as these are often difficult to access. Recent studies have focused on implementing new survey and processing techniques for rapid tree root assessment based on combined time-frequency analyses of GPR data [3].

This research also explores the adoption of a geostatistical approach for the spatial data analysis and interpolation of GPR data. The radial development of roots and the complexity of root network constitute a challenging setting for the spatial data analysis and the recognition of specific spatial features.

Preliminary results are therefore presented based on a geostatistical analysis of GPR data. To this end, 2-D GPR outputs (i.e., B-scans and C-scans) were analysed to quantify the spatial correlation amongst radar amplitude reflection features and their anisotropy, leading to a more reliable detection and mapping of tree roots. The proposed processing system could be employed for investigating trees difficult to access, such as road trees, where more comprehensive analyses are difficult to implement. Results' interpretation has shown the viability of the proposed analysis and will pave the way to further investigations.

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