EGU22-6168
https://doi.org/10.5194/egusphere-egu22-6168
EGU General Assembly 2022

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

Livia Lantini[1], Sebastiano Trevisani[2], Valerio Gagliardi[3], Fabio Tosti[1], and Amir M. Alani[1]
[1]School of Computing and Engineering, University of West London, London, United Kingdom of Great Britain – England, Scotland, Wales (livia.lantini@uwl.ac.uk)
[2]University IUAV of Venice, Venice, Italy
[3]Department of Engineering, Roma Tre University, Rome, Italy

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.

Acknowledgements

The authors would like to express their sincere thanks and gratitude to the following trusts,

charities, organisations and individuals for their generosity in supporting this project: Lord Faringdon Charitable Trust, The Schroder Foundation, Cazenove Charitable Trust, Ernest Cook Trust, Sir Henry Keswick, Ian Bond, P. F. Charitable Trust, Prospect Investment Management Limited, The Adrian Swire Charitable Trust, The John Swire 1989 Charitable Trust, The Sackler Trust, The Tanlaw Foundation, and The Wyfold Charitable Trust.

References

[1] Tyrväinen, L., Pauleit, S., Seeland, K., & de Vries, S., 2005. "Benefits and uses of urban forests and trees". In: *Urban Forests and Trees*. Springer, Berlin, Heidelberg.

[2] Lantini, L., Tosti, F., Giannakis, I., Zou, L., Benedetto, A. and Alani, A. M., 2020. "An Enhanced Data Processing Framework for Mapping Tree Root Systems Using Ground Penetrating Radar," Remote Sensing 12(20), 3417.

[3] Lantini, L., Tosti, F., Zou, L., Ciampoli, L. B., & Alani, A. M., 2021. "Advances in the use of the Short-Time Fourier Transform for assessing urban trees' root systems." Earth Resources and Environmental Remote Sensing/GIS Applications XII. Vol. 11863. SPIE, 2021.