



UWL REPOSITORY

repository.uwl.ac.uk

Assessing the root system of urban trees by geostatistical analysis of GPR data

Lantini, Livia ORCID logo ORCID: <https://orcid.org/0000-0002-0416-1077>, Trevisani, Sebastiano, Tosti, Fabio ORCID logo ORCID: <https://orcid.org/0000-0003-0291-9937> and Alani, Amir (2022) Assessing the root system of urban trees by geostatistical analysis of GPR data. In: SPIE Sensors + Imaging, 5-7 Sep 2022, Berlin, Germany.

This is the Accepted Version of the final output.

UWL repository link: <https://repository.uwl.ac.uk/id/eprint/9267/>

Alternative formats: If you require this document in an alternative format, please contact: open.research@uwl.ac.uk

Copyright:

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy: If you believe that this document breaches copyright, please contact us at open.research@uwl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

Rights Retention Statement:

Assessing the root system of urban trees by geostatistical analysis of GPR data

Livia Lantini, Sebastiano Trevisani, Fabio Tosti, and Amir M. Alani

The monitoring and preservation of natural resources are vital in present times. With regards to urban trees, their benefits to the environment and the community are widely recognised. Nevertheless, the coexistence between street trees and the built environment is based on a delicate balance, as safeguarding the natural asset may conflict with the damaging mechanisms that tree roots cause to roads, building foundations and underground utilities.

Ground penetrating radar (GPR) is becoming popular as a reliable non-destructive testing (NDT) method for assessing and mapping tree roots. In street trees management, there is an increasing need for dedicated investigation methods, mainly related to accessibility constraints. Recent studies have investigated the feasibility of novel survey and processing methodologies for fast tree root evaluation based on time-frequency analysis of GPR data.

The purpose of this research is to present an analysis combining GPR with geostatistics, a branch of spatial statistics focused on the analyses and modelling of spatial data. The complex spatial patterns of tree roots represent a challenging spatial field to be investigated both from the geophysical as well as from the spatial statistical perspective. Two-dimensional GPR outputs from a real-life case study were analysed to assess the spatial correlation of radar data and evaluate the best interpolation approaches, allowing for more reliable detection and mapping of tree roots. The interpretation of the results confirmed the feasibility of the proposed approach, paving the way for novel and faster survey methodologies for urban trees.

100-word text summary for the program

Ground penetrating radar (GPR) is becoming a popular non-destructive method for assessing and mapping tree roots. The complex spatial patterns of tree roots represent a challenging spatial field to be investigated both from the geophysical as well as from the spatial statistical perspective. Two-dimensional GPR outputs from a real-life case study were analysed to assess the spatial correlation between radar reflection characteristics of roots. The interpretation of the results confirmed the

feasibility of the proposed approach, paving the way for novel and faster survey methodologies for urban trees.