EGU24-4142, updated on 14 May 2024
https://doi.org/10.5194/egusphere-egu24-4142
EGU General Assembly 2024

Efficiency and Accuracy in GPR-Based Tree Root Assessment: A Comparative Analysis of Scanning Patterns

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The growing importance of monitoring and preserving natural resources underscores the need for effective tree root assessment, particularly in the context of sustainable urban planning and ecosystem management. Tree roots, vital yet elusive plant organs, pose a significant challenge for accurate evaluation [1].

Ground-penetrating radar (GPR) has emerged as a valuable tool in this regard. Recent applications have focused on developing methodologies for tree root assessment in challenging conditions, such as the use of frequency-based spectrogram imagery for the assessment of urban trees [2], and the use of deep learning methods for the automatic recognition of tree roots [3].

Acknowledging the critical role of tree roots and the challenges associated with their assessment, the need for a method that balances precision with practicality needs to be addressed. To this end, this study presents a comparative analysis of two distinct scanning patterns—semi-circular and grid-shaped—to evaluate their efficiency and accuracy in GPR-based tree root assessment.

The methodology involved a data collection around a lime tree using both scanning patterns. The semi-circular scanning pattern, known for its detailed data acquisition, was contrasted with the grid-shaped pattern, which offers a potentially more time-efficient and practical alternative. The datasets were then subjected to thorough analysis, encompassing root detection, resolution, and overall efficacy.

This comparative analysis contributes to informing practitioners and researchers about the compromises between detailed root insights and the practical constraints of time and resources. The results of this study not only contribute to the optimisation of GPR-based tree root assessments but also aid in decision-making for urban planners and arborists seeking a balance between precision and efficiency in managing urban green spaces.

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. The Authors would also like to thank the Ealing Council and the Walpole Park for facilitating this research.

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