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Advances in Ground Penetrating Radar Signal Processing for Mapping Tree Root Systems

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Management and conservation of natural heritage are becoming increasingly important as health of ancient trees is threatened by the presence of unknown and aggressive pathogens [1]. In this regard, root systems are threatened by fungal infections inducing rotting of roots and eventually leading to death of trees. These infections may easily spread to nearby trees and affect larger areas. As these decays may not show evident symptoms, an early-stage identification is crucial to protect trees.
In this context, non-destructive testing (NDT) methods are gaining momentum as they are faster and more versatile than destructive techniques. Specifically, ground penetrating radar (GPR) has emerged as an increasingly reliable geophysical inspection method for mapping tree roots [2]. Automated algorithms for tracking roots in a three-dimensional environment have been developed [3]. More recently, interconnections between tree roots of different tree species have been investigated based on mass density distributions of roots in depth [4].
The aim of this research is to improve upon existed methods and provide a more commercially appealing framework for root characterisation. To this extent, advanced signal processing – both in time and frequency domain - is applied in an effort to reduce false alarms and retain a high probability of root detection. In addition, data collected on various types of trees using different antenna systems and survey methodologies are processed to investigate how these parameters affect the overall performance of GPR.
Results presented in this abstract are part of a major research project that the authors have undertaken for the last two years.

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