

# Material Classification of Underground Utilities From GPR Images Using DCT-Based SVM Approach

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**Abstract**—In this letter, we introduce the utilization of discrete cosine transform (DCT) coefficients as features supplied to the support vector machine (SVM) classifier to identify underground utility material from ground penetrating radar (GPR) imagery. Different types of features, reflected signal amplitudes, and statistical features, combined with the SVM classifier for material identification of underground utilities, are also studied and compared to the DCT-based approach. The system performance is conducted by simulation studies using generated GPR images created by a GPR finite-difference time-domain-based simulator used to develop various acquisition situations by changing the utility material type, position, and size parameters. The efficiency of the proposed technique in material identification is assessed using noisy generated GPR images degraded with speckle noise. Two-dimensional median and adaptive Wiener filters are also examined as a preprocessing step to the studied techniques. Simulation results show that the proposed technique combined with adaptive Wiener filter reveals a good performance regarding the recognition accuracy compared to the other studied techniques in noisy environment.

**Index Terms**—Discrete cosine transform (DCT), feature extraction, ground penetrating radar (GPR), support vector machine (SVM), underground utilities.