Advanced fusion of geophysical data through combined use of 2D Discrete Wavelet Transform and Multiresolution Singular Value Decomposition applied to GPR-3D and magnetic data

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Despite strong evidences that are visible at the surface that suggests the presence of buried structures, sometimes, both the GPR and magnetic data do not allow to clearly about the presence of these structures. Usually, this lack of perceptibility is due to the physical and chemical conditions of the medium that produces an increasing of background noise and masks the useful information. This causes a decrease in the signal-to-noise ratio of the data, preventing a good assessment about the existence of buried structures at subsurface.

Nevertheless, we believe that the recorded signal of both methods has the useful part of the signal hidden. Data fusion techniques are widely used in brain tumour detection in medicine by combining data from different clinical exams, both with low perceptibility.

This work presents an approach that allows using advanced fusion algorithms to combine geophysical data from GPR-3D and magnetics. This creates an enhanced image from both datasets with better quality than the individual images from each method.

The data fusion approach is performed through the combined use of 2D Discrete Wavelet Transform, Multiresolution Singular Value Decomposition and Image Gradient. This scheme allows us to select the useful information to obtain a higher quality and sharper fused image using the best of input datasets. The geophysical data fusion was successfully tested on three datasets, with different levels of perceptibility: high, intermediate and low.

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