



Total Generalised Variation: An improved regulariser for Electrical Resistivity Tomography inversion.

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The regularisation terms used in the inversion of geophysical data affects the structure visible in the solution. The commonly used Tikhonov and Total Variation (TV) regularisers favour smooth and piecewise constant solutions respectively, however unrepresentative solutions arise when the structure of the underlying parameter distribution is not reflected in the regulariser.

The Total Generalised Variation (TGV) is a convex higher order generalisation of the TV functional, favouring piecewise smooth solutions. This has particular importance in hydrogeology, where smooth contaminant plumes or wetting fronts can be present alongside the sharp contrasts of engineered structures and geological faults. This behaviour may also show advantages in the time domain, where both gradual and sudden changes may be present.

We use a second order TGV regulariser to solve the Electrical Resistivity Tomography inverse problem. Our algorithm decouples the minimisation problem into two components, each equivalent to a TV minimisation problem, which can then be solved alternately using the iteratively reweighted least squares method until a solution is found.

We will present our initial synthetic results demonstrating the relative performance of TGV relative to TV and L2 regularisers. The computational cost is comparable to a conventional TV or L2 inversion.