



Unsupervised delineation of landfill geometries based on geophysical imaging results

Matthias Steiner¹, Werner Chwatal^{1,2}, Andreas Freudenthaler², and Adrian Flores Orozco¹

¹Geophysics Research Division, Department of Geodesy and Geoinformation, TU-Wien, Wien, Austria

(matthias.steiner@geo.tuwien.ac.at)

²Pöyry Austria GmbH, Wien, Austria

Environmental aspects and the growing interest in the economical exploitation of landfills urges the need for cost-efficient workflows providing information with high spatial resolution. Especially for landfill mining, a detailed characterization of the landfill geometry and the waste composition is critical to assess the economic potential. Geophysical methods have proven to fulfill these requirements since they permit to collect data in a quasi-continuous manner. However, the subjective perception of the geophysical imaging results might bias the interpretation, e.g. the characterization of the landfill boundaries and the estimation of waste volumes. To overcome such shortcomings, we present here an unsupervised method for the post-processing of geophysical imaging to identify subsurface interfaces associated to e.g. landfill geometries, waste variation etc. Our methodology is applicable for results obtained with a single method, or the combination of different geophysical methods, e.g. refraction seismic tomography (RST), electrical resistivity tomography (ERT) or induced polarization (IP). Assuming strong contrasts in the retrieved physical properties associated to interfaces, our method computes the magnitude of the gradient vector for each point in the resolved model. In the next step, a random walker algorithm converts the gradient magnitude image into a binary image permitting to obtain the contours of subsurface regions characterized by high gradients. Originating from the centroid for such a region further base points are determined and used in the final step to compute shape and location of the corresponding interface. To demonstrate the applicability of our method we present here results obtained for a landfill located in Upper Austria, where RST, ERT and IP data were collected along several transects. Our results demonstrate that the method proposed here has the potential to enhance geophysical investigations of landfills by permitting an improved interpretation of the imaging results, as required, for instance to estimate waste volume.