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Machine Learning (Neuronal Net, Random Forest, and C5.0 single decision tree) based on pXRF data as a tool to date sediment layers of the Nile Delta

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This paper presents the application of machine-learning techniques on pXRF data to establish a chronology for sediment cores around Tell Buto (Tell el-Fara´in) in the northwestern Nile Delta. As modern laboratories for dating techniques like OSL or ^{14}C are rare in Egypt and sample export is restricted, we are facing a lack of opportunities to create a robust chronology, which is indispensable in modern Geoarchaeology.

Therefore, we present a new approach to transfer archaeological age information gained at the excavation at Buto to corings of the wider Buto area. Sediments of archaeological outcrops and pits with known age are measured using pXRF to create a geochemical “fingerprint” for several historic eras. Afterwards, these “fingerprints” are transferred to corings of the surrounding areas using machine-learning algorithms.

This paper presents 1) the application of three different machine-learning approaches (Neuronal Net, Random Forest, and C5.0 decision tree) to check if archaeological age information can be transferred to sediments far off the settlement mounds using pXRF data, 2) the comparison of all approaches and the evaluation if the easily anticipated decision tree and Random Forest show similar results as the “black-box system” Neuronal Net, and finally, 3) a case study that provides the results of Altmeyer et al. (in review) for Kom el-Gir, a further settlement mound little north of Buto, with a chronostratigraphic framework based on this approach.

Reference:

Altmeyer, M., Seeliger, M., Ginau, A., Schiestl, R. & J. Wunderlich (in review): Reconstruction of former channel systems in the northwestern Nile Delta (Egypt) based on corings and electrical resistivity tomography (ERT). (Submitted to E & G Quaternary Science Journal).