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A machine-learning based data fusion approach for improved corrosion testing

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Half-cell potential mapping (HP) is the most popular nondestructive test (NDT)-method for the localization of corrosion damage in concrete. It is generally recognized, that HP is prone to the environmental factors that arise from salt induced deterioration, such as varying moisture and chloride gradients. Additional NDT-methods are capable to determine distinctive areas, but cannot yet be used to estimate more accurate testing results. We introduce a supervised machine learning (SML) based approach for data fusion of seven different features to make use of the additional sensor information. SML are methods that explore relations between different (sensor) data from predefined data labels. We use a simple linear classifier named logistic regression to distinguish defect and intact areas. The test performance improves drastically compared to the best single method, HP. In order to generate representative, labeled data we conducted a comprehensive experiment that simulates the deterioration-cycle of a chloride-exposed building part in the lab. Our data set consist of 18 measurement campaigns, each containing HP-, ground-penetrating-radar-, microwave-moisture-, and wenner-resistivity-data. We detail the challenges that arise with a data driven approach in NDT and how we addressed them.