Estimation of Critical Temperature of High- Temperature Superconductors using machine learning approach

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The critical temperature T_c of a High-Temperature Superconductor (HTS) is often the most significant parameter of a prepared HTS sample. The T_c value can be estimated from magnetoresistance and AC susceptibility vs temperature measurements. Estimation of T_c is a time-consuming task. This task is also hard in cases when significant noise is present or unphysical contributions from laboratory equipment are apparent in a measurement. To deal with these issues we developed a method of estimation of critical temperature T_c using a machine learning approach. Our algorithm utilises one artificial neural network (ANN) for finding a relevant part of measurement for T_c estimation task based on the shape of the measurement. The second ANN estimates T_c using the regression technique. The ANNs were trained on a dataset consisting of more than 1000 AC susceptibility vs temperature measurements. The performance of the algorithm is shown and compared to a standard approach. Our solution can be extended for finding other parameters, which are derived from the shape of a measurement curve.