# Model-Enhanced Machine Learning and Vice Versa

**Maximilian Merkert**[a], Sebastian Sager[a].

[a] *Otto-von-Guericke University Magdeburg*

Machine learning (ML) methodology has been successfully applied to many classification problems from different areas. Whereas the accuracy is often astonishing, the interpretability of the results has become an ubiquitous issue. In order to overcome this important but unsolved challenge, we propose to combine the interpretability of expert systems with the deductive power of data driven ML—either by first reducing the complexity of the data with the help of an expert model before applying ML methods or by using ML to design suitable components of an expert model. As a showcase we consider two projects in which ML and mathematical optimization models incorporating expert knowledge are used together.

Our first example considers the arguably most difficult classification case of cardiac arrhythmias. Here the largest database with the gold standard (intracardiac measurements after invasive procedures) only contains 380 samples, yielding an additional challenge to ML. As a second example we consider the task of central optimization of autonomous traffic at traffic-light-controlled urban intersections. Here ML can help to incorporate realistic human driving behavior for non-autonomous vehicles into a model for mixed-traffic scenarios.