Data-based machine learning by itself is not sufficient
In data-based machine learning, we develop statistical learning algorithms that recognize patterns and laws in given data. The benefits of ML algorithms depend to a great extent on the quality and quantity of the available data. As a rule, enough measured data is collected for the purpose of quality assurance in the textile industry. However, only in the rarest of cases is sufficient data available to make a connection between the process parameters and the product quality. Consequently, we are not able to use pure, data-driven machine learning – especially for plant and process optimization for today’s customized production processes.

Hybrid simulation-based machine learning
To design and optimize production processes in the textile branch with ML methods, we develop and apply a hybrid approach. Extensive experience is available for process and product design in textile industry. We formalize this expert know-how by building a physical model to describe the process and, subsequently, implement a computer based simulation. Models provide the missing data for the development of suitable ML algorithms and linking with available measurements. In this concept, ML closes the gap between physical based simulation of production processes and the level of quality of the end products – which, in many cases, is not accessible to physical models.

The optimization of winding machines with regard to a better dyeing of the wound bobbins illustrates this innovative hybrid ML process in AiF’s DensiSpul project.