Data-driven mechanics - theoretical and numerical aspects in the context of inelastic material behaviour

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Due to the volatile development of storage capacities as well as suitable soft- and hardware, the amount of available data has increased by many orders of magnitude over the last decades. This influences almost all parts of practical life but also science and technology. In particular, the area of computational mechanics has a significant role in it, since it seeks for physically relevant models validated by meaningful data. The question arises as to whether the challenging step of setting up parametric constitutive models can be left out completely. Is it possible to represent and numerically predict the material behaviour purely by means of data? On the one hand, the presentation shall focus on data-driven approaches for inelastic material behaviour, where loading and unloading paths in a stress-strain diagram do not coincide.
An important point is to clarify which data sets are needed to obtain a physically reasonable material description. What are today's limitations – also in comparison to standard continuum mechanical modelling? Another field of interest concerns the important question how the computational efficiency of such approaches can be improved. In the talk, several ideas to reduce the computational effort and to deal with large amounts of data are discussed. Of high significance are also connections to machine learning algorithms or other surrogate approaches including model order reduction.