Understanding distributed data – a semantic web approach for data based analysis of NDT data in civil engineering

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In the field of non-destructive testing (NDT) in civil engineering, a large number of measurement data are collected. Although they serve as a basis for scientific analyses, there is still no uniform representation of the data. An analysis of various distributed data sets across different test objects is therefore only possible with high manual effort.

We present a system architecture for an integrated data management of distributed data sets based on Semantic Web technologies. The approach is essentially based on a mathematical model - the so-called ontology - which represents the knowledge of our domain NDT. The ontology developed by us is linked to data sources and thus describes the semantic meaning of the data. Furthermore, the ontology acts as a central concept for database access. Non-domain data sources can be easily integrated by linking them to the NDT construction ontology and are directly available for generic use in the sense of digitization. Based on an extensive literature research, we outline the possibilities that this offers for NDT in civil engineering, such as computer-aided sorting, analysis, recognition and explanation of relationships (explainable AI) for several million measurement data.

The expected benefits of this approach of knowledge representation and data access for the NDT community are an expansion of knowledge through data exchange in research (interoperability), the scientific exploitation of large existing data sources with data-based methods (such as image recognition, measurement uncertainty calculations, factor analysis, material characterization) and finally a simplified exchange of NDT data with engineering models and thus with the construction industry.

Ontologies are already the core of numerous intelligent systems such as building information modeling or research databases. This contribution gives an overview of the range of tools we are currently creating to communicate with them.