

Tips to use AI for NDT and SHM application

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Tips to use AI for NDT and SHM application are explained in the presentation. Firstly, fundamentals of machine learning for unsupervised and supervised learning are introduced by using artificial acoustic emission (AE) signals induced on metal scale. For the unsupervised learning, k-means method is introduced and shows application examples for classification problem. It will be noted that the method can be utilized for fracture mode classification problems on FRP structures. For the supervised learning, neural network (NN) and convolution NN (CNN) is introduced and shows application examples for classification problem. It will be noted that the method can be utilized to monitor damages in FRP structures. Then, suitable digital sampling conditions and filter for time-series data for NDT/SHM are discussed. Secondary, following application examples are introduced. <classification problem> 1) Visual inspection of composite overwrapped pressure vessel (COPV) - Discuss about architecture of NN, type of input images - Introduce filtered images after convolution layers 2) UT for thermal insulator - Discuss about architecture of NN - Tips on problem setting for NDT/SHM with AI <regression problem> 3) Source location of AE on anisotropic thin plate - Discuss about architecture of NN - Discuss about extrapolation and interpolation of the data Thirdly, different way to use AI for NDT/SHM is introduced. The convolution layer in CNN acts as filter for the input data and the layer extract characteristics of input data which are used for NN to solve the problems. During the training of CNN, not only the conventional NN layers but also the convolution layer act as filters are trained. After the training, suitable convolution layer/filter is determined for solving each problem. By investigating and interpreting the trained convolution layer, there is a possibility to discover suitable characters to interpret the input data and suitable filters to extract the characteristics that are not usual in engineering field by now. Finally, personal opinion about relationship between NDT/SHM people and AI people, and task for the NDT/SHM people in AI academic field are introduced.