Parametric Uniform Manifold Approximation And Projection To Improve The Structural Damage Classification In A Wind Turbine Foundation

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Common structural health monitoring approaches of wind turbine foundations are based on guided waves with a known input excitation, but in these types of structures the applicability of guided waves is not functional since the external disturbance effects caused by wind and marine waves are ignored. Different strategies make use of data-driven approaches, and this work presents the development of a data-driven methodology that combines different methods from the point of view of the machine learning paradigm. Representation learning is a type of machine learning that searches to better understand the data through its transformation and visualization. This is based on abstracting a different representation of the original data to be able to better interpret it. Manifold learning is a subdivision of representation learning and it is based on the idea that high-dimensional data can be represented in a low-dimensional space. This work shows a damage classification methodology applied in a small-scale wind turbine foundation. This methodology is based on a data driven approach where data from accelerometers were collected and arranged. This data have a high dimensionality, to facilitate the task performed by a machine learning classifier, a parametric UMAP (Uniform Manifold Approximation and Projection) method is used to reduce the data dimensionality. A cross validation approach is performed in a 5-class classification problem obtaining a classification performance showed by the high accuracy value achieved.