Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)

Micro-mechanical damage diagnosis methodologies based on machine learning and deep learning models

Shahab Shamshirband, Nabi Mehri Khansari

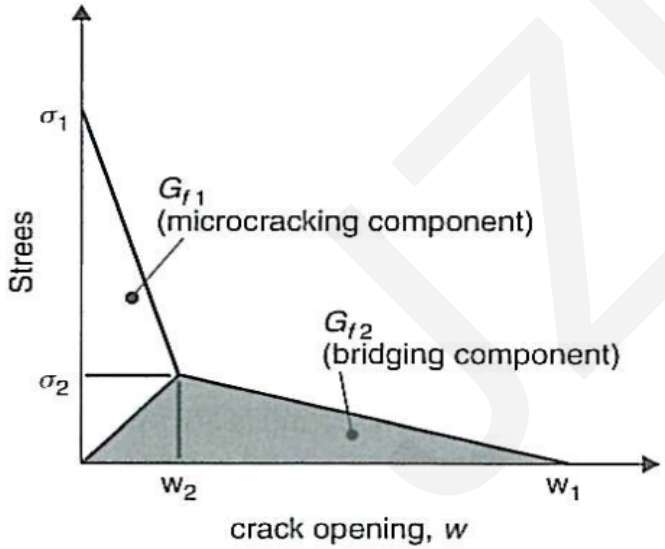
Cite this as: Shahab Shamsirband, Nabi Mehri Khansari, 2021. Micro-mechanical damage diagnosis methodologies based on machine learning and deep learning models. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 22(8):585-608. https://doi.org/10.1631/jzus.A2000408

Damage Application & Component

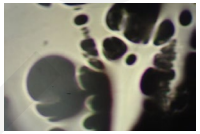
Damage in airplane wing

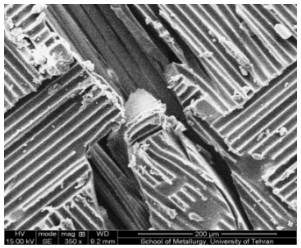
Damage in Ship

Damage in turbine blade

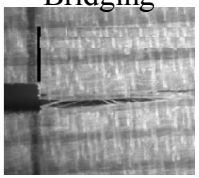


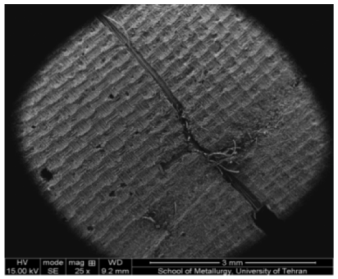
Micro cracking





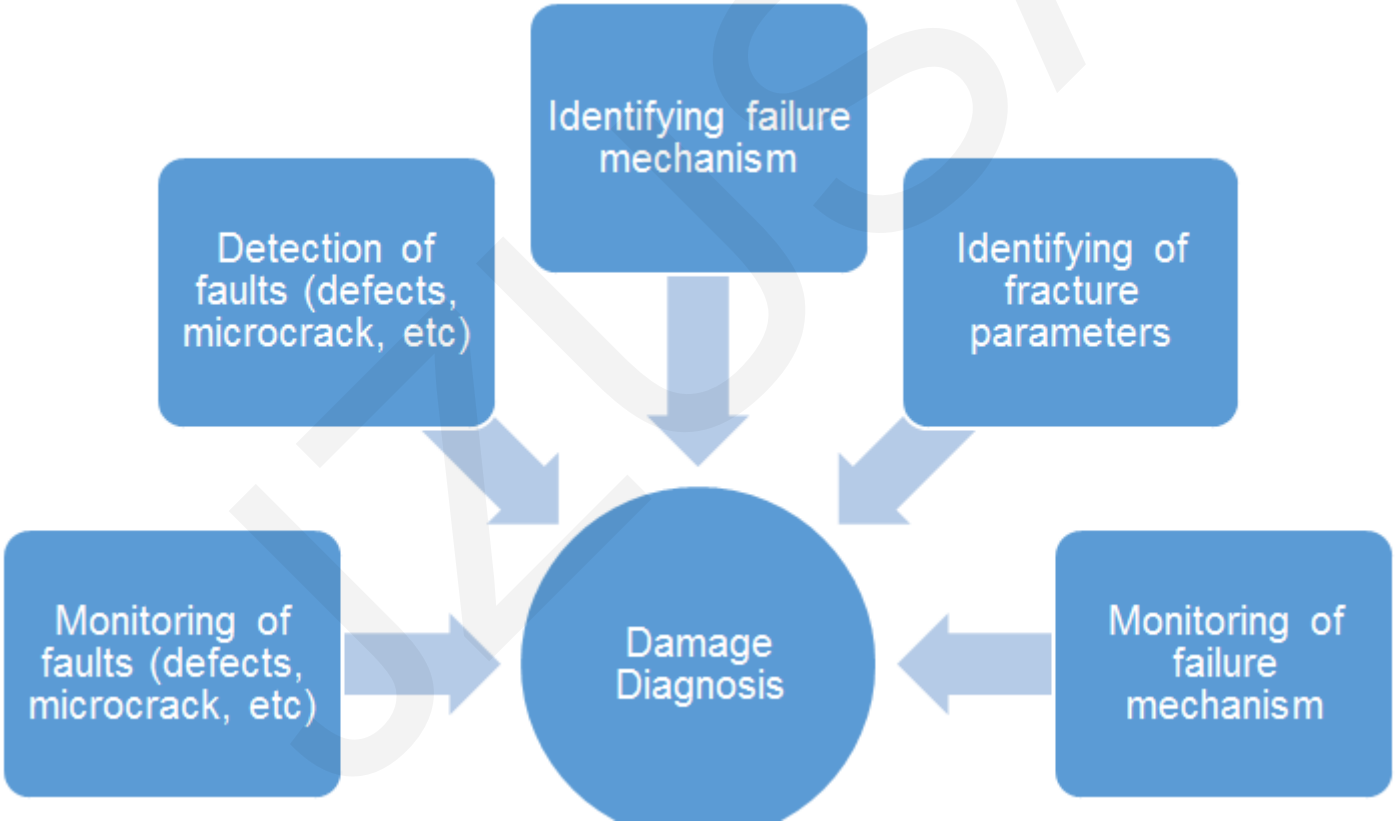
Bridging



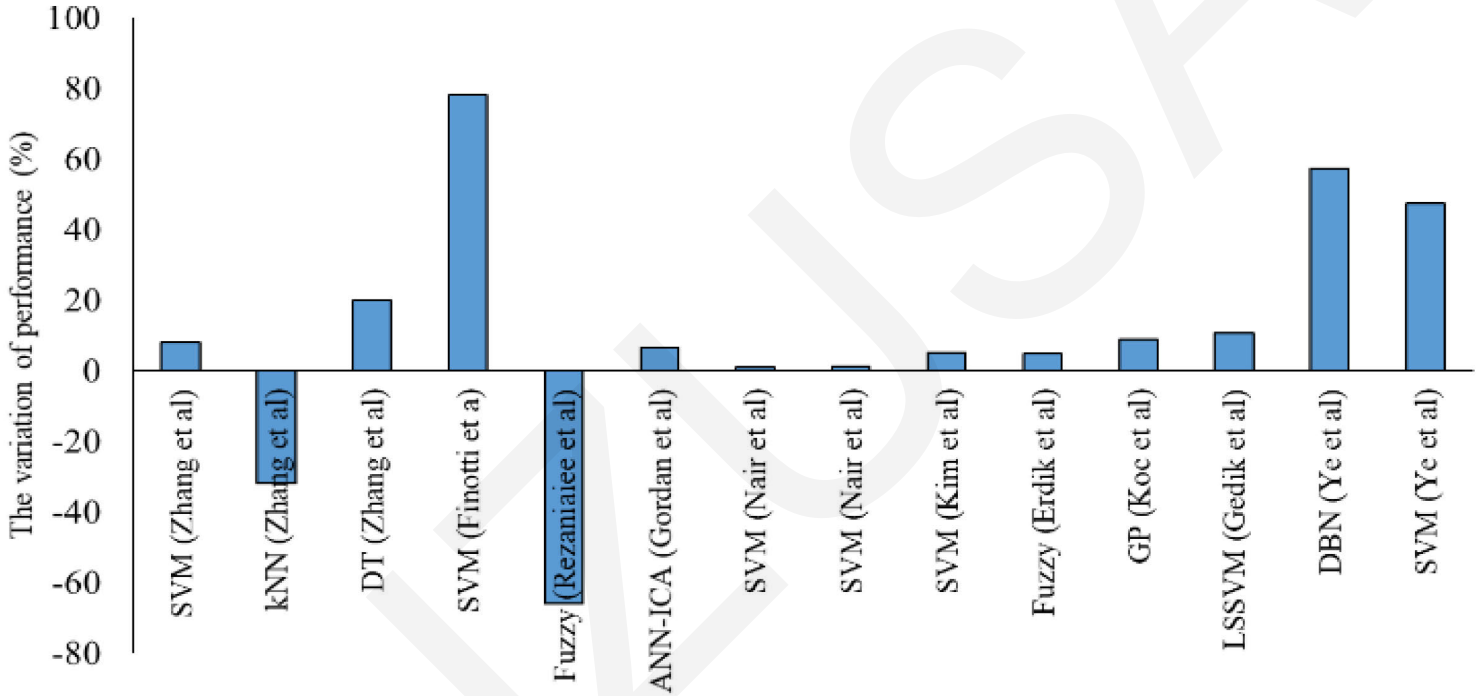


Research Strategy and Concepts

The present research investigates the state of the art ML and DL methods and their applications in material damage detection and prediction.

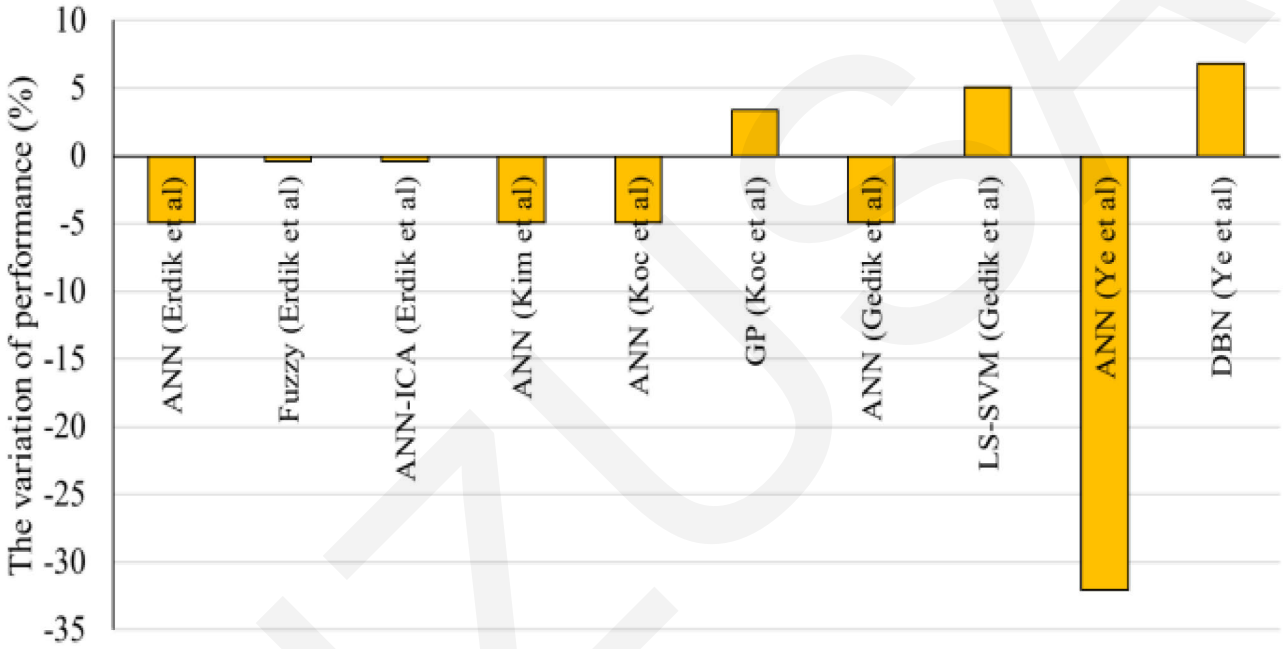


Detection Comparison Methods



variation of performance (%) factors in comparison with ANN

Detection Comparison Methods



The variation of performance (%) factors in comparison with support vector based techniques

Conclusions

- The present study, discusses a comprehensive state of the art of ML and DL techniques developed for micromechanical damage diagnosis in isotropic and orthotropic materials. As it was described, ML/DL methods can have significant role in damage identification at various loading and material conditions. Therefore, in the present research, there is an attempting to present a classification for ML and DL based models including ANN, DL, SVM and other type of learning models for detection of damage in industrial structures. The progress of damage diagnosis is a function of the advancement of ML and DL techniques. The review of these particular applications has demonstrated the promising robustness of the ML models. Based on the findings, deep learning followed by ensemble based techniques has the highest application and robustness in the complex of micromechanical damage diagnosis. Also, based on our best of knowledge, increasing data size reduces the accuracies in LR, ANN and SVM but ensemble and DL techniques have the lowest sensitivity to data size and indicate a highest robustness in big datasets as well as small datasets.