

Remaining Useful Life prediction with a Deep Self-Supervised Learning Approach

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With the increasing availability of data for Prognostics and Health Management (PHM), Deep Learning techniques are now the subject of considerable attention in Prognostics for Predictive Maintenance, achieving more accurate Remaining Useful Life (RUL) predictions. However, one of the major challenges for DL techniques resides in the difficulty of obtaining large amounts of labeled data on industrial systems [1]. To overcome this lack of labeled data, an emerging learning technique is considered in our work : Self-Supervised Learning [2], a sub-category of unsupervised learning approaches. It consists in learning meaningful and general representations from unlabeled data, without requiring human-annotated labels, which are applicable to a wide range of related supervised tasks (i.e. downstream tasks) with only few labeled data (i.e. "Few-Shots Learning").

In our research, we are addressing data scarcity in a fatigue damage prognostics problem, and are interested in estimating the RUL of aluminum panels (typical of aerospace structures) subject to fatigue cracks from strain gauge data. The project aims to investigate whether pre-training DL models in a self-supervised way on unlabeled sensors data can be useful for downstream tasks in PHM (i.e. RUL estimation) with only Few-Shots Learning. A synthetic dataset composed of large unlabeled strain data is used for the pre-training task. Results show that the self-supervised pre-trained models significantly outperform the non pre-trained models in downstream RUL prediction task, showing promising results in prognostic tasks when only limited labeled data is available.

REFERENCES

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