

Read me file: implementation of "Zero-fault-shot learning for bearing spall type classification by hybrid approach"

The codes in this directory implement the demonstration on the experimental dataset of the study:

Matania, O., Cohen, R., Bechhoefer, B., & Bortman, J. "Zero-fault-shot learning for bearing spall type classification by hybrid approach" *Mechanical Systems and Signal Processing*, 112117 (2025).

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Zero-fault-shot learning for bearing spall type classification by hybrid approach

Omri Matania^{a,*}, Roe Cohen^a, Eric Bechhoefer^b, Jacob Bortman^a

^a BGU-PHM Laboratory, Department of Mechanical Engineering, Ben-Gurion University of the Negev, P.O. Box 653, Beer Sheva 8410501, Israel

^b GPMS International Inc., 93 Pilgram Place, Waterbury, VT 05676, USA

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ABSTRACT

Spall type classification, a task in which the type of the spall is estimated, is an important stage for bearing diagnosis and prognosis. Many machine learning algorithms have been suggested for spall type classification. However, they are not relevant for diagnosing critical rotating machinery, where very few, if any, faulty examples (labeled and unlabeled) are available due to safety considerations. In this study, a novel hybrid algorithm is proposed, which enables the classification of the spall type based on zero-fault-shot learning. The novel algorithm combines physics-based algorithms together with machine learning to overcome the lack of faulty data. It projects the signals into an invariant feature space by physics-based algorithms and classifies the spall type by a fully connected neural network. The new algorithm is demonstrated on several well-known experimental datasets and significantly improves the performance of currently available learning algorithms for zero-fault-shot learning. It improves the results of the state-of-the-art algorithm from at most 60% on the six tested datasets to at least 98% accuracy on all tested datasets with the newly suggested algorithm.

The experimental dataset consists of measured signals [see Fig. 5(c), Fig. 8 and Table 1] and simulated dataset [see Fig. 5(a) and Fig. 8].

You can run the codes using MATLAB and Python by three steps:

1. Download datasets.zip file from:

https://drive.google.com/drive/folders/11GX9r8-P34TtrxxCa6NqAAgF6DyF1_3v

and extract its data. Set the right path in the main.m file:

```
9 % ----- %  
10 % Datasets loading  
11 % ----- %  
12 tic()  
13  
14 data_path = 'D:\data\papers\zero_fault_shot_learning\datasets\' ;  
15
```

2. Run main.m file.
3. Run the Jupyter notebook physical_domain_adaptation.m.

You can use the codes and data for any academic purposes; however, you are requested to cite:

[1] Matania, O., Cohen, R., Bechhoefer, B., & Bortman, J. " Zero-fault-shot learning for bearing spall type classification by hybrid approach." Mechanical Systems and Signal Processing, 112117 (2025).
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For any question do not hesitate to send an email to Omri Matania in omrimatania@gmail.com.