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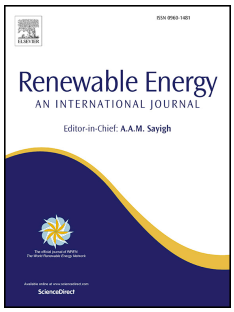

Bayesian state prediction of wind turbine bearing failure

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Bayesian State Prediction of Wind Turbine Bearing Failure

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Abstract

A statistical approach to abstract and predict turbine states in an online manner has been developed. Online inference is performed on temperature measurement residuals to predict the failure state Δn steps ahead of time. In this framework a case study is performed showing the ability to predict bearing failure 33 days, on average, ahead of time. The approach is based on the separability of the sufficient statistics and a hidden variable, namely the state length. The predictive probability is conditioned on the data available, as well as the state variables. It is shown that the predictive probability can be calculated by a model for the samples and a hazard function describing the probability for undergoing a state transition. This study is concerned with the prior training of the model, for which run-to-failure time series of bearing measurements are used. For the sample model prediction is conditioned on prior information and predict the next Δn samples from a feature space spanned by the prior samples. By assuming that the feature space can be described by a multivariate Gaussian distribution, the prediction is treated as a Gaussian process over the feature space.

Keywords: Fault Prediction, Bayesian Inference, Machine Learning, Data Driven, Classification, Wind Turbines.

1. Introduction

The continuous growth of wind energy generating sources, especially in harsh environments such as off-shore, has led to an increasing demand on more careful

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