MetroPT-3 Dataset

(Abstract - RR) From a metro train in an operational context, readings from pressure, temperature, motor current, and air intake valves were collected from a compressor's Air Production Unit (APU). This dataset reveals real predictive maintenance challenges encountered in the industry. It can be used for failure predictions, anomaly explanations, and other tasks.

Data Set Characteristics:	Multivariate Time series	**Number of Instances:**	15169480
Attribute Characteristics:	Real	**Number of Attributes**	15
Associated Tracks:	Classification, Regression	**Missing Values**	N/A

Data Set Information:

The dataset was collected to support the development of predictive maintenance, anomaly detection, and remaining useful life (RUL) prediction models for compressors using deep learning and machine learning methods.

It consists of multivariate time series data obtained from several analogue and digital sensors installed on the compressor of a train. The data span between February and August 2020 and includes 15 signals, such as pressures, motor current, oil temperature, and electrical signals of air intake valves. The monitoring and logging of industrial equipment events, such as temporal behaviour and fault events, were obtained from records generated by the sensors. The data were logged at 1Hz by an onboard embedded device. You can find a schematic diagram of the air production unit of the compressor system in Figure 4 of the accompanying paper [1]. Also, the paper [2] provides a detailed examination of data collection and specifications of various types of potential failures in an air compressor system.

Relevant Papers:

[1]- Davari, N., Veloso, B., Ribeiro, R.P., Pereira, P.M., Gama, J.: Predictive maintenance based on anomaly detection using deep learning for air production unit in the railway industry. In: 2021 IEEE 8th International Conference on Data Science and Advanced Analytics (DSAA). pp. 1–10. IEEE (2021) (DOI: 10.1109/DSAA53316.2021.9564181)

[2] Veloso, B., Ribeiro, R.P., Pereira, P.M., Gama, J.: The MetroPT dataset for predictive maintenance. Scientific Data 9, no. 1 (2022): 764. (DOI: 10.1038/s41597-022-01877-3)

[3]-Barros, M., Veloso, B., Pereira, P.M., Ribeiro, R.P., Gama, J.: Failure detection of an air production unit in the operational context. In: IoT Streams for Data-Driven Predictive Maintenance and IoT, Edge, and Mobile for Embedded Machine Learning, pp. 61–74. Springer (2020) (DOI: 10.1007/978-3-030-66770-2_5)

Source:

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Attribute Information:

The dataset consists of 15169480 data points collected at 1Hz from February to August 2020 and is described by 15 features from 7 analogue (1-7) and 8 digital (8-15) sensors:

1. TP2 (bar) – the measure of the pressure on the compressor.

2. TP3 (bar) – the measure of the pressure generated at the pneumatic panel.

3. H1 (bar) – the measure of the pressure generated due to pressure drop when the discharge of the cyclonic separator filter occurs.

4. DV pressure (bar) – the measure of the pressure drop generated when the towers discharge air dryers; a zero reading indicates that the compressor is operating under load.

5. Reservoirs (bar) – the measure of the downstream pressure of the reservoirs, which should be close to the pneumatic panel pressure (TP3).

6. Motor Current (A) – the measure of the current of one phase of the three-phase motor; it presents values close to 0A - when it turns off, 4A - when working offloaded, 7A - when working under load, and 9A - when it starts working.

7. Oil Temperature (ºC) – the measure of the oil temperature on the compressor.

8. COMP - the electrical signal of the air intake valve on the compressor; it is active when there is no air intake, indicating that the compressor is either turned off or operating in an offloaded state.

9. DV electric – the electrical signal that controls the compressor outlet valve; it is active when the compressor is functioning under load and inactive when the compressor is either off or operating in an offloaded state.

10. TOWERS – the electrical signal that defines the tower responsible for drying the air and the tower responsible for draining the humidity removed from the air; when not active, it indicates that tower one is functioning; when active, it indicates that tower two is in operation.

11. MPG – the electrical signal responsible for starting the compressor under load by activating the intake valve when the pressure in the air production unit (APU) falls below 8.2 bar; it activates the COMP sensor, which assumes the same behaviour as the MPG sensor.

12. LPS – the electrical signal that detects and activates when the pressure drops below 7 bars.

13. Pressure Switch - the electrical signal that detects the discharge in the air-drying towers.

14. Oil Level – the electrical signal that detects the oil level on the compressor; it is active when the oil is below the expected values.

15. Caudal Impulse – the electrical signal that counts the pulse outputs generated by the absolute amount of air flowing from the APU to the reservoirs.

Failure Information:

The dataset is unlabeled, but the failure reports provided by the company are available in the following table. This allows for evaluating the effectiveness of anomaly detection, failure prediction, and RUL estimation algorithms.

Nr.	Start Time	End Time	Failure	Severity	Report
#1	4/18/2020 0:00	4/18/2020 23:59	**Air leak**	High stress	
#1	5/29/2020 23:30	5/30/2020 6:00	**Air Leak**	High stress	Maintenance on 30Apr at 12:00
#3	6/5/2020 10:00	6/7/2020 14:30	**Air Leak**	High stress	Maintenance on 8Jun at 16:00
#4	7/15/2020 14:30	7/15/2020 19:00	**Air Leak**	High stress	Maintenance on 16Jul at 00:00