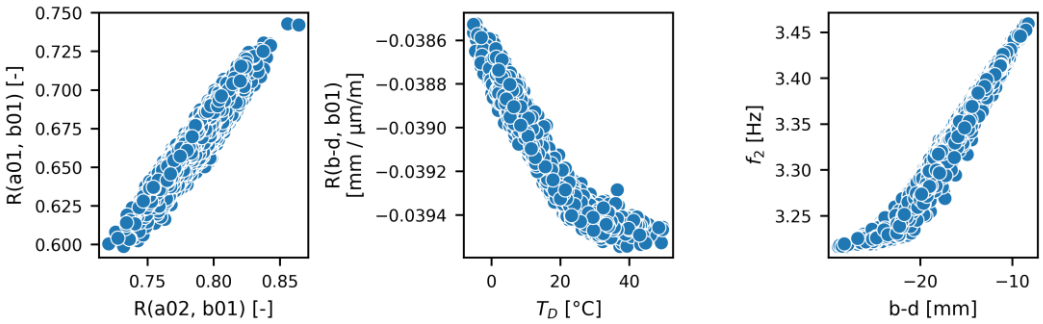
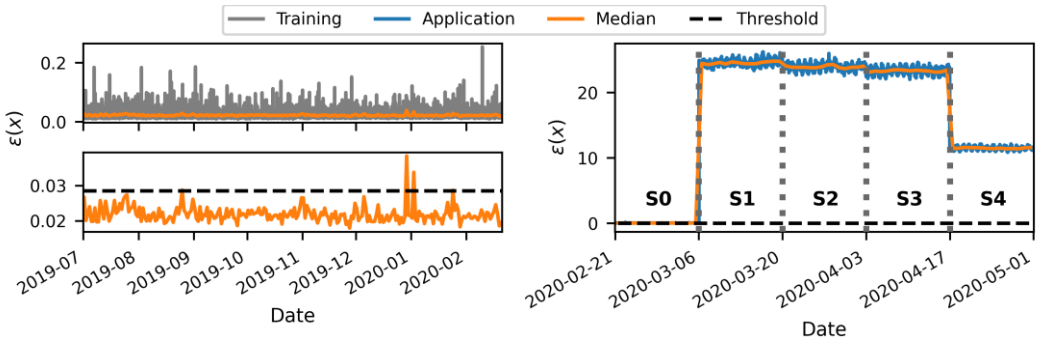


Figure 9. Correlation structure of selected features of the simulated data



(a) (b)

Figure 10. Anomaly detection with simulated data: (a) training period (b) application period

- An autoencoder with five perceptron layers is suitable to reconstruct the non-linear real-world monitoring data. A compression rate of 0.5 is required to achieve a high accuracy of the model. It is observed that the anomaly detection procedure can detect the erroneous offset of sensor signals.
- A crack in the bottom chord is simulated with an FE-model of the bridge under realistic temperature and traffic loads. The simulated data shows similar non-linear dependencies as the real-world data. In order to investigate if the procedure can also detect structural damage, an autoencoder with the same architecture and compression rate as for the real-world data is used with the simulation. Damage is clearly identified.
- The simulation shows that the reconstruction error does not necessarily increase with progressing damage severity. Moreover, the procedure gives no insights into the sources of anomalies. Further research is required on methods to simplify the interpretation of anomalies. A combination or a coupling of different types of models, physical and non-physical, could be effective for this task.

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