Tampere University

OPENS-Analytics of Industrial Systems

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Analytics of Industrial Systems





Objective-

- Fault detection
- Optimization of maintenance actions
- Avoid unnecessary visits of technicians
- Decision support system

Methods-

- Machine learning, Deep learning
- Data pre-processing
- Automated feature extraction
- Dimensionality reduction, classification
- Sensor, maintenance data

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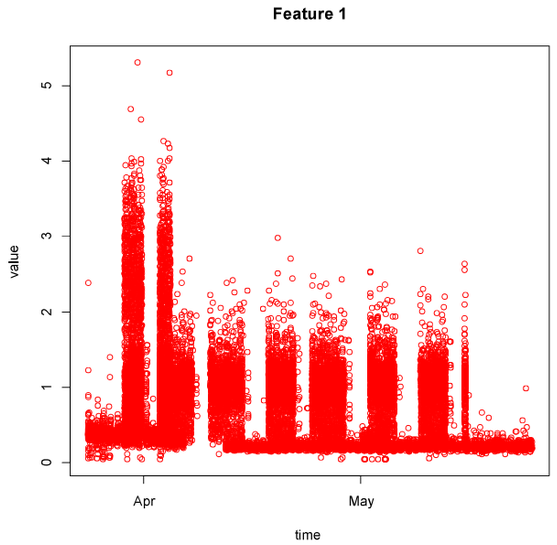
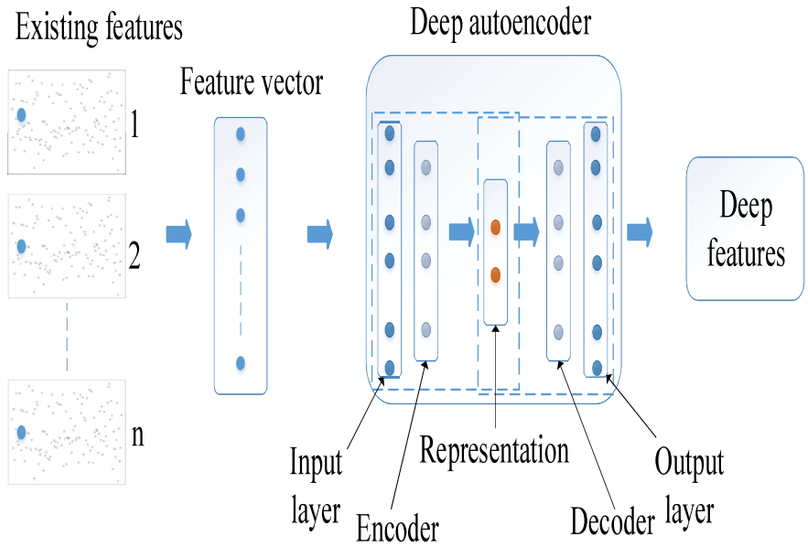
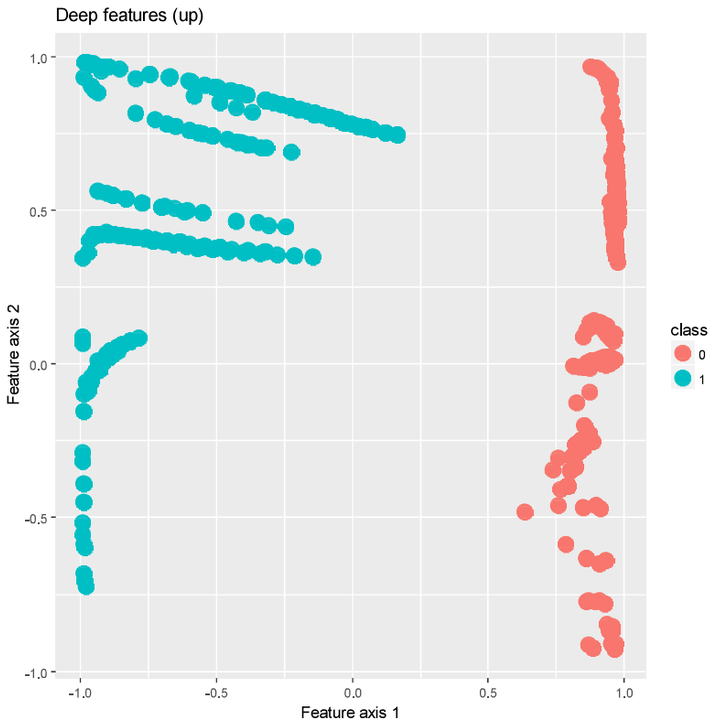
Deep autoencoder





Deep features



Results-UP

	Deep features	Existing features
Accuracy	1	0.65
False positives	1	0.61

Results-DOWN

	Deep features	Existing features
Accuracy	1	0.62
False positives	0.95	0.58

Class 0- Healthy (Red)
Class 1- Faulty (Blue)

K. M. Mishra, T. Krogerus and K. Huhtala, ”Deep autoencoder feature extraction for fault detection of elevator systems,” in Proceedings of the 27th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN), pp. 191-196, 2019.

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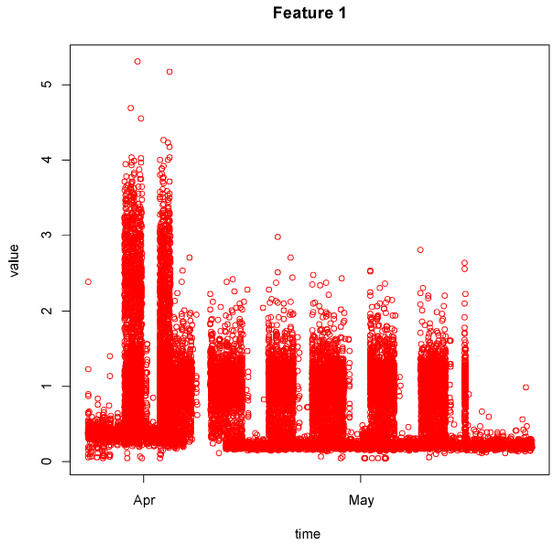
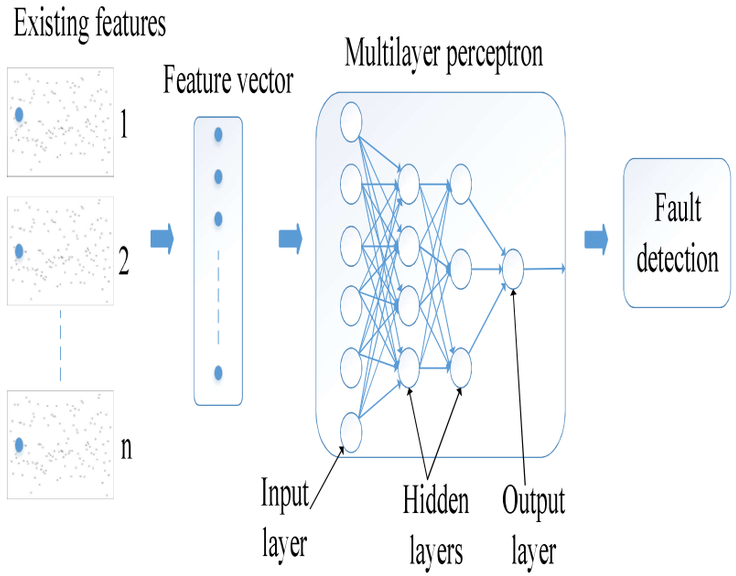
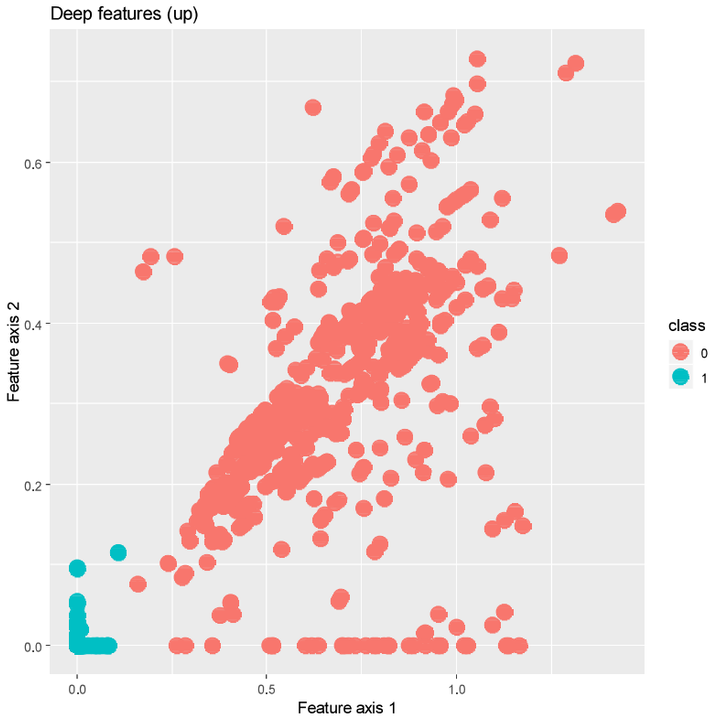
Multilayer Perceptron





Deep features



Results-UP

	MLP (Deep features)	RF (Existing features)
Accuracy	0.99	0.65
False positives	1	0.61

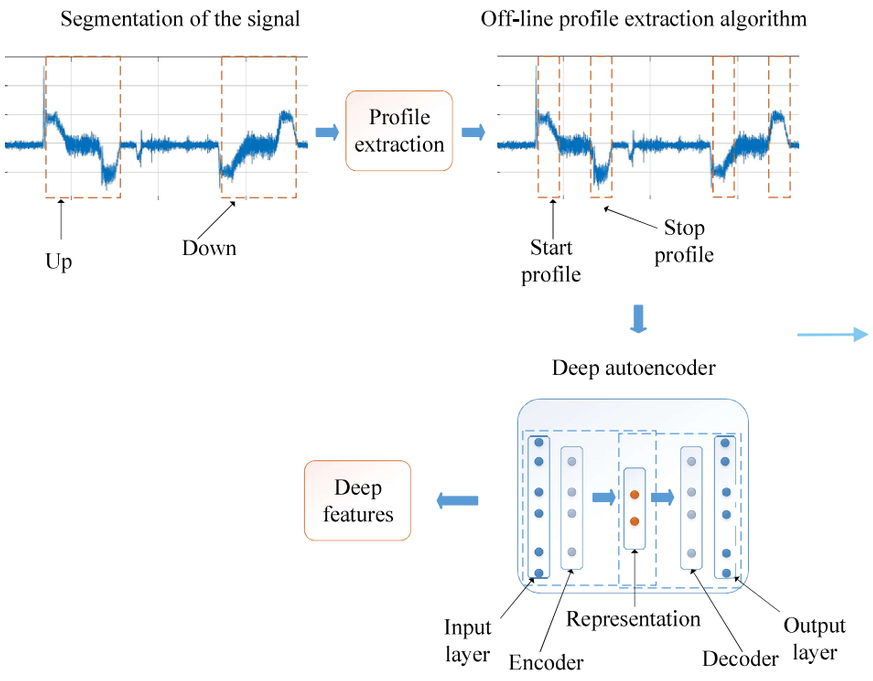
Results-DOWN

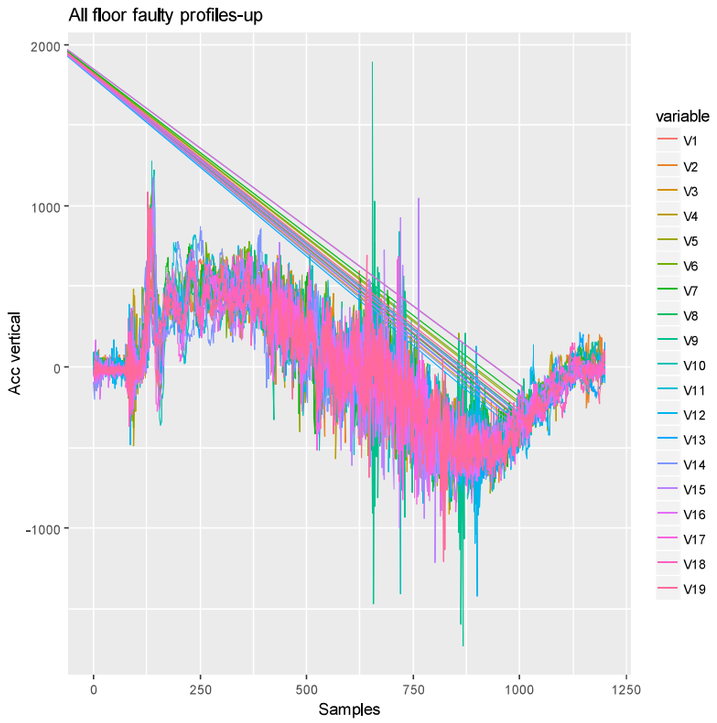
	MLP (Deep features)	RF (Existing features)
Accuracy	0.99	0.62
False positives	1	0.58

Class 0- Healthy (Red)
Class 1- Faulty (Blue)

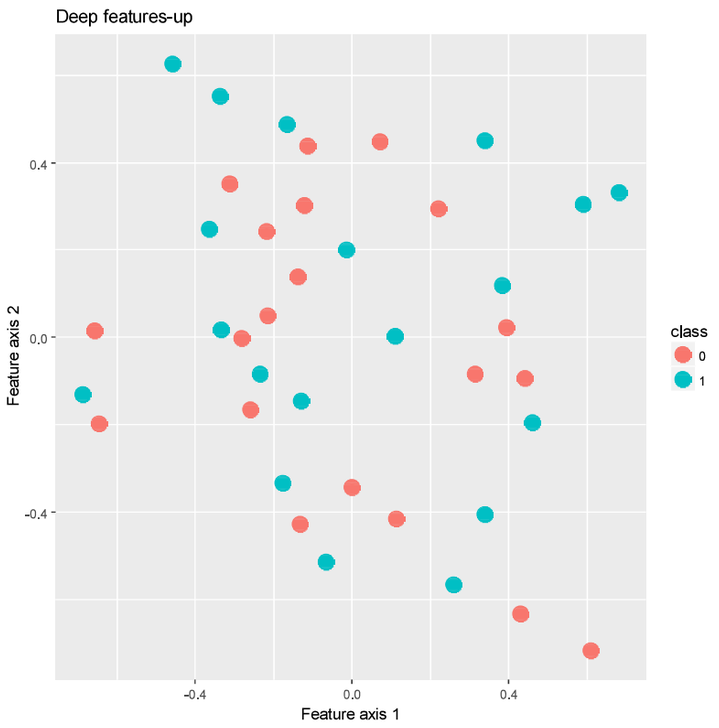
K. M. Mishra, and K. Huhtala, “Fault detection of elevator systems using multilayer perceptron neural network”. in Proceedings of the 24th IEEE Conference on Emerging Technologies and Factory Automation (ETFA), pp. 904-909, 2019.

Profile extraction algorithm





Deep features



Results-UP

	Deep features	Existing features
Accuracy	1	0.55
False positives	1	0.48

Results-DOWN

	Deep features	Existing features
Accuracy	1	0.78
False positives	0.98	0.66

Class 0- Healthy (Red)
Class 1- Faulty (Blue)

K. M. Mishra, J. E. Saxen, J. Bjorkqvist and K. Huhtala, ” Fault Detection of Elevator System Using Profile Extraction and Deep Autoencoder Feature Extraction,” in Proceedings of the 33rd annual European Simulation and Modelling Conference (ESM), pp. 79-83, 2019.

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Thank you for your attention.

Questions?

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