Integrated Dimensionality Reduction and Sequence Prediction using LSTM

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Making Sense of Illustrated Handwritten Archives View project

MPS - Medieval Paleographic Scale View project
**Problem**

- Most industrial or complex processes present temporal dependencies which stretch over a long time.
- The underlying patterns in these processes can be extremely non-linear.
- Use of linear predictive model (ARMA/ARIMA\[1\]) is not suitable.
- Hidden Markov Model\[2\] has prediction limitation when dealing with temporal dependencies that stretch over long durations.

**Objectives**

- Use of external and a proposed integrated dimensionality reduction LSTM predictive systems for predicting message logs from industrial machines.
- Conversion of nominal codes (raw codes) to other vectorial paradigms to obtain better correlated patterns.

**Methods**

- **External Methods:** Recurrent Neural Networks (RNN) \[3-7\]
- **Proposed Method:** Integrated Dimensionality-reduction LSTM

**Results**

- **ID-LSTM Prediction on OHE codes during training and testing phases (left plot) and index predictions (right plot) over a duration of 10K time-counts.**

**NOTE**

- A separate dimensionality reduction by PCA is not needed: the ID-LSTM uses 10 hidden dimensions in the bottleneck layer.
- One-hot-encoding is a must: do not try to predict arbitrary raw integer codes

**Future Directions**

- We suggest that it may be possible to combine the proposed model with an early anomaly detection algorithm.
- To allow continuous prediction of physical problems in the machines generating the message logs.
- Optimization of LSTM-based feature dimensionality reduction in a realistically large dataset.

**References**


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