

Exercise Sheet 3: Sequence Models

January 12, 2023

For the following exercises, it is best to use a deep learning framework like *pytorch*.

1) MLP

- a) Predict the demand of all product-location-date combinations in `test.csv` using a feed-forward neural network (if you want with several hidden layers). You can choose one of the two setups described in exercise 2) a and b of exercise sheet 1. Repeat the evaluations with this model.
- b) Include embedding layers for the categorical variables product ID (potentially also for product groups) and location ID to replace the one-hot encodings.
- c) Use t-SNE (for example from *scikit-learn*) to visualize the embeddings from the previous exercise.

2) Predict the demand of all product-location-date combinations in `test.csv` using a CNN. (Hints: You need to prepare sequence samples corresponding to time windows as inputs. You can go multivariate by means of several channels.) Again, you can choose one of the two setups described in exercise 2) a (corresponding to a multi-step CNN model with several output values for the different horizons) and b (corresponding to a CNN with the prediction for the next day as single output value) of exercise sheet 1. Repeat the evaluations with this model.

3) Predict the demand of all product-location-date combinations in `test.csv` using a LSTM. (The structure of inputs and outputs is very similar to CNNs.) Again, you can choose one of the two setups described in exercise 2) a and b of exercise sheet 1. Repeat the evaluations with this model.

4) Transformer

- a) Predict the demand of all product-location-date combinations in `test.csv` using a transformer. (The structure of inputs and outputs is very similar to CNNs and LSTMs.) Again, you can choose one of the two setups described in exercise 2) a and b of exercise sheet 1. Repeat the evaluations with this model.
- b) Use the Temporal Fusion Transformer from *pytorch_forecasting*.