Ciências ULisboa | Informática

Aprendizagem Automática Avançada
(2º Ciclo de Informática)

Time Series Exercises

Implement the following models to learn the described time series for Problem 1 and 2:

- An LSTM model, such as described in this tutorial.
- A focused time-lagged feedforward network (tutorial).

For both of them, use a filter (time delay) of size 12.

Observe the evolution of their learning process and compare their performances.

Compare the performances by observing the mean squared error loss in the following manner:

i) Train with the first 2400 data points and test with data points 2401 to 2500, to observe the burn-in effect.

ii) Train from data points 2401 to 4900 and test with data points 4901 to 5000.

Problem 1 *

Use as a time series a sinusoidal function with 100 periods and 50 points per period, with:

i) no noise, clean.

ii) with noise by adding a Gaussian $\mathcal{N}(0, 0.05)$.

Problem 2 *

Use as a time series the output of the following autoregression model:

$$X_t = \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \alpha_3 X_{t-3} + U$$

where,

$$\alpha_1 = 0.6,\ \alpha_2 = -0.54,\ \alpha_3 = -0.44,\ U \sim \mathcal{N}(0, 0.01)$$

Generate a time series with 5000 data points, with the initial data points being $[5, 6, 3]$.

Note: You might require training with more epochs than regularly. Try with a higher number such as 50 epochs.