

TP RL and TS forecasting

Marco Silva

Cours ISMIN 3A ITS

December, 2024

This TP focus on the practical aspects of Reinforcement learning and Time series forecasting.

During the course, several techniques were presented in order of utility and complexity. Here, you will have to apply this knowledge on different dataset.

Time Series forecasting

1. Prepare the data

- Load the "TimeSeriesForecasting.csv " file. It contains three named columns and 24 unnamed ones (Column 1 to 24). The time index is called time, whereas the variable to predict is called targets. The column forecasted targets are predictions made by the the industrial engineers against whom you will compare your predictions.
- Perform all the necessary data analysis and cleaning on your dataset to make it ready for modeling an prediction.
- Split the data into training (75%) and test (25%) data (data is ordered, be careful how you split it).

2. Analyze your time series

3. Start predicting:

- Smoothing techniques: Use moving average (MA) and exponential smoothing (ES) to predict your targets.

-Discuss your results.

- AutoRegressive Models: Use the AutoRegressive (AR), and AutoRegressive with Integrated Moving Average (ARIMA) models to predict your targets.

- These models have a Look back parameter. Create a function to reshape your data according to a look back parameter (Default =1).
- Train and test your model.
- Discuss your results.
- Use Recurrent neural networks.
 - Discuss your results.
 - Make use of feature transformation and reduction techniques to enhance performance of the method if needed
- Compare performance and approaches among all different methods used.

Reinforcement Learning

1. Reinforcement learning : Deep Q Network (DQN)

- Implement the basic DQN algorithm. You'll implement an update for the Q-network, a target network.
- Debug your DQN implementation on CartPole-v1. It should reach reward of nearly 500 within a few thousand steps.
- Varie the learning rate (ex : variations around 0.05). What happens to (a) the predicted Q-values, and (b) the critic error?

Work to be done

- The rendering of this TP will be a Jupyter Notebook in the form (name_firstname.ipynb).
- Send work to marco.costasilva@emse.fr no further than 20th January 2025 to be evaluated.
- Do not hesitate to try different parameters (and hyperparameters). You'll be evaluated in part on the performance of your models. So, tune them well.
- The discussion you make of your results must be documented into your report.
- The report (Jupyter file) should be structured, have an easily readable code with explanatory comments. It also should contain markdown cells explaining and discussing the steps you're undertaking.
- In every training and test you should plot the targets and prediction