

On Deep Learning

Practical Session

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Outline

- Remarks on previous sessions
- Introduction to TensorFlow
- Computational graph: tensors and operations
- Implementing neural networks in Python with TensorFlow:
 - Time Series Classification
 - Time Series Forecasting
 - Fraud Detection

When should we use deep learning?

- For tackling **complex** problems
- We have **lots** of data available
- Highly **scalable** solutions
- **High-dimensional** and **non-linear** data: vision, speech, text, ...
- Model **performance** is crucial

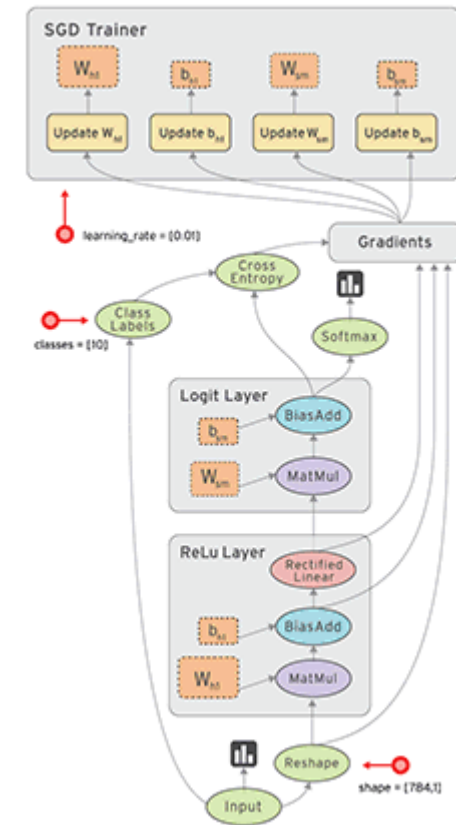
What is TensorFlow?

- Machine learning framework
- Computes gradients
- Developed by Google Brain for internal use
- Open-sourced in 2015
- Widely used in research and industry
- Allows deployment in diverse platforms (CPUs, GPUs, and TPUs)



Computational Graph

- Numeric computation is represented as a **graph**
- Nodes are **operations**
- Edges are **tensors** (multi-dimensional arrays)



Colab Environment

- Similar to Jupyter Notebooks
- Runs online in Google servers
- Free
- GPU and TPU support up to 12h in row
(Tesla K80 GPU, 12GB of RAM)



Let's get started!

Code available on Github 

github.com/jpcpereira/pdeng__tutorial_deep_learning

Fraud Detection

Using autoencoders **UNSUPERVISED**

`fraud_detection.ipynb`



Open in Colab

Fraud Detection

[fraud_detection.ipynb](#)



Time Series Classification

Using Recurrent Neural Networks **SUPERVISED**

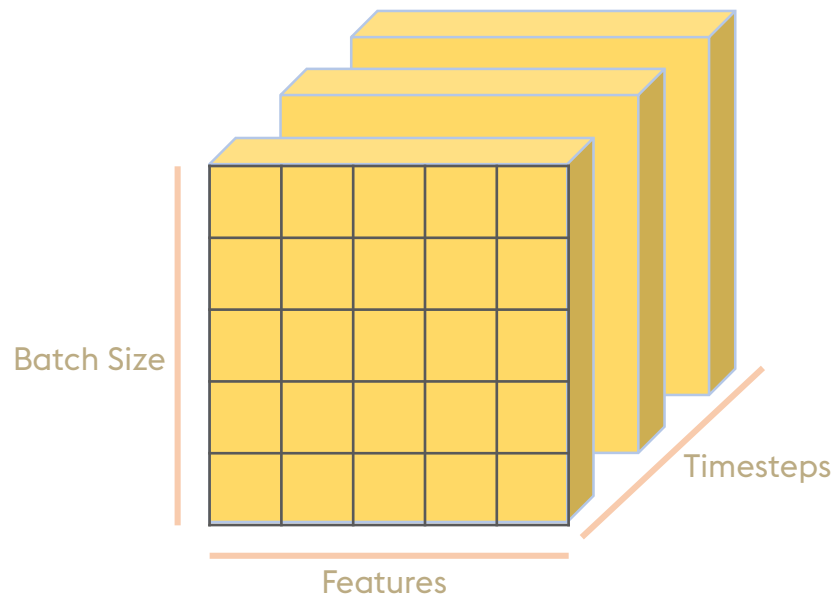
`time_series_classification.ipynb` • •



Open in Colab

Training RNNs in TensorFlow

Data Format



training_data is a tensor with shape:
(BATCH_SIZE, TIMESTEPS, DIMENSIONS)



Time Series Forecasting

Using Recurrent Neural Networks (Supervised)

`time_series_forecasting.ipynb`



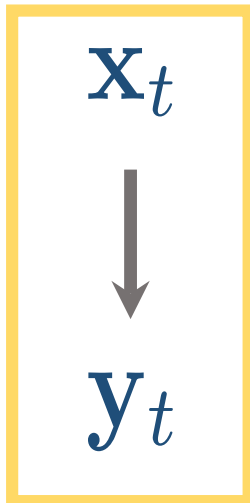
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Task

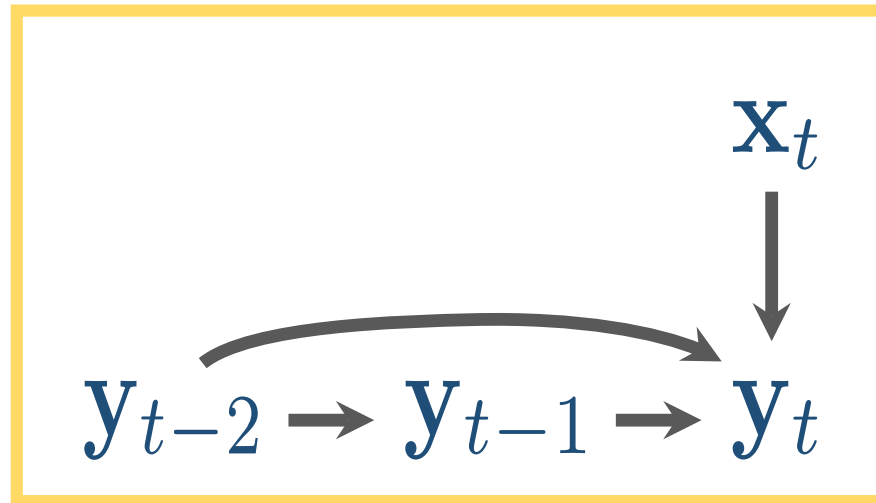
- Time series forecasting can be seen as a **regression task**
- Very often the **order** of the observations matter.
- Let's use a Recurrent Neural Network (RNN)!

Time Series Forecasting Models

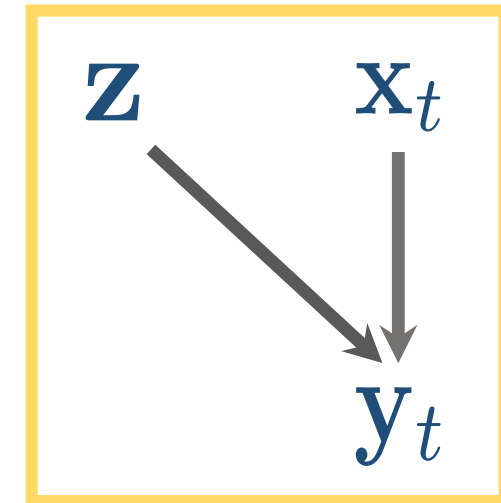
Features
(exogenous variables)



Autoregressive



Latent Variables



RNN References

TensorFlow 2.0

Tweets by Francois Chollet (inventor of Keras)

<https://twitter.com/fchollet/status/1105139360226140160>

Questions?

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Thank you for your attention!