Artificial Neural Networks (Gerstner). Laboratory for week 2

Week 2: Setup, XOR

0. Setting up

Setup your computer so that you can run Keras in a jupyter notebook.

The requirements are

1. Python 3

2. Jupyter Notebook

3. Tensorflow

4. Keras

You can either install Keras on your machine (using pip for example) or use the following procedure. If you are a Windows user, we recommend to setup a Linux partition on your machine.

1. Install Anaconda (or Miniconda)

2. Install Jupyter Notebook

3. Create a conda environment

   ```
   $ conda create −n cs456env
   ```

4. Activate the environment

   ```
   $ source activate cs456env
   ```

5. Install Tensorflow

   ```
   $ conda install −c conda−forge tensorflow
   ```

6. Install Keras

   ```
   $ conda install −c conda−forge keras
   ```

7. Add python and ipykernel in the virtual environement

   ```
   $ pip install ipykernel
   $ python −m ipykernel install −−user −−name=cs456env
   ```

8. Open Jupyter Notebook

   ```
   $ cd working dir
   $ jupyter notebook
   ```

9. Create a new notebook with the cs456env kernel selected

10. Check that Keras is installed

    ```
    $ import keras
    ```

1. XOR t For this exercise, you will implement an ANN that model an XOR gate[1]. This exercise will allow you to get use to symbolic programming and the Keras frontend.
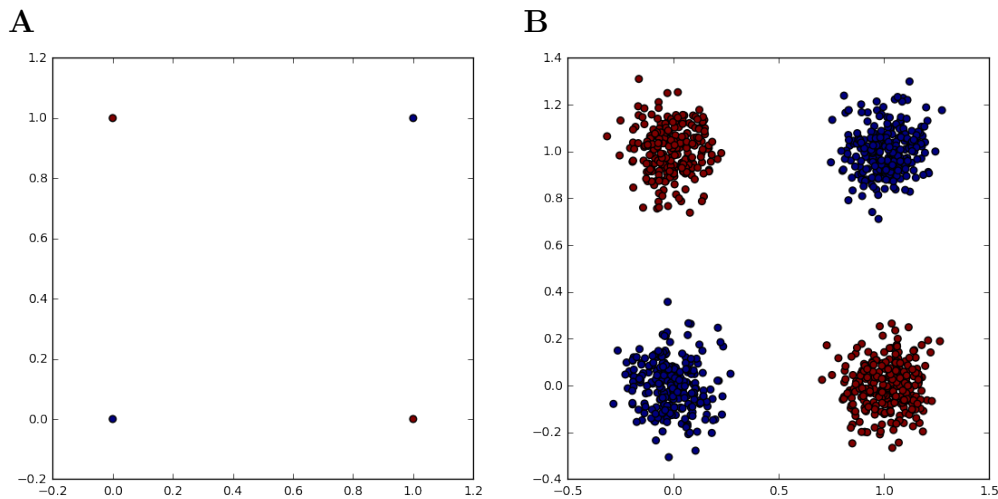
A

B

Figure 1: **XOR classification task.** Graphical visualization of the XOR problem. **A** XOR problem without noise $\sigma = 0$. **B** XOR problem with Gaussian noise $\sigma = 0.1$.

(a) Read and follow a Keras tutorial on the XOR problem[2]

(b) Augment the XOR problem with noisy data as in Figure 1. Try several combinations of architecture, optimizer, and activation functions to achieve good performances. Report the network performances (loss and accuracy) in a table.

Hint: For robustness of your parameter search, use split sets (training, validation, testing) and cross validation.

(c) Plot the learning curves (loss and accuracy) and visualize the data and network predictions. Plot the separating surface.

Hint: Uniformly sample the input space to determine the separating surface.

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[1]https://en.wikipedia.org/wiki/XOR_gate
[2]https://goo.gl/pUKAYL