Electricity Price Forecasting based on Regression Tree Models

Contents

1 Introduction to Neural Networks

Neural Networks (NN) are a mathematical construct inspired by the connection of neurons in nature. It consists of an input and output layer with an arbitrary amount of hidden layers between them. Each layer consits of a numer of neurons (nodes) with the number of nodes in the in-/output layers corresponding to the dimensions of the in-/output.

Each neuron recieves the output of all layers in the previous layers, except for the input layer, which recieves the components of the input.

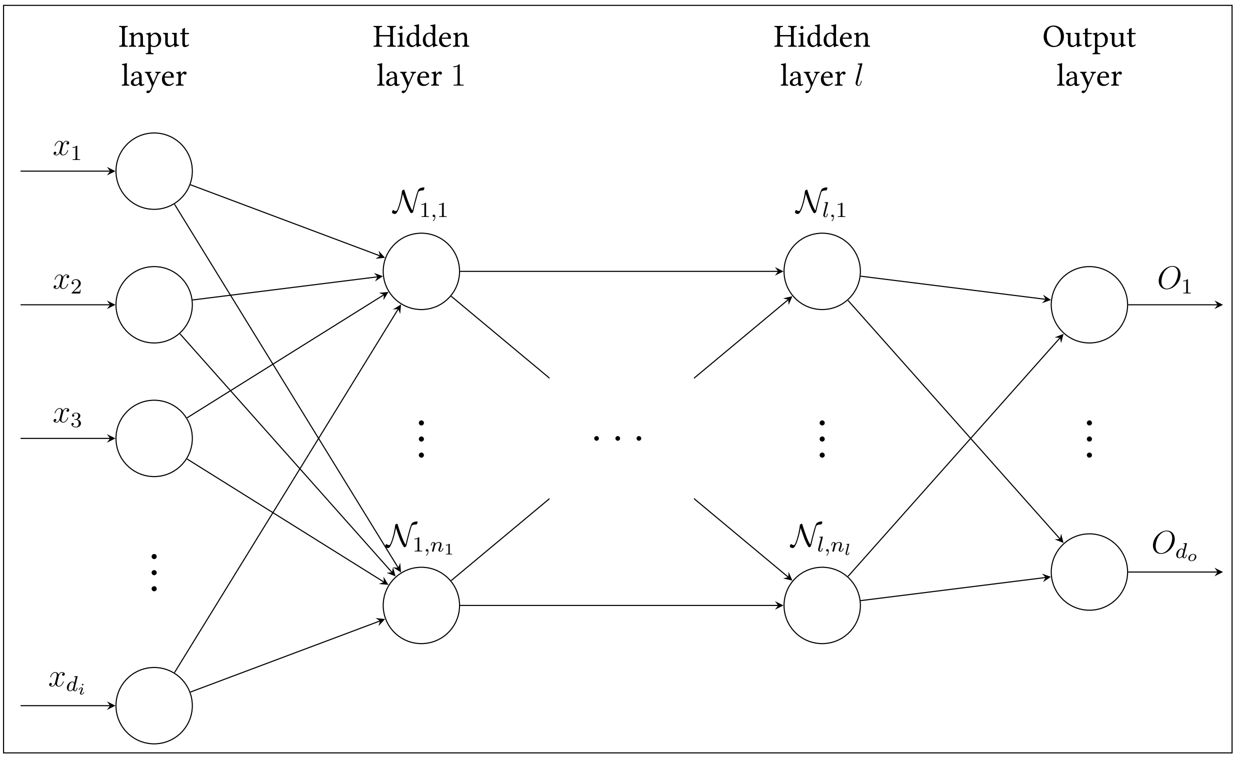
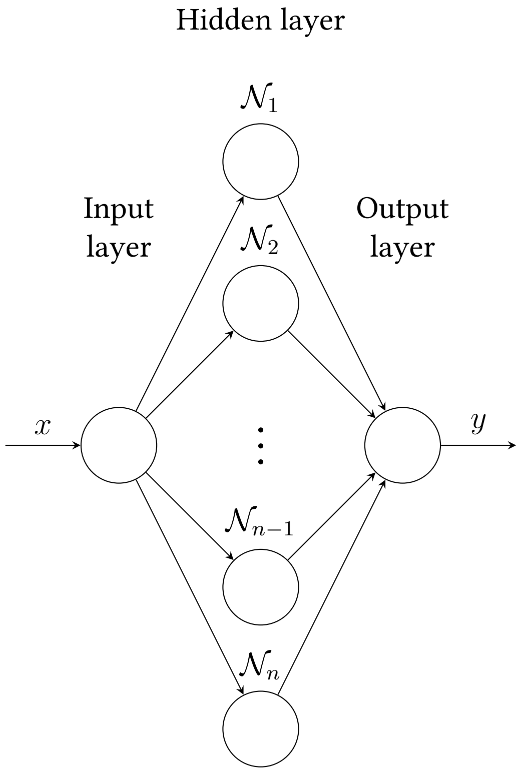


Figure 1.1: test


Hidden layer
$\mathcal{N}_1$
Input layer
$\mathcal{N}_2$
Output layer
x
y
$\mathcal{N}_{n-1}$
$\mathcal{N}_n$

With the following Theorem we will have an explicit desrctiption for the limes of RN as the amount of nodes is increased.

Theorem 1.1 (Ridge weight penaltiy corresponds to adapted spline)**.** *For arbitrary training data* $(x_i^{train}, y_i^{train})$ *it holds*

$$\mathbb{P}\text{-}\lim_{n\to\infty} \left\| \mathcal{RN}^{*,\tilde{\lambda}} - f_{g,\pm}^{*,\tilde{\lambda}} \right\|_{W^{1,\infty}(K)} = 0.$$

With

$$\begin{aligned} \tilde{\lambda} &:= \lambda n g(0), \\ g(x) &:= g_\xi(x)\mathbb{E}\left[v_k^2 | \xi_k = x\right], \forall x \in \mathbb{R} \end{aligned}$$

and $RN^{*,\tilde{\lambda}}$, $f_{g,\pm}^{*,\tilde{\lambda}}$ *as defined in ??? and ??? respectively.*

In order to proof Theo 1.1 we need to proof a number of auxilary Lemmata first.