NIO

Exercise 09: MLP

Duc Duy Pham, M.Sc.

Raum: BC 410
Tel.: 0203-379-3734
Email: duc.duy.pham@uni-due.de

Content

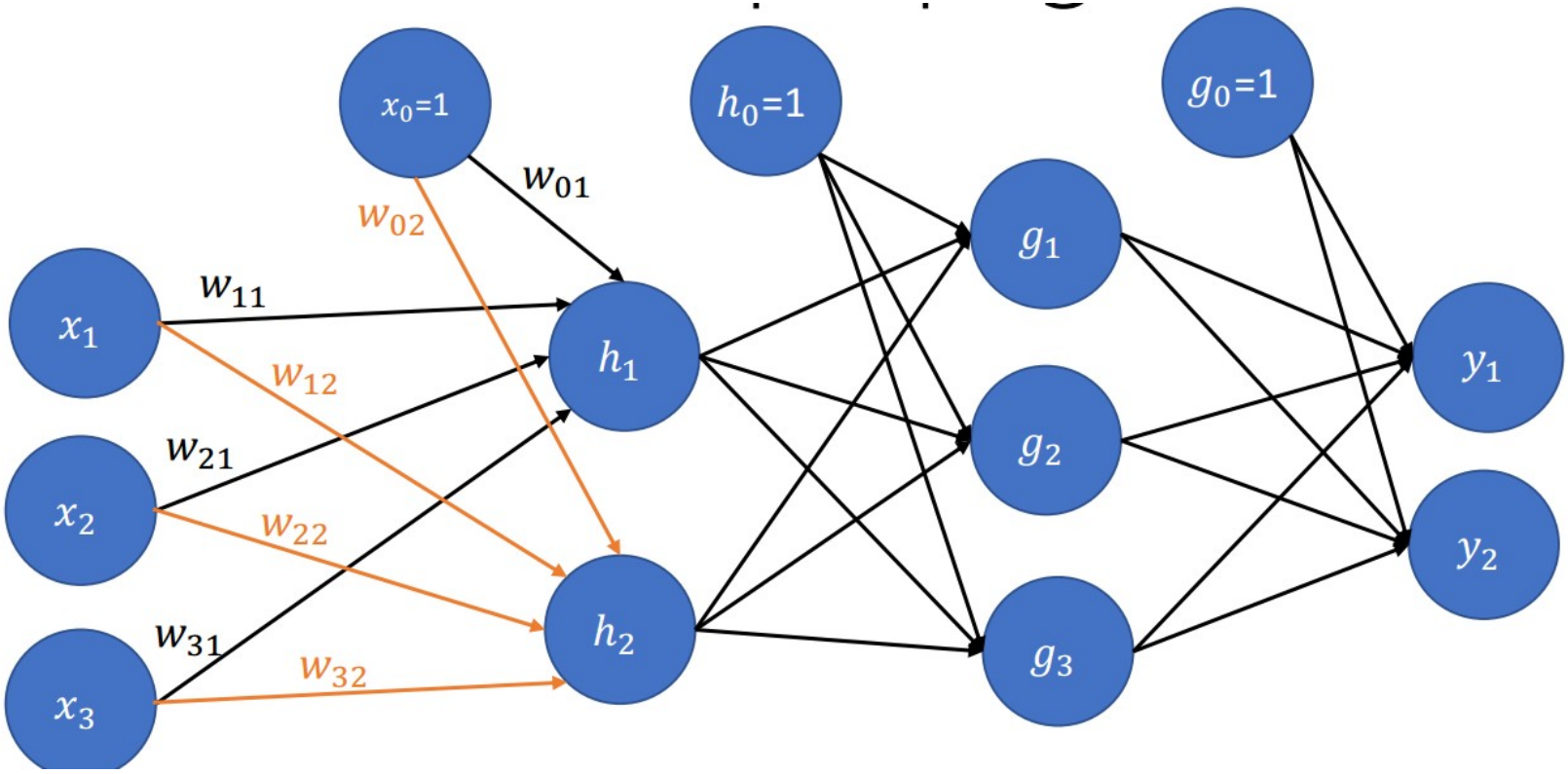
- Revision Practical Tasks (Already uploaded)
- **Revision Lecture (MLP)**
- New Task (Already uploaded)

Revision

- What are the trainable parameters of a MLP?

Revision

- Given a 3-Layer MLP with K input neurons and L, M, N neurons (units) in the other layers respectively, how many trainable parameters, does this MLP have?


x_0=1
h_0=1
g_0=1
w_{01}
w_{02}
w_{11}
w_{12}
w_{21}
w_{22}
w_{31}
w_{32}
x_1
x_2
x_3
h_1
h_2
g_1
g_2
g_3
y_1
y_2

Revision of lecture

- What statements regarding Backpropagation are true?
  1) Backpropagation is the same as gradient descent
  2) Backpropagation is used to establish gradient descent
  3) Backpropagation is a universal optimization method
  4) Backpropagation is used to update the weights

Revision of lecture

- What are the 3 main steps for Backpropagation Learning?

Revision of lecture

- What does the following assignment (from the lecture) stand for?

$$w_{l,i,j}^{t+1} := w_{l,i,j}^{t} - \mu \left. \frac{\partial D(w)}{\partial w_{l,i,j}} \right|_{w_{l,i,j}^{t}}$$

Revision of lecture

- Why not only propagate „forward“?

$$\frac{\partial d^m(w)}{\partial w_{\ell,i,j}} = \frac{\partial d^m(w)}{\partial y_{\ell,j}} \cdot \frac{\partial y_{\ell,j}}{\partial w_{\ell,i,j}}$$

$$\frac{\partial d^m(w)}{\partial y_{\ell,j}} = \sum_{n=1}^{N_{\ell+1}} \frac{\partial d^m(w)}{\partial y_{\ell+1,n}} \cdot \frac{\partial y_{\ell+1,n}}{\partial y_{\ell,j}}$$

$$= \sum_{n=1}^{N_{\ell+1}} \frac{\partial d^m(w)}{\partial y_{\ell+1,n}} \cdot \frac{\partial}{\partial y_{\ell,j}} \left[f_\sigma \left(\sum_{q=0}^{N_\ell} w_{\ell+1,q,n} \cdot y_{\ell,q} \right) \right]$$

$$= \sum_{n=1}^{N_{\ell+1}} \frac{\partial d^m(w)}{\partial y_{\ell+1,n}} f'_\sigma(u_{\ell+1,n}) \frac{\partial}{\partial y_{\ell,j}} u_{\ell+1,n}$$

$$= \sum_{n=1}^{N_{\ell+1}} \frac{\partial d^m(w)}{\partial y_{\ell+1,n}} y_{\ell+1,n}(1 - y_{\ell+1,n}) \cdot w_{\ell+1,j,n}$$

Training MLPs

- What is Batch-Learning?

Training MLPs

- What are epochs?

Training MLPs

- How can we prevent overfitting/choose hyperparameters?

Training MLPs

- MLP topology for classification task?

Content

- Revision Practical Tasks (Already uploaded)
- Revision Lecture (MLP)
- **New Task (Already uploaded)**

Jupyter Notebook

- Implement a Multi Layer Perceptron in tensorflow