



# Unconventional computation and algorithms

## Laboratory protocol



**Topic:** Artificial neural networks – multilayer ANN with backpropagation

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**Note:** *please remember that laboratory examples and studies are designed for students that regularly visit NAVY lectures. Laboratory staff is for you there to help you with programming and examples collection, but not for teaching of materials, that is done on lectures!!!*

### Problem definition:

Create inside your framework for artificial neural networks (ANN) a

1. Multilayer ANN, minimum 2 neurons in 2 learning layers.
2. Create backpropagation learning algorithm.
3. Use XOR problem training set
4. Learn your ANN.
5. Record learning in graph as dependence of global error on epoch.
6. Made a conclusion.

### Nápověda:

Delta pro výstupní vrstvu ...  $\delta_i^L = (y_i^L - d)y_i^L(1 - y_i^L)$

Delta pro ostatní skryté vrstvy ...  $\delta_i^{L-i} = y_i^{L-i}(1 - y_i^{L-i}) \sum_{k=1}^n w_{ki}^L \delta_k^L$

Změna váhy u vstupní vrstvy ...  $\Delta w_{ij}^L(t) = \eta \delta_i^L(t) y_j^{L-1}(t)$

Změna váhy u ostatních vrstev ...  $\Delta w_{ij}^{L-i}(t) = \eta \delta_i^{L-i}(t) y_j^{L-(i+1)}(t)$

Nová váha ...  $w_{ij}^L(t+1) = w_{ij}^L(t) + \Delta w_{ij}^L(t)$

### Solution design:

### Results and facts:

### Conclusion:

