

How to prepare for the final exam?

- Exam on Friday, 2nd June, 14:00-17:00.
- Most likely 30-50 multiple-choice questions.
- Your contribution to formulating these questions is most welcome! (mail me your ideas before 27th May).
- “Question Hour” on Wednesday, 31st May, 11:15-??
- Get some ideas from the 2016 requirements & exam (3 bottom files in Content -> 2015-2016 -> Slides)

NN 1: Introduction



- History of “classical” NNs: slides 16-19
- Early applications: slides 24-27 (NetTalk and Alvin)
- Deep Learning Revolution: slides 29-34

NN 2: Statistical Pattern Recognition



- Slides 3-23
 - Bayes Theorem
 - Optimal Decision Boundary
 - Risk Minimization
- Regularization (slides 37-38; example with polynomial overfitting)

NN 3: Density Estimation



- Slides 1-15:
 - Parametric models
 - Maximum Likelihood Principle
 - The EM Algorithm
- Slides 22-23 plus Assignment 0+++
 - Histograms
 - Curse of Dimensionality

NN 4: Linear Models

- Slides 1-36:
 - Linear separability
 - Perceptron Learning Algorithm
 - Gallant's Pocket Algorithm
 - Cover's Theorem
 - Adaline
 - Logistic Regression
 - Stochastic Gradient Descent
- Slides 43-45
 - Multi-class linear separability
 - Multi-class Perceptron (slide 44)
 - (*skip SVM's*)

NN 5: MLP and Backpropagation

- Slides 1-30:
 - MLP
 - Expressive Power of MLP
 - Backpropagation Algorithm
 - Adaptive Gradient Descent
 - *(skip Conjugate Gradients and other tricks)*

NN 6: Practical Aspects



- Slides 1-6: Alternative Error Measures
 - SSE (regression tasks)
 - Cross Entropy (binary classification)
 - Cross Entropy + SoftMax activation (multi-class classification)
- Slides 8-28: Various Heuristics

NN 7: Convolutional Networks I

- All slides
 - convolution
 - weights sharing
 - subsampling
 - pooling
 - dropout
 - ReLU's
- Details of the LeNet5 network: be able to count trainable weights between the layers!
- Do the “Homework” (slide 28)

NN 8: Introduction to Keras and A2

- You are supposed to know (roughly) various applications of DNN listed in the “Keras Examples” repository:

<https://github.com/fchollet/keras/tree/master/examples>

NN 9: Convolutional Networks II

- Slides 7-9, 6
 - Momentum
 - Nesterov Momentum
- Details of the ImageNet network
(Slides 28-40 of DeepLearning.pdf)
 - how 3-D inputs (RGB images) are treated?
 - why “two networks”?
 - data augmentation
 - be able to count trainable weights between the layers

NN 10, 11: Recurrent Neural Networks

- All 4 parts of the tutorial of Denny Britz:
<http://www.wildml.com/2015/09/recurrent-neural-networks-tutorial-part-1-introduction-to-rnns/>
 - Recurrent Neural Networks (plain)
 - LSTM (Long Short Term Memory) networks
 - GRU (Gated Recurrent Unit) networks
 - the leading example of text generation
 - Be able to explain the architecture of LSTM and GRU layers
 - Be able to calculate the number of trainable parameters
- the Keras example of time-series modeling:
https://github.com/fchollet/keras/blob/master/examples/stateful_lstm.py

NN 12: RBMs and Deep Belief Networks

- Slides 1-28
 - Restricted Boltzmann Machine model
 - Energy, Generative Model, Likelihood
 - Contrastive Divergence Algorithm
 - Deep Belief Networks
 - AutoEncoders,
 - Denoising AutoEncoders
- Pages 9-27 of the MSc Thesis R.B. Palm
- An application of RBMs to the Netflix Challenge