# Computer Vision Prüfungsstoff

## Basics of Neuronal Networks

## Layers

1. Difference between convolutional and fully connected layers considering weight sharing/number of parameters/…?
2. Why do we use a convolutional layer on an image instead of a fully connected layer?
3. How does a convolution operation in a specific configuration (given feature map configuration like batch size x number of channels x width x height with specific values) work?
4. What would the output of convolution with kernel size and kernel amount and stride look like?
5. What is the expected output of the convolution layer?
6. What is the expected output of a convolutional transpose?
7. Convolutional transform 🡪 easy example
8. What is the idea and purpose of Batch-Normalization? (8.7.1)

## Loss functions

1. Cross entropy (binary cross entropy)?
2. Mean squared error (mean absolute error)?
3. When would you use the one over the other?

## Optimization

1. What is standard gradient descent (Update rule & idea of GD)?
2. What’s the problem with standard gradient descent? Why do we not use standard GD?
3. What’s the difference between standard stochastic GD and Mini-batch stochastic GD?
4. What is stochastic gradient descent (Update rule & idea)?
5. What is Mini-Batch SGD (Update rule & idea) ?
6. What are potential alternatives (ADAGRAM adaptive gradients; momentum)?

## Backpropagation

1. What’s the idea of Backpropagation?
2. What is the advantage in terms of implementation?
3. Compute Derivative of Loss with respect to Theta (parameter)?
4. Simple example   
   construct rectified quadratic unit 🡪 softplus activation function log(1-exp(x))
5. Given forward pass 🡪 compute derivative with respect to the parameters
6. Basics of backpropagation, chain rule probability, what is required to implement a new layer,
7. Why is it enough to have derivative w.r.t. input (recursive relationship between the gradient of two layers 🡪 two main equations)?

# Auto Encoders

1. What are Auto-Encoding architectures?
2. What happens, if we have only linear Layers (no activation)?
3. What are denoising Auto-Encoders?
4. How would you design a convolutional auto-encoder for a specific problem?
5. What do we sue AE for?

# Variational Auto – Encoders

1. Generative modeling with VAE
2. What is a VAE, what is the main idea behind it?
3. What is a variational approximation (simplest case) and to what does it lead in the standard VAE approach that we discussed?
4. What does the architecture look like?
5. How do we get the loss?
6. Why do I need this and what can I do with it?
7. What is the idea and the end result?

# Semantic Segmentation

1. How do you do Segmentation?
2. What’s the difference between segmentation and classification?
3. What does a standard segmentation architecture look like?