

1. **MLP**
2. **Function composition, chain rule**, abstract Computational Graphs, **autodifferentiation**
3. ML frameworks with pros/cons, usage
4. **ConvNets**, training and preprocess **tips & tricks**
5. ImageNet winner architectures and **embedding** them into real world applications
6. ConvNet visualization, adversarial samples
7. NLP basics, language model, recurrent networks
8. CharRNN, Seq2Seq model **training, embedding, comparison**
9. attention mechanism, Word embedding and ConvNet in NLP
10. Semi-supervised, reinforcement learning, DQN
11. OpenAI Atari gym training, **playing against the AI**
12. Generative models, **GAN, stability, measure**
13. **DCGAN and infoGAN**,
14. **WGAN, Improved WGAN**

| Topic | Reference for content                                                                                                                                                                                                                                                                                                                                                                                          | Goal                                                                                       |
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| 1     | <a href="https://goo.gl/YxCBHe">https://goo.gl/YxCBHe</a> (interactive app)                                                                                                                                                                                                                                                                                                                                    | TF-playground from linear separation -> to non-linear cases (MLP)                          |
| 1     | <a href="http://cs231n.github.io/">http://cs231n.github.io/</a> (lab - Stanford)<br><a href="http://cs231n.github.io/python-numpy-tutorial/">http://cs231n.github.io/python-numpy-tutorial/</a><br><a href="http://cs231n.github.io/ipython-tutorial/">http://cs231n.github.io/ipython-tutorial/</a>                                                                                                           | If we want to carry out experiments we have to know about our instruments                  |
| 1     | <a href="https://goo.gl/ba8dc5">https://goo.gl/ba8dc5</a> (slide - Stanford)<br><a href="https://goo.gl/7exfA8">https://goo.gl/7exfA8</a> (slides - MIT)                                                                                                                                                                                                                                                       | MLP practical applications, visualize Gradient Descent and weight update                   |
| 1, 2  | <a href="https://goo.gl/MbfGUH">https://goo.gl/MbfGUH</a> (blog)                                                                                                                                                                                                                                                                                                                                               | Forward backward understanding / Computational Graph basics                                |
| 2     | <a href="https://goo.gl/q6aL6u">https://goo.gl/q6aL6u</a> (distill - interactive demo)                                                                                                                                                                                                                                                                                                                         | Interactive tool for Gradient Descent visualization - rather theoretical approach          |
| 2, 3  | <a href="http://cs231n.github.io/">http://cs231n.github.io/</a> (lab - Stanford)<br>MODULE 1 - first half<br><a href="http://cs231n.github.io/classification/">http://cs231n.github.io/classification/</a><br><a href="http://cs231n.github.io/linear-classify/">http://cs231n.github.io/linear-classify/</a><br><a href="http://cs231n.github.io/optimization-1/">http://cs231n.github.io/optimization-1/</a> | Computational Graphs in practice                                                           |
| 3     | <a href="http://cs231n.github.io/">http://cs231n.github.io/</a> (lab - Stanford)<br>MODULE 1 - second half<br><a href="http://cs231n.github.io/neural-networks-1/">http://cs231n.github.io/neural-networks-1/</a><br><a href="http://cs231n.github.io/neural-networks-2/">http://cs231n.github.io/neural-networks-2/</a>                                                                                       | General Steps of experiments:<br>Data preparation<br>Architecture setup<br>Loss definition |

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|      | <a href="http://cs231n.github.io/neural-networks-3/">http://cs231n.github.io/neural-networks-3/</a>                                                                                      | Training and evaluation                                                                           |
| 4    | <a href="https://goo.gl/hK1JTv">https://goo.gl/hK1JTv</a> (interactive app)                                                                                                              | Caffe Online Demo - pixel-wise segmentation                                                       |
| 4    | <a href="https://goo.gl/E8VvHB">https://goo.gl/E8VvHB</a> (interaktív alkalmazás)                                                                                                        | Online visualization with javascript, very effective for demonstration purposes                   |
| 4    | <a href="https://goo.gl/STfEAp">https://goo.gl/STfEAp</a> (slides - MIT)<br><a href="http://cs231n.stanford.edu/syllabus.html">http://cs231n.stanford.edu/syllabus.html</a><br>Lecture 5 | Basics of ConvNets, how they work, what are their pros/cons                                       |
| 4    | <a href="https://goo.gl/SwzivH">https://goo.gl/SwzivH</a> (blog - kiegészítő)<br>From beginning to Visualization                                                                         | Conv network function:<br>Detailed description supported by interesting and simple examples       |
| 3, 4 | <a href="https://goo.gl/mgp8uu">https://goo.gl/mgp8uu</a><br>(slides - Stanford)                                                                                                         | <b>Deep Learning Software</b><br>Caffe, Torch, Theano, TensorFlow, Keras, PyTorch, etc            |
| 4    | <a href="http://cs231n.stanford.edu/syllabus.html">http://cs231n.stanford.edu/syllabus.html</a><br>Lecture 9                                                                             | Most popular architectures:<br>AlexNet, VGG, GoogLeNet, ResNet                                    |
| 4, 5 | <a href="https://goo.gl/wGn8vR">https://goo.gl/wGn8vR</a> (slides - MIT)                                                                                                                 | Multimodal processes                                                                              |
| 4, 5 | <a href="https://goo.gl/n6V8GV">https://goo.gl/n6V8GV</a> (slides - Stanford)                                                                                                            | Detection & Segmentation                                                                          |
| 5    | <a href="https://youtu.be/VOC3huqHrss">https://youtu.be/VOC3huqHrss</a> (video - demo)<br>Akár mehet live video is az Oktogon-ról                                                        | YOLO network demo - live video recognition (with bounding boxes)                                  |
| 5    | <a href="https://goo.gl/xn383Y">https://goo.gl/xn383Y</a> (slides - Stanford)                                                                                                            | <b>Real-World Use</b><br>Convolution algorithms,<br>CPU / GPU<br>Low-precision, model compression |
| 6    | <a href="http://yosinski.com/deepvis">http://yosinski.com/deepvis</a> (workshop)<br><a href="https://goo.gl/ANXc5o">https://goo.gl/ANXc5o</a> (distill)                                  | Guided backprop / deconvolution demonstration (live)                                              |
| 6    | <a href="https://goo.gl/zjGzNf">https://goo.gl/zjGzNf</a> (slides - Stanford)                                                                                                            | Tricking neural networks,<br>Adversarial samples                                                  |
| 6    | <a href="https://goo.gl/5Uakhv">https://goo.gl/5Uakhv</a> (blog)                                                                                                                         | Neural Style Transfer, (Live Demo)                                                                |
| 6    | <a href="https://goo.gl/sGWcWG">https://goo.gl/sGWcWG</a> (C. Olah blog)                                                                                                                 | Deep Dream                                                                                        |
| 7    | <a href="https://goo.gl/NhPWwF">https://goo.gl/NhPWwF</a> (slides - MIT)                                                                                                                 | Intro to sequence modeling                                                                        |

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| 7, 8   | <a href="https://goo.gl/xAf29w">https://goo.gl/xAf29w</a> (blog)                                                                                                        | <b>Karpathy: CharRNN -&gt; classic</b>                                                                                  |
| 8, 9   | <a href="https://goo.gl/QqSRn1">https://goo.gl/QqSRn1</a> (blog)                                                                                                        | Seq2Seq model                                                                                                           |
| 9      | <a href="https://goo.gl/PdEG9s">https://goo.gl/PdEG9s</a> (distill - Interaktív Demo)                                                                                   | RNN variants, attention mechanism visualization                                                                         |
| 9      | <a href="http://www.wildml.com/">http://www.wildml.com/</a> (blog)                                                                                                      | Britz: Simple real world application - word embedding, chatbots and sentiment analysis                                  |
| 10     | <a href="https://goo.gl/NJ1c1r">https://goo.gl/NJ1c1r</a> (blog)                                                                                                        | Karpathy Intro to Reinforcement Learning - Policy Gradient, Q - Learning<br><br>Pong AI for atari GYM                   |
| 10, 11 | <a href="https://goo.gl/Xqw3eN">https://goo.gl/Xqw3eN</a> (blog)                                                                                                        | <b>Comprehensive list of RL from beginners to advanced</b>                                                              |
| 12     | <a href="https://goo.gl/GH7Kh7">https://goo.gl/GH7Kh7</a> (Article - OpenAI)                                                                                            | Theoretical background, motivation                                                                                      |
| 12     | <a href="https://goo.gl/pQieGT">https://goo.gl/pQieGT</a> (slides - NIPS)                                                                                               | Ian G. : GAN intro theory / alternatives / applications                                                                 |
| 12     | <a href="https://goo.gl/AWkyzh">https://goo.gl/AWkyzh</a> (demo - interaktív)                                                                                           | GAN 1d example                                                                                                          |
| 13     | <a href="https://goo.gl/APBLco">https://goo.gl/APBLco</a> (slides)                                                                                                      | GAN Applications                                                                                                        |
| 13     | <a href="https://goo.gl/FR7Ccz">https://goo.gl/FR7Ccz</a> (demo - video)                                                                                                | <a href="#">iGAN: Interactive Image Generation</a>                                                                      |
| 13     | <a href="https://goo.gl/SKq4fM">https://goo.gl/SKq4fM</a> (demo - static)<br><a href="https://goo.gl/VeJ1Ws">https://goo.gl/VeJ1Ws</a> (blog)                           | CyclicGAN - application - <b>Unpaired Image-to-Image Translation</b>                                                    |
| 14     | <a href="https://arxiv.org/abs/1701.07875">https://arxiv.org/abs/1701.07875</a> (original)<br><a href="https://goo.gl/WvgBhN">https://goo.gl/WvgBhN</a> (dropbox paper) | WGAN: there are theoretical innovations as well (not just practical)! - great step forward in 2017                      |
| 14     | <a href="https://arxiv.org/abs/1704.00028">https://arxiv.org/abs/1704.00028</a> (original)                                                                              | WGAN improvement on loss -> Lipschitz constraint with gradient of gradients<br><br>(makes good use of calculus courses) |
| 14     | <a href="https://goo.gl/RZbcvL">https://goo.gl/RZbcvL</a> (demo - notebook)                                                                                             | Toy 2d example for WGAN with 4                                                                                          |

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|    | <a href="https://goo.gl/7tYJoi">https://goo.gl/7tYJoi</a> (demo - notebook)                                                          | different Lipschitz constraint on multi-gaussian distribution                               |
| 14 | <a href="https://goo.gl/AbkUa7">https://goo.gl/AbkUa7</a> (blog)<br><a href="https://goo.gl/Dhwypr">https://goo.gl/Dhwypr</a> (blog) | Improved WGAN description + Semi-Improved training (alternative loss for Lipschitz penalty) |