

# Machine learning exam program

ml-mipt advanced, spring 2021

## Natural Language Processing

1. Embeddings
2. word2vec: linearity, skip-gram, negative sampling
3. Unsupervised translation approach
4. Ways to work with text data (RNN, CNN, classical approaches)
5. Attention, Self-attention approaches
6. Transformer structure
7. Machine translation metrics, quality functions
8. BERT structure, main ideas

## Reinforcement Learning

9. RL problem statement. State, Action, Reward, Environment, Action
10. Crossentropy method
11. Value function, Q-function
12. Q-learning, approximate Q-learning. DQN, bells and whistles (Experience replay, Double DQN, autocorrelation problem)
13. Policy gradient and REINFORCE algorithm
  - a. Baseline idea, A2C
14. Policy gradient applications in other domains (outside RL). How Self-Critical Sequence Training is performed? What is used as a baseline?

## Computer Vision

15. Computer Vision problem statements: classification, detection, segmentation
16. Metrics in CV: IoU, mAP
17. Main datasets: PASCAL VOC, ImageNet, COCO, OpenImages
18. R-CNN -> Fast -> Faster structure, main ideas, metrics and performance
19. Focal Loss
20. Non Maximum Suppression algorithm
21. YOLO v1 -> v3 main ideas
22. Separable convolutions
23. MobileNet v1, v2 blocks
24. Upsampling methods: poolings, transposed convolutions
25. FCN, DeconvNet, SegNet
26. U-Net
27. Mask R-CNN
28. Neural style transfer technique
29. Model compression methods (distillation and quantization concepts)
30. KL divergence. Relations to crossentropy

31. Variational Autoencoders: structure, loss function, training process

32. Generative Adversarial Networks: structure, loss function, training process

## Theoretical minimum

1. KL-divergence
2. Log derivative trick
3. Metrics in CV: IoU, mAP
4. Value function, Q-function
5. Focal Loss
6. Attention mechanism (motivation, main idea, Bahdanau & Luong attention scores)