March, 2023

Questions for exam "Self-supervised learning" in HSE

1. Definition and purpose of Self-supervised learning. Differences from other training paradigms. Example of three SSL tasks from different domains.
2. Classical pretext tasks: exemplar, context prediction, inpainting, puzzles, colorization.
3. Fine-tuning vs linear probing vs combination. What is better and when?
4. Mutual information, entropy, joint entropy, conditional entropy. Main properties (with proofs).
5. General definition of contrastive learning, contrastive loss (InfoNCE). Mutual information lower bound (formula without proof).
6. Contrastive learning with negative examples: SimCLR, MoCo.
7. Contrastive learning without negative examples: BYOL, SimSiam.
8. Contrastive learning and clustering: DeepCluster, SwAV.
9. Applications of contrastive loss: Dense CL, Supervised CL.
10. Transformers for images: ViT, DEiT.
11. Self-supervised transformers: DINO.
12. Masked image modeling: BEiT, MAE, MaskFeat.
13. Improving contrastive learning for images: DiLo, LooC, NNCLR.
14. BERT: architecture, pre-training tasks. RoBERTa, ALBERT.
15. Decoder-based models: GPT, XLNet.
16. Encoder-decoder models: MASS, BART.
17. Models for source code domain with AST: code2vec, code2seq.
18. Models for source code domain without AST: CodeT5, Codex.
19. CodeBERT, GraphCodeBERT.
20. Scheme of diffusion models. Algorithm for DDPM learning. Objective function formula and its idea for DDPM.
21. Contrastive Predictive Coding (CPC).
22. Masked modeling for audio: Wav2Vec 2.0, HUBERT.
23. Augmentations for audio contrastive learning: Multi-format CL, BYOL-A.
24. Graph SSL: overview of approaches & tasks.