Advanced Machine Learning
Sample Exam Questions

General Machine Learning

1. What is the difference between supervised and unsupervised learning?
2. Inductive machine learning is often referred to as an ill-posed problem. What does this mean?
3. How will GDPR impact on the use of machine learning?
4. What is the difference in evaluation approaches for machine learning for industry and machine learning for academic research?
5. If performing a machine learning benchmark of 10 algorithms using 10 datasets what approach would you take and what statistical significance tests would you use?
6. Why are there so many different evaluation metrics (.e.g AUC, accuracy, F1 score, gain, lift, …) used in machine learning?
7. Machine learning is plagued by hyper-parameters set with magic numbers. Discuss.

Ensembles

8. Thomas Dietrich describes 3 motivations for ensemble learning, what are these?
9. What is the Bayes Optimal Classifier?
10. Your colleague has told you that she has implemented a Bayes Optimal Classifier. Should you believe her?
11. What is the difference between the bagging and boosting ensemble algorithms?
12. What is the key insight behind the gradient boosting algorithm?

Deep Learning Fundamentals

13. Deep learning is often referred to as "representation learning". Why is this?
14. What is the difference between a cost function and a loss function?
15. Describe how the dropout algorithm combats over-fitting in deep neural networks.
16. Describe the gradient descent algorithm.
17. Describe the back propagation of error algorithm.
18. What is the difference between batch and stochastic gradient descent?
19. Some say that mini-batch gradient descent mixes the best of batch and stochastic gradient descent. Discuss.
20. What are the exploding gradient and vanishing gradient problems?
21. Training deep learning models is more likely to suffer from plateaus than local minima. Discuss.

Deep Learning CNNs & RNNs

22. Why are convolutions so attractive for image processing tasks?
23. What does it mean to say that a CNN has sparse connections?
24. What does it mean to say that a CNN has shared weights?
25. People often say that a CNN is translation invariant. What does this mean?
26. Compare the gradient descent with momentum, rmsprop, and adam optimisation algorithms.
27. What does it mean to unroll an RNN?
28. What is the differences between one-to-many, many-to-one, and many-to-many RNNs?
29. Describe an application suited to each of a one-to-many, many-to-one, and many-to-many RNN?

Reinforcement Learning

30. Describe the main components of a reinforcement learning system.
31. Why is the reward only an indirect measure of an agent's performance in reinforcement learning?
32. What is the difference between a stationary and non-stationary k-armed bandit problem?
33. What is the Markov property withy regard to Markov decision processes (MDPs)
34. What is the epsilon greedy action selection policy?
35. What is the difference between off-policy learning and on-policy learning in reinforcement learning?
36. How does reinforcement learning differ from unsupervised and supervised learning?
37. How is deep learning integrated into the reinforcement learning framework in deep Q learning?