ECE601 HW01A

1. Define supervised, unsupervised, and reinforcement learning (one line for each suffices).
    1. Supervised learning is when the machine learning algorithm uses labeled data to train
    2. unsupervised is when unlabeled data is used to train the algorithm
    3. reinforcement learning is when the algorithm gets feedback on its training and uses that to fine tune the output
2. In the context of supervised learning, explain “Tunable Mapping = Bag of Mappings”.
    1. a tuneable mapping is when you have some parameters you can tune for the desired outcome, in the context of chapter 7, Tunable mapping = bag of mappings. this is referring to how one model can be used to make different outputs based on the input of tuning. like how you can have a machine that can generate pictures of dogs, but with a tweak of tuning it can generate pictures of cats instead
3. Mention a few important developments behind the recent success of machine learning.
    1. In chapter 7, there is a list of 4 big developments; Big data, computing power, better ML, AI combinations
        1. big data: with the help of more information being more widely available, much more training data can be used to make a better model
        2. computing power: with stronger computers, more complex models are more viable and can train faster and better
        3. better ML: much better algorithms have been developed to further the development of AI
        4. AI combinations: with this technique you can combine multiple ML models to be greater than the sum of their parts
4. Explain each of the following terms briefly (one or two lines suffices):
    1. Training data
        1. Training data is the data that the ML model uses to generate its algorithm
    2. Test Data
        1. Test data different than training data, this is for comparing what the ML alg. outputs vs what you want it to output, and using that information you can

reinforce the model

3. Model complexity (which can be more rigorously defined as the VC dimension.)
    1. model complexity is the number of parameters and size of training set, just like the wine tasting example, in order to make a competent model, the training data set needs to be large enough, and the ML alg needs enough parameters to be able to capture the training data efficiently
4. Overfitting
    1. This is when the ML alg. only performs well on the training data, and fails test data, very precisely tuned for only the training data
5. Underfitting
    1. This is when the ML alg. doesn't perform well on any data set and is too simple to output what you want.
6. Bias-Variance trade off
    1. Bias-Variance is just another name for the precision vs accuracy problem, high bias but low variance is very tight grouped outputs that are centered off the mark, meanwhile low bias but high variance is widespread outputs that are centered correctly at the target.
7. The slow change assumption
    1. overall the future should resemble the past so the AI has time to learn,otherwise the patterns become a lot harder to find and the training will be much more difficult, ie. doesn't change much overtime
8. The tail problem
    1. As I understand from the book, the tail problem describes the issues of edge cases that might not have been in the training data for AI such as a self driving car finding things thrown out into street, the tail end of the probability curve.
9. Cross validation
    1. This is where the testing dataset is used to validate the ML alg's performance on unseen data
10. Learning curves
    1. this phenomenon is how the ML alg improves overtime with training, usually starts fast and slowly gets better as diminishing returns comes into play
11. Fitting graphs
    1. this is a graphical representation that shows the models performance on its training and testing set, good for showing how the model improves as it trains more on the training data