

Advanced Machine Learning (Take Home – Mini Exam)

1) What is the essence of deep learning?

Ans) Deep Learning(DL) is a subset of Machine learning which is in turn a subset of Artificial Intelligence. The main essence of Deep Learning is to meaningfully transform the data. It is a multistage learning approach of a data representation. Using neural network models Deep Learning uses a number of layered representations of the input data to finally transform the input into something more useful. Each layer in the neural network model learns the input data representation and when the all the data representation results from the different layers are compared better results are obtained. The concept of deep learning is therefore similar to Rubik's cube where in successive twists in correct direction will solve the cube, similarly successive data representations learnt produce better results in DL models.

2) What makes deep learning different from other machine-learning models?

Ans) The main difference between deep learning models and machine learning models lies in the techniques used in generating the models and also their complexity. DL models use neural networks which use the concept of multistage data transformations represented as layers which learn the input and map the input data to output. Whereas, ML algorithms do this by learning from many samples that provide inputs and targets using feature engineering. DL models automatically learn and extract the features from the input data which reduces the need of feature engineering which is time consuming.

3) What are the essential components to successfully develop and deploy deep-learning models?

Ans) Following are the essential components to successfully develop and deploy a DL model:

- Proper input data which is correctly split into training , testing and validation sets.
- Clearly defining the problem and expected outputs.
- Transforming the input data into required format like tensors.
- Choosing a suitable DL model depending upon the type of data whether CNN, RNN, etc. and also defining the number of layers to be used.
- Continuously monitoring the output result and then optimizing it to improvise the model using loss functions and by adding suitable weights.
- Choosing a proper environment for the deployment of the model and also keep doing the iterative process of improvising the model by optimizing it.
- Making sure that the deployed model works fine in the real time environment all the time.

4) What are some key deep-learning architectures? Why are they needed? Compare and contrast a few use cases.

Ans) Convolution Neural Networks(CNN), Recurrent Neural Networks(RNN) AND Transformers are few key deep learning architectures. CNN are used for classifying image data like in healthcare it is used to analyze different X-ray images and depict the possible disease the patient might have been affected with. RNN are used for classifying time-series data, for instance it is used for understanding feedback of customers on a product in social media. Transformers are used in natural language processing like in chatbots where speech and text data are analyzed.

5) What limitations do you see for deep-learning models? These can be technical, managerial, legal, ethical, etc.

Ans) Main limitations of DL Models is their Data dependency. Proper input data depending upon the problem is required to obtain good results. Any bias in the sample data leads to the failure of the model therefore leading to few ethical concerns . Overfitting due to unwanted noise in the data is another major limitations of the DL models. Interpretability is another limitation often encountered in DL models. Data privacy of the data in consideration is another challenge which may lead to legal concerns when neglected.