Neural Computation

Week 1

Train Dataset – Used to train a model

Validation Dataset – Used to validate the model at each epoch in an unbiased manner that can be used to verify and modify the hyper parameters if needed

Both the above datasets need to be labelled so that we can get metrics like loss and accuracy for verifying.

Test Dataset – Test the model after the model is already trained. (Data is different from both training and validation set). The test set should be unlabelled since we don’t need metrics for verifying.

If the validation results are good that means the model is good on a generalized data set

When the results on the training data and validation data both are good the model is said to be good.

Dataset ------> 80% for training and 20% for testing

Split the training dataset again ------> 80% training and 20% for validation

Timeline

Description automatically generated

Over fitting - When the results on training data are better but the results on validation data are not then the model is over fitting. When training performance is good but testing performance is bad. The model is not generalized to all data. Happens when model is too complex.

Under fitting – When training performance is poor. Happens when model is too simple.

Gradient Descent – Iterative algorithm uses cost function and derivatives to help a graph fit optimally to data

Epoch - Number of times the entire dataset passes through the neural network. Also, number of times the weights and biases are changed.

Machine Learning Tasks:

Classification – A ML algorithm to label data and classify them.

Regression – An algorithm that takes in a bunch of independent numerical variables and predicts a dependent variable output. Basically, a function.

Machine Translation – Translating text from one language to another language

Transcription –

Synthesis and Sampling –

Performance Metrics:

Accuracy – Classification tasks - Used to predict Discrete values (class labels).

Residual – Regression tasks – Used to predict continuous values.

Types of Learning Tasks:

Supervised Learning – The data is labelled, and the dataset is of 2 dimensions. A correct output is known and compared for the training dataset. That is how the model learns for the unlabelled test dataset. Learn a function that maps an input to an output based on examples of input-output pairs.

Text, letter

Description automatically generatedDiagram

Description automatically generated

Types of Classification:

Binary Classification – Classify input into 2 possible outputs. Example would be spam detection in emails. The performance is measured based on the outputs correctly classified.

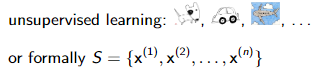
Multiclass Classification – Giving a bunch of inputs and choosing one of the several discrete outputs.

Example would be a medical diagnosis predicting a condition from a bunch of inputs. This is performed using probabilistic classification.

Logo

Description automatically generated

Unsupervised Learning – The data is unlabelled, and the dataset is of 1 dimension. The model learns to find and formulate patterns based on the unlabelled dataset. Clustering tries to form similar groups. Dimensionality reduction tries to reduce the data without losing too much of its information. Association is finding relationships between all the variables in the data set like for example people who buy X products also buy Y products along with them.



Diagram

Description automatically generated

Reinforcement Learning – An agent interacts with the model and receives and observation at every stage of the action. The model gets rewarded +1 or -1 depending on the output. An example would be a mouse in a maze trying to learn how to get out. At each turn the state of the position will be sent to the agent and an appropriate response would be generated. The agent wants to learn a policy, or mapping from observations to actions, which maximizes its average reward over time.

Diagram

Description automatically generated

Loss Function - How far is the prediction from the desired output.

Loss(prediction, target) returns a number “the loss”

Classification: (0-1 loss)

Loss is 1 if prediction is wrong

Loss is 0 if prediction is right

Regression: (Squared loss)

Loss =

Performance on training set has a bias towards the model and cannot serve as an estimate of its performance on true environment!

Text

Description automatically generated

Graphical user interface, text, application

Description automatically generated

Underfitting vs Overfitting

Diagram

Description automatically generated

Workflow

Text, timeline

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