Ensemble Learning

- If you are planning to buy an air-conditioner, would you enter a showroom and buy the air-conditioner that the salesperson shows you? The answer is probably no.
- you are likely to ask your friends, family, and colleagues for an opinion, do research on various portals about different models, and visit a few review sites before making a purchase decision.
- In a nutshell, you would not come to a conclusion directly.
- Instead, you would try to make a more informed decision after considering diverse opinions and reviews.
- In the case of ensemble learning, the same principle applies.

Ensemble Learning

- The ensemble methods in machine learning combine the insights obtained from multiple learning models to facilitate accurate and improved decisions.
- The ensemble methods in machine learning help minimize these error-causing factors, thereby ensuring the accuracy and stability of machine learning (ML) algorithms.

Ensemble Learning

- Assume that you are developing an app for the travel industry.
- It is obvious that before making the app public, you will want to get crucial feedback on bugs and potential loopholes that are affecting the user experience.
- What are your available options for obtaining critical feedback?

  1) Soliciting opinions from your parents, spouse, or close friends.

  2) Asking your co-workers who travel regularly and then evaluating their response.

  3) Rolling out your travel and tourism app in beta to gather feedback from non-biased audiences and the travel community.

You are taking into account different views and ideas from a wide range of people to fix issues that are limiting the user experience. The ensemble neural network and ensemble algorithm do precisely the same thing.

Ensemble Learning

- With these examples, you can infer that a diverse group of people are likely to make better decisions as compared to individuals.
- Similar is true for a diverse set of models in comparison to single models. This diversification in Machine Learning is achieved by a technique called Ensemble Learning.

Simple Ensemble Techniques

- Max Voting
- Averaging
- Weighted Averaging

Max Voting

- The max voting method is generally used for classification problems.
- In this technique, multiple models are used to make predictions for each data point.
- The predictions by each model are considered as a ‘vote’.
- The predictions which we get from the majority of the models are used as the final prediction.

Max Voting

Example:

- you asked 5 of your colleagues to rate your movie (out of 5)
- three of them rated it as 4 while two of them gave it a 5.
- Since the majority gave a rating of 4, the final rating will be taken as 4.

The result of max voting would be something like this:

Colleague 1	Colleague 2	Colleague 3	Colleague 4	Colleague 5	Final rating
5	4	5	4	4	4

Averaging

- Similar to the max voting technique, multiple predictions are made for each data point in averaging.
- In this method, we take an average of predictions from all the models and use it to make the final prediction.
- Averaging can be used for making predictions in regression problems or while calculating probabilities for classification problems.

Averaging

Example:

In this example, the averaging method would take the average of all the values.

i.e. (5+4+5+4+4)/5 = 4.4

Colleague 1	Colleague 2	Colleague 3	Colleague 4	Colleague 5	Final rating
5	4	5	4	4	4.4

Weighted Average

- This is an extension of the averaging method.
- All models are assigned different weights defining the importance of each model for prediction.
- For instance, if two of your colleagues are critics, while others have no prior experience in this field, then the answers by these two friends are given more importance as compared to the other people.

The result is calculated as [(5*0.23) + (4*0.23) + (5*0.18) + (4*0.18) + (4*0.18)] = 4.41.

Colleague 1	Colleague 2	Colleague 3	Colleague 4	Colleague 5	Final rating	
weight	0.23	0.23	0.18	0.18	0.18	
rating	5	4	5	4	4	4.41