Figure 1 depicts the overall abstract framework for a group Ensemble, every ensemble is comprised of a set of baseline classifiers (also known as classifier ensembles) that have been trained on input data and provide predictions that are then aggregated to get an overall prediction.

A diagram of a algorithm

Description automatically generated

**Figure 1 General Framework of Ensemble(Mohammed and Kora, 2023)**

Based on the basis model generation technique, the ensemble prediction method may be further divided into two categories heterogeneous ensemble and homogeneous ensemble as shown in Figure 2, where the homogeneous combines the same number of base learners unlike the heterogeneous which contains different base learners, (Wang, Wang and Srinivasan, 2018). Classifiers of the same kind make up homogeneous ensembles, whilst classifiers of various types make up heterogeneous ensembles.(Sabzevari, Martínez-Muñoz and Suárez, 2022), on our model, we will use heterogeneous ensembles.

A diagram of a data processing process

Description automatically generated

**Figure 2 General Framework of heterogeneous and heterogeneous ensemble**

Since multiple classifiers are used in ensemble techniques this will provide predictions that are more reliable and accurate (Sisodia and Sisodia, 2018). Stacking, gradient boosting, and Bagging are a few common ensemble approaches. (Sciences, 2023), below we will find a definition for each of them:

**Boosting**

The original dataset is split up into several subgroups for boosting, as shown on **Figure 3,**  as its describe how the boosting works, the subset is used to train the classifier one by one, when the new output generate from the base learner the learner divided it into two groups the first group is for the data which detected correctly and the second for the misclassified data then it’s give it a weight higher than the correctly classified data, then the misclassified groups will be an input for the second classifier and so on until the dataset is finished.

A diagram of a model

Description automatically generated

**Figure 3 Boosting - How It Works (Dorfer, 2023)**

**Bagging:**

Another name for bagging is bootstrap aggregation. Using replacement, as shown in **Figure 4,** its describe how the bagging works, bagging chooses a random subset of patterns from the training set With a few repetitions and omissions, the newly generated training set will have the same number of patterns as the original training set, every base learner will generate an output the final prediction output will aggregate based on the problem nature if it’s a classification then we will take the majority voting and if it’s a regression problem then we will take the average.

A diagram of a bagging model

Description automatically generated

**Figure 4 Bagging (Bootstrap Aggregation) - How It Works (Dorfer, 2023)**

**Stacking:** is a model assembling technique used to combine information from multiple predictive models to generate a new model (meta-model). The architecture of a stacking model involves as shown on **Figure 5**, two or more base models, referred to as a level-0 model, and a meta-model that combines the predictions of the base models, referred to as a level-1 model. In level 0 models (base models), models fit on the training data and whose predictions are compiled the major issue on the stack method is overfitting, time consuming and its need a huge amount of data. (Latha and Jeeva, 2019).

A diagram of a tree

Description automatically generated

**Figure 5 Stacking- How It Works (Dorfer, 2023)**