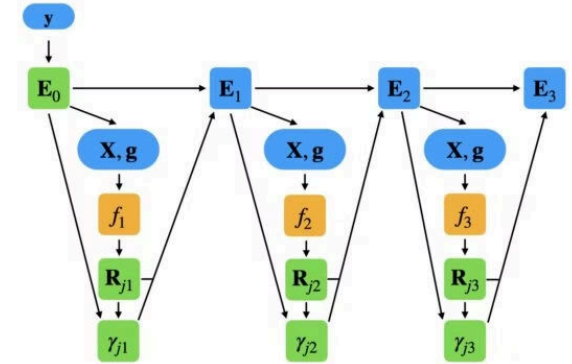


Introduction to Gradient Boosting

Gradient Boosting is a powerful ensemble learning method that combines multiple weak learners to create a strong predictor. It sequentially builds models, each aiming to correct the errors made by the previous models.



Base Estimator: Decision Trees

Decision Trees

Decision Trees are widely used in Gradient Boosting as base estimators. They partition data based on features to create a hierarchical structure for making predictions.

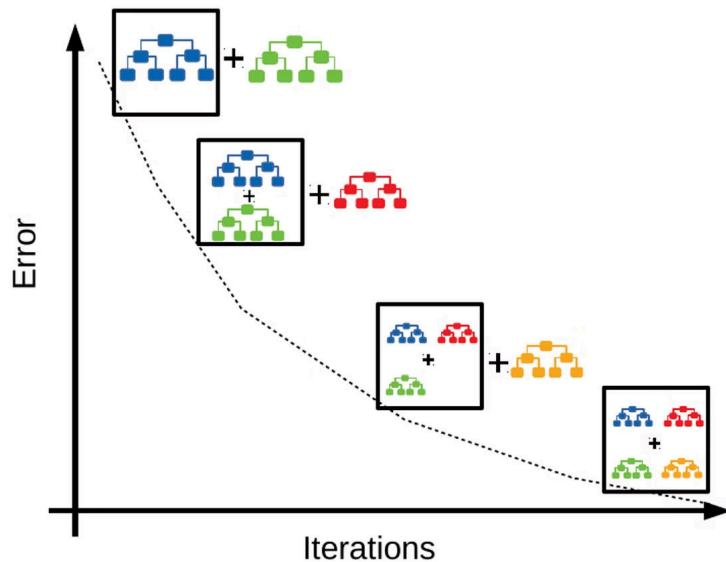
Tree Structure

Each node in the tree represents a feature, while the branches correspond to different values of the feature. The leaves of the tree contain the final predictions.

Decision Making

The algorithm traverses the tree based on the values of the input features, arriving at a leaf node that provides the predicted output.

Gradient Descent: Optimization



1

Loss Function

The model's performance is evaluated using a loss function, which measures the difference between predicted and actual values.

2

Gradient Calculation

The gradient of the loss function is calculated to determine the direction of steepest descent.

3

Parameter Update

Model parameters are updated iteratively in the direction of the negative gradient, aiming to minimize the loss.



Building the Ensemble

1

Sequential Construction

Gradient Boosting sequentially adds weak models (decision trees) to the ensemble, each focusing on correcting errors made by the previous ensemble.

2

Weighted Sum

Predictions from the ensemble are combined through a weighted sum, where the weights are determined based on the performance of each model.

3

Regularization

Regularization techniques are often used to prevent overfitting and improve the generalization ability of the ensemble.

4

Adaptive Learning

The algorithm adapts to the data by focusing on the most challenging examples, improving the accuracy of the ensemble over time.

Gradient Boosting Regressor

1

Regression Problem

Gradient Boosting Regressors are used for regression problems, where the goal is to predict a continuous numerical output.

2

Multiple Trees

The regressor combines predictions from multiple decision trees, each focusing on a different aspect of the data.

3

Iterative Refinement

With each iteration, the model learns from its mistakes, gradually improving its predictions and reducing the error.

Regression line

