# Food Industry AI-ML Case Study

In the food industry, the sugar content of a product is an important parameter to determine its quality and taste. Beer recipes are an important part of the food industry, specifically the beverage sector. Craft beer is becoming increasingly popular, and there is a growing demand for high-quality beer with consistent taste and quality. One important factor that contributes to the taste and quality of beer is the sugar content, which is typically measured using a sugarscale such as specific gravity or Plato. However, measuring sugar content can be time-consuming and require expensive equipment.

Therefore, the goal of this Auto-ML problem is to develop a model that can accurately classify the sugarscale of a given beer recipe. By predicting the sugarscale, breweries can ensure that the sugar content of their beer is consistent across different batches, which can help to improve the overall quality and taste of their product.
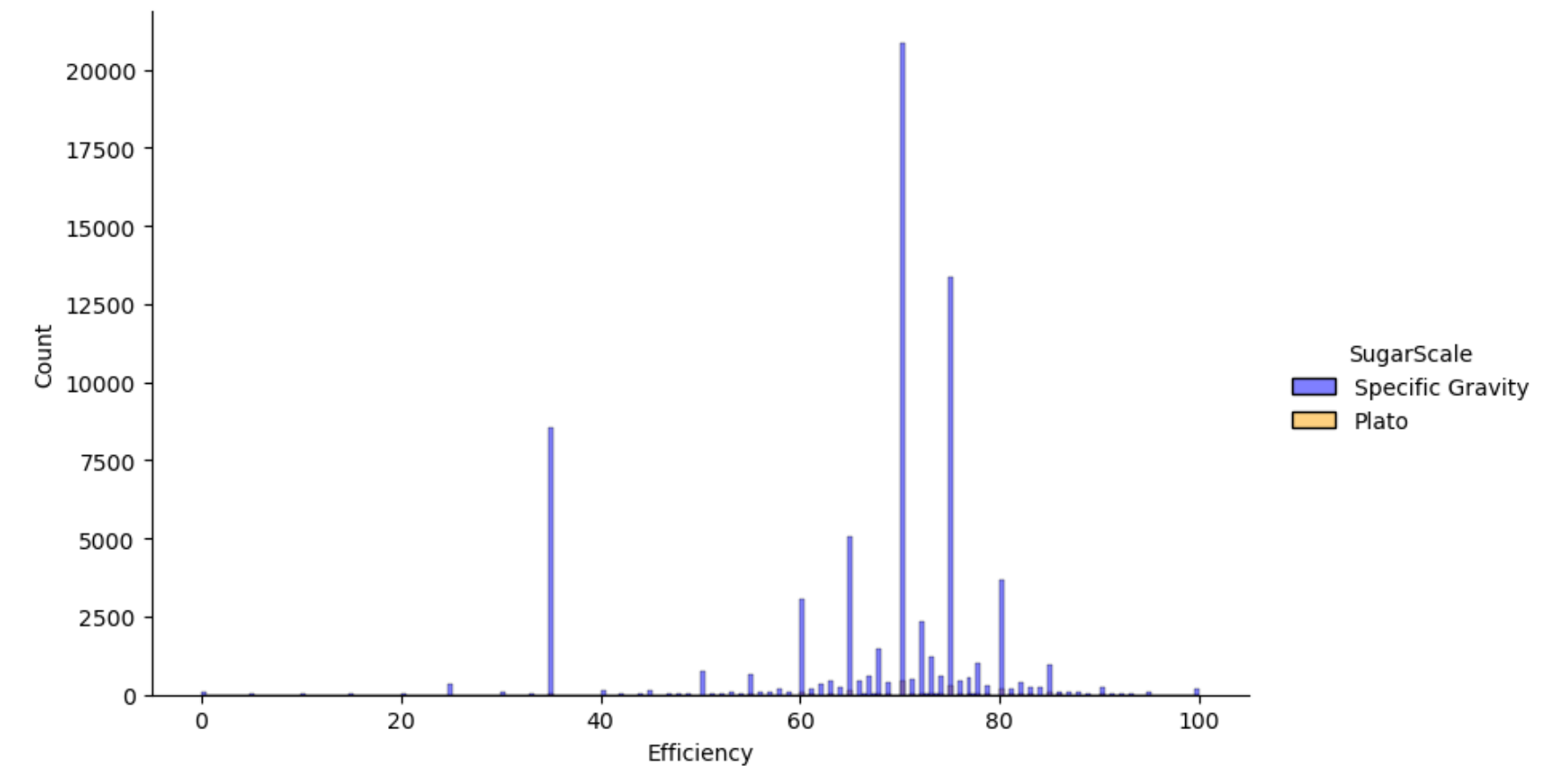
Class Distribution
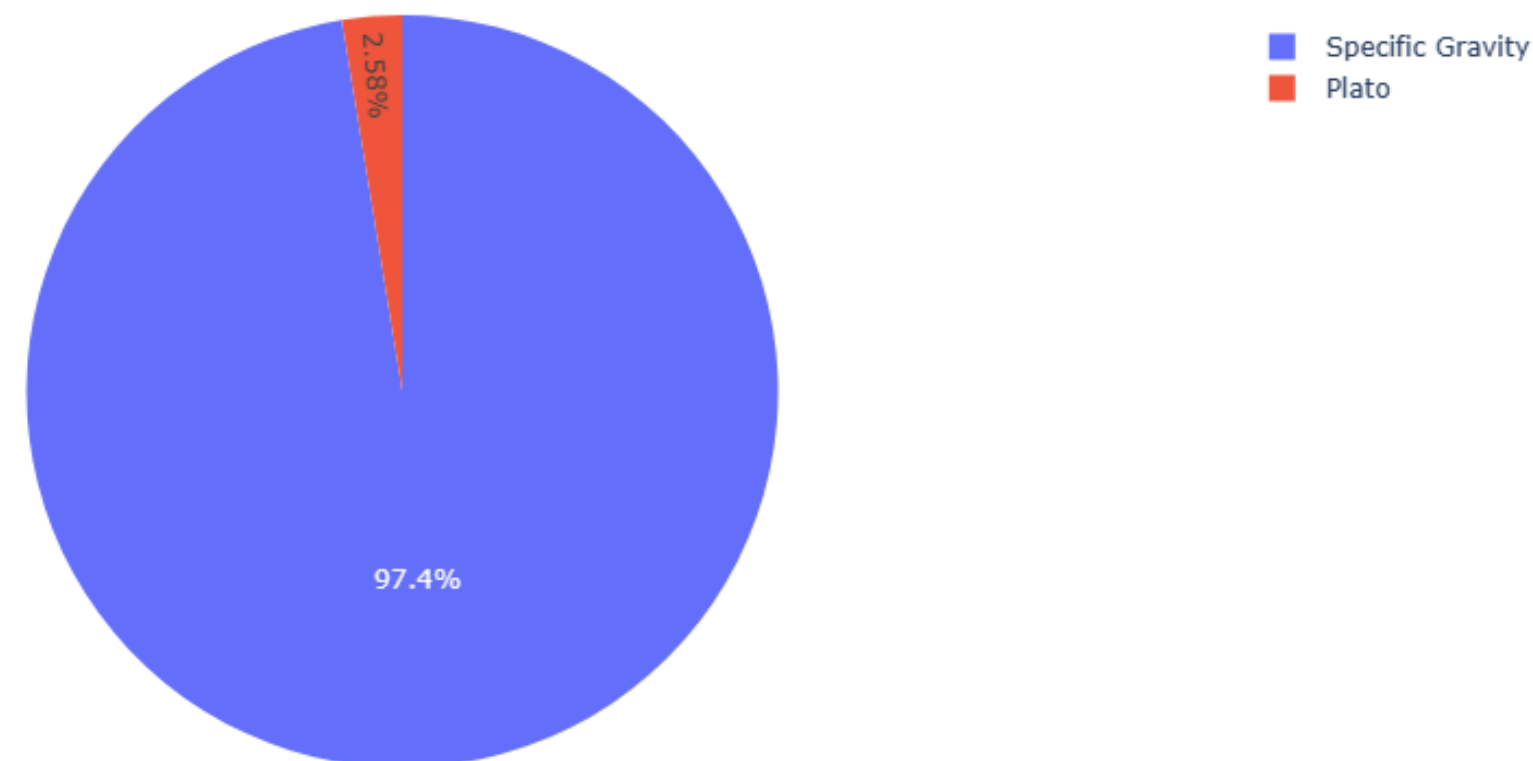
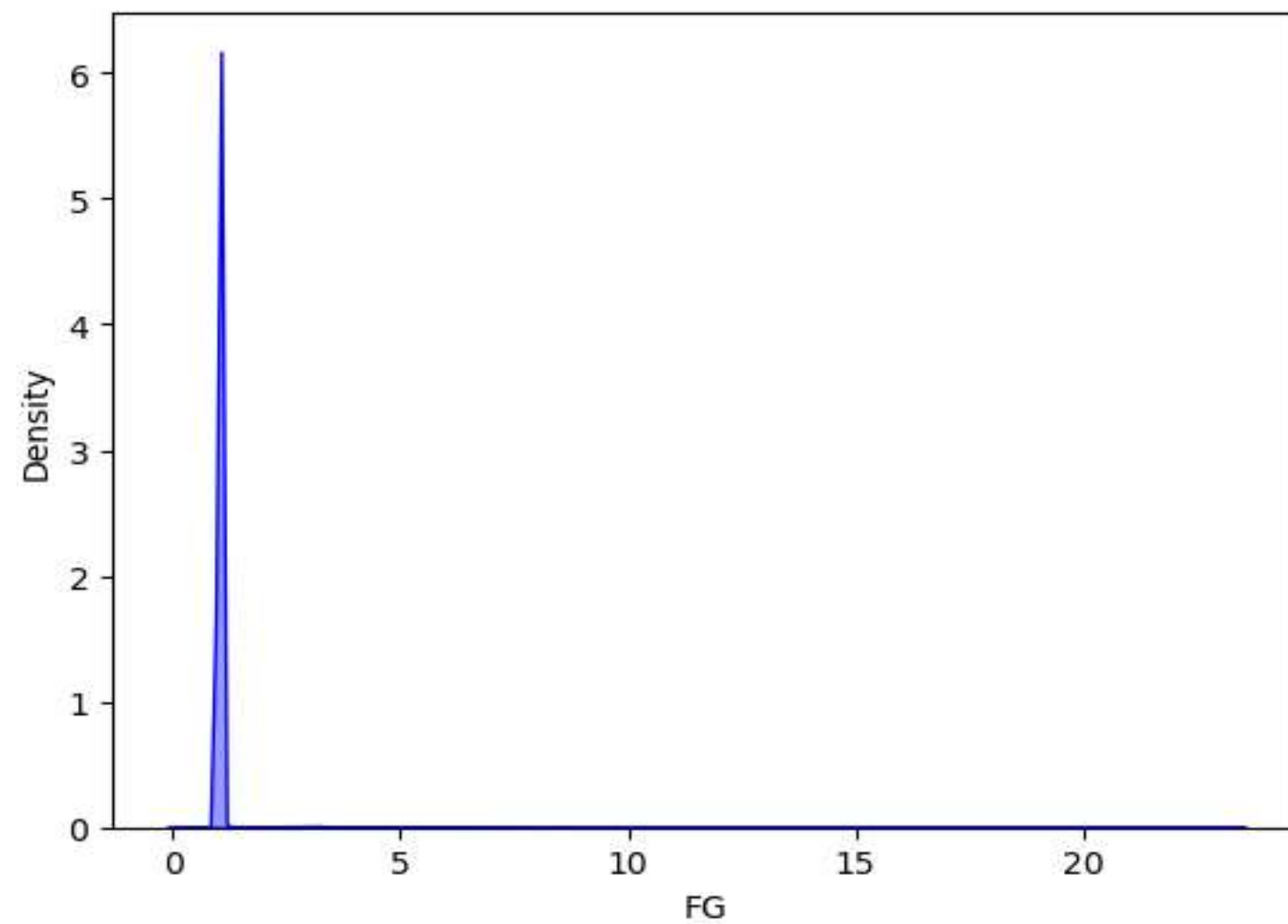| SugarScale	No. of Beers
Specific Gravity	71959
Plato	1902

Features Responsible
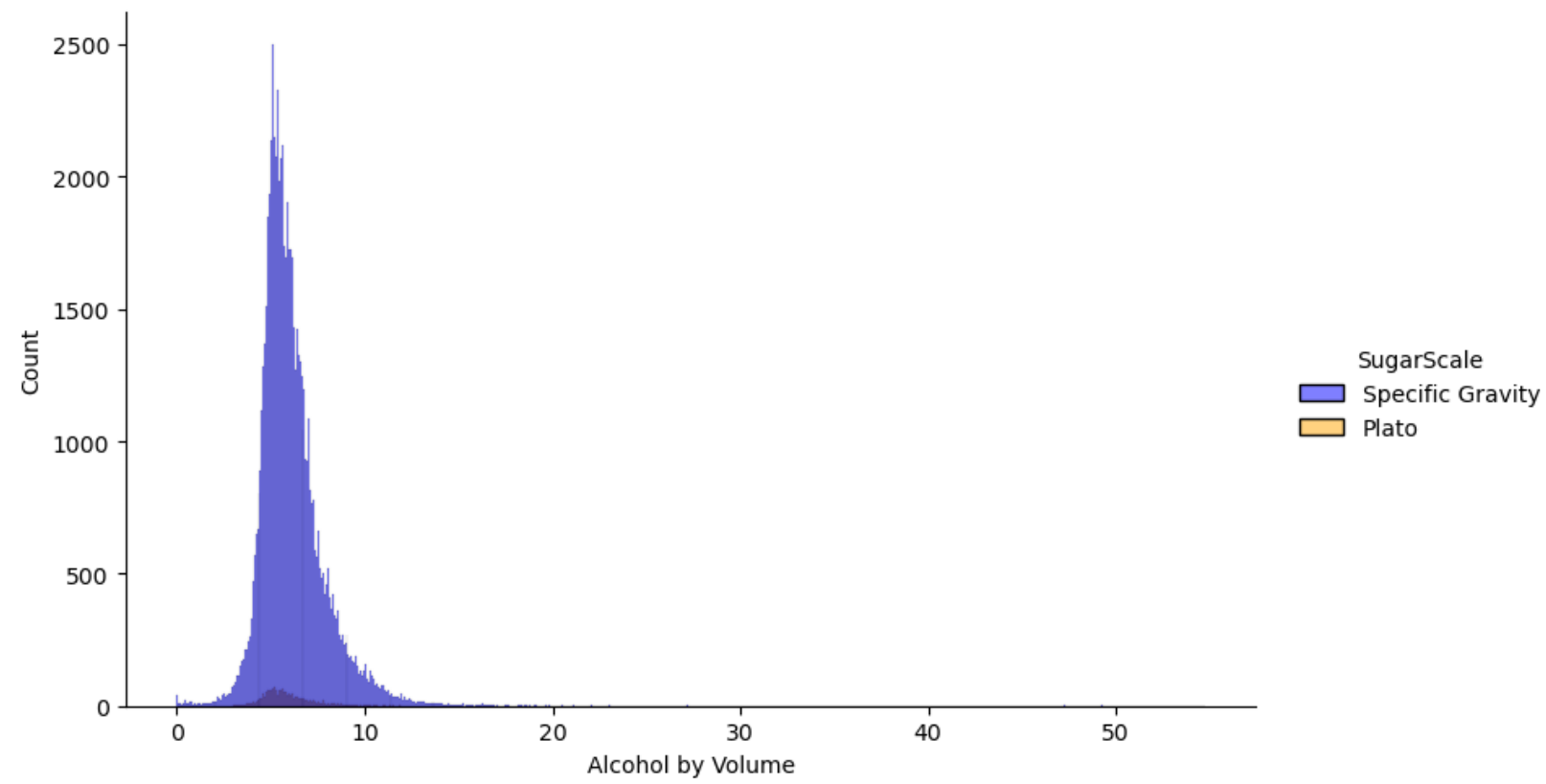
- **Alcohol By Volume** : The measurement of percentage of Alcohol in the beer recipe.

- **Efficiency** : Efficiency in a beer recipe refers to the percentage of extract (sugars) obtained from the grain during the brewing process.

- **Final Gravity** : FG (Final Gravity) in a beer recipe refers to a measurement of the specific gravity of the beer after fermentation.
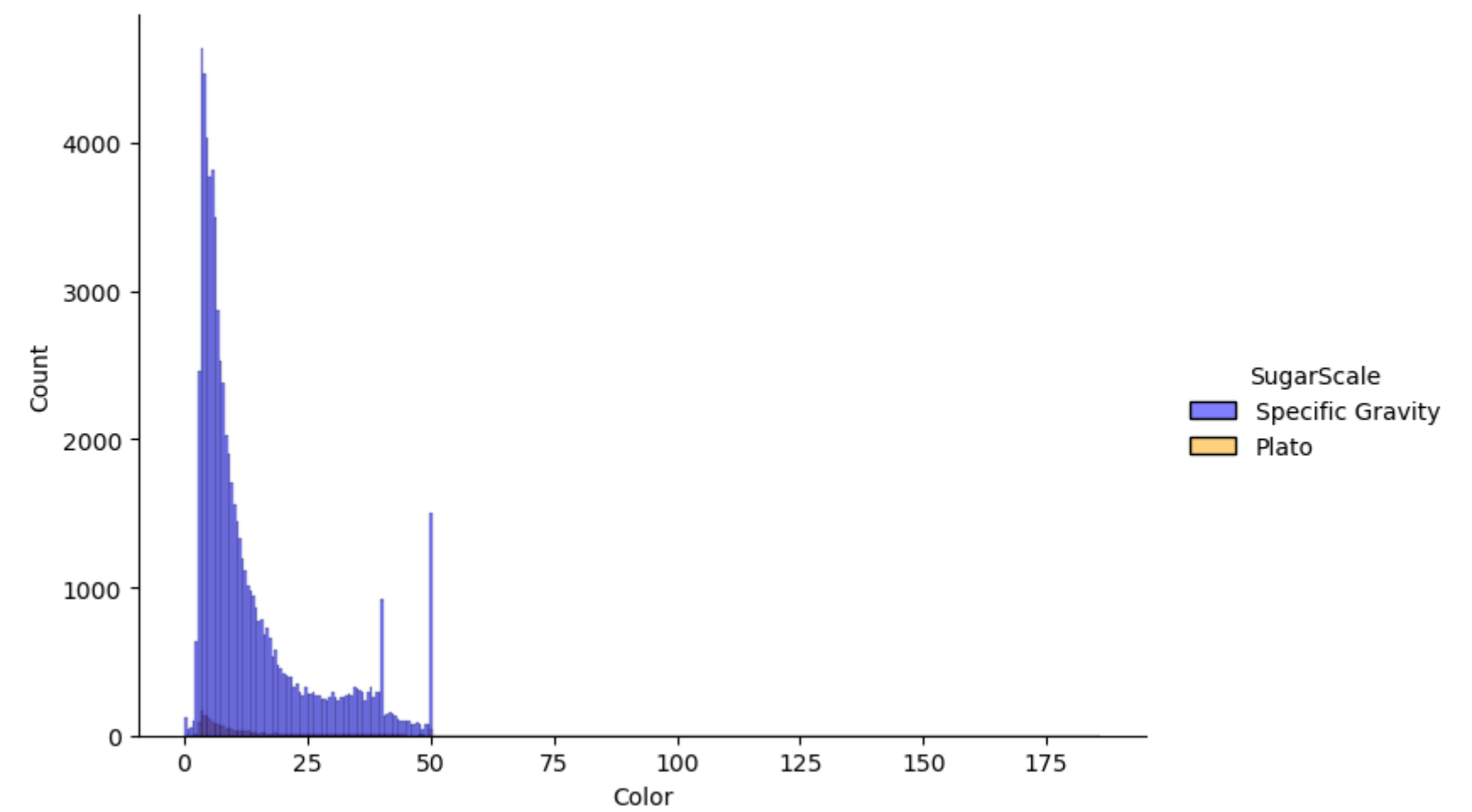
Color : The color of a beer in a recipe refers to the visual appearance of the beer and it is usually measured in SRM (Standard Reference Method).

Auto-ML Methodology Results

Case	Percentile	No.of Features	Random Forest	XGBoost	RNN	MLP	Decision Tree	Avg. Accuracy
Case 1	25	6	100	100	94.65	100	100	**98.93**
Case 2	50	12	100	100	28.99	99.89	99.91	**85.75**
Case 3	75	17	100	100	35.54	91.02	100	**85.31**
Case 4	90	21	100	100	95.23	99.97	99.91	**99.02**

- Based on our observation, RandomForest and XGBoost was the best performing algorithm with 100% accuracy in across all percentile.
- 90th percentile is the best percentile with an average accuracy of 99.02%.

Conclusion

As we conclude, predicting the sugar scale in beer recipe is a crucial task for the food industry to ensure the quality and consistency of the product. By using Auto-ML models, we can classify the sugar scale such as Specific gravity or Plato accurately based on various features such as malt, hops, and yeast. The dataset has 73861 records with 7 Categorical Features and 16 Numerical Features. 97.4% of the dataset shows that sugarscale in a beer recipe is Specific Gravity.

For classification, models were created with algorithms using Auto-ML techniques like Decision Tree, Recurrent Neural Network, Multilayer Perceptron, Random forest and XGBoost . With these models, performance measurement values were obtained for feature sets of 6, 12, 17 and 21. The Auto-ML algorithms were able to predict whether the sugarscale in a beer recipe is in Specific gravity or Plato with an average accuracy between 85% – 100% and helped to identify factors that determine the sugarscale in a beer recipe . The major factors include Alcohol by Volume, Efficiency, Final Gravity and Color. When the results are examined, it is observed that with the addition of each new feature, the success of classification decreased and increased at 90th percentile. Based on the performance measurement values obtained, it is possible to say that the study achieved success in classifying the sugarscale in a beer recipe. Overall, Auto-ML can significantly improve the beer brewing process and ensure customer satisfaction.