

## Classification of Brand Perception Using Random Forest: Brand Preference, Brand Loyalty, and Brand Trust

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# Introduction

## Brand Preference (BP), Brand Loyalty (BL), and Brand Trust (BT);

- 'Brand Asset Management: Profitable Growth Through Your Brands' by Davis (1964), second edition.
- Personal values are important for BP as they fulfill individual needs and influence '**perceived quality**' (Ebrahim, 2013; Yang et al., 2015).
- Customer loyalty involves a repeated purchasing process (Gumus, 2016) and is influenced by ease of return and '**recognizability**' (Chen, 2021; Aaker, 1996).

**Yang, et al., (2015):**\*Sustainable Brand Reputation: Evaluation of IPhone Customer Reviews with Machine Learning and Sentiment Analysis\*.

**Sayılı, et al., (2016):** \*Brand Loyalty Analysis System Using K-Means Algorithm\*.

**Pamuksuz and Yun, (2021):** \*A Brand-new Look At You: Predicting Brand Personality In Social Media Networks With Machine Learning\*.

**Dong, (2023):** \*Application of User Preference Mining Algorithms Based on Data Mining and Social Behaviour in Brand Building\*.

# Methodology: Random Forest Classification

Machine Learning (ML);

- Turing (1950); McCarthy et al., (1955)

Random Forest Classification (Breiman, et al., 1984; Quinlan, 1986; Breiman, 1996; Breiman, 2001)

**Step 1.** Randomly sample data and independent variables to construct  $M$  decision trees using different subsets of the training dataset  $D_n$ .

**Step 2.** Each tree  $h(x_i; \theta_j, D_n^{(j)})$  predicts the class of the independent variable  $x_i$ , based on the splitting criteria used for that specific tree.

**Step 3.** The final class prediction is determined by majority vote among the  $M$  trees:

$$\hat{y}(x_i) = \arg \max_{c \in C} \left\{ \sum_{j=1}^M \mathbf{1} [h(x_i; \theta_j, D_n^{(j)}) = c] \right\}$$

# Dataset and Implementation

## Characteristics of the Dataset

Table 1 – Cronbach's Alpha.

	Alpha ( $\alpha$ )
Overall	0.8399

Table 2 – Dataset Overview.

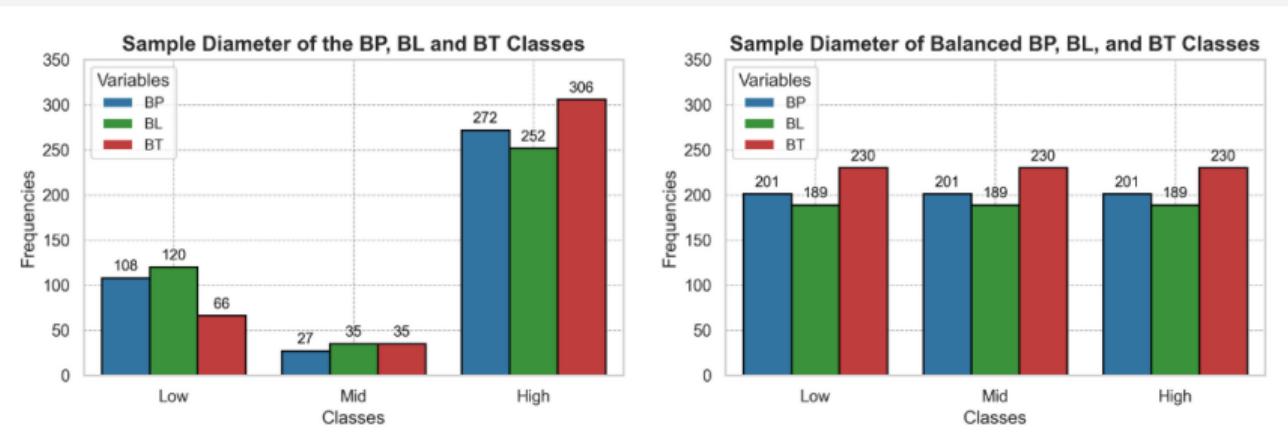
	Male	Female	$n_i$
Econometrics	65	99	164
Economics	75	108	243
$\sum_{i=1}^k n_i$		407	

Table 3 – Variables and Classes.

Variables	Classes
<b>Dependent</b>	
BP	Low, Mid, High
BL	Low, Mid, High
BT	Low, Mid, High
<b>Independent</b>	
Age, Gender, Department, Year, BandR, Place, Income, Socialmedia, Ishopping, BrandMonitoring, Price, Quality, Timeofuse, ProductionDate, Seasonality, Material, Discount, Fashion, Design, Psychologicalimpulses, Country, Recognizability	

# Dataset and Implementation

## Original Dataset and Balanced Dataset



- The generated data originated from the original training set itself, meaning that no external information was introduced to the model.

# Dataset and Implementation

## Confusion Matrices and Performance Metrics;

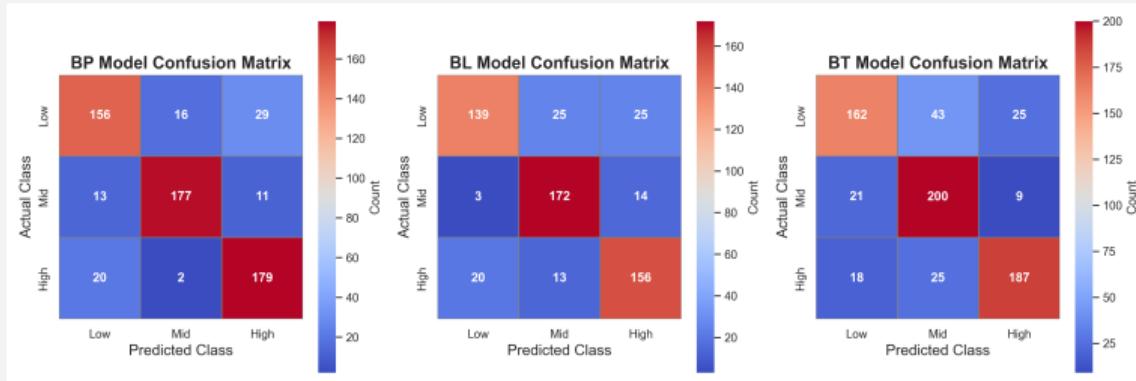


Table 4 – Model Performance Metrics.

BP Model				BL Model				BT Model				
Classes	Precision	Recall	F1	Classes	Precision	Recall	F1	Classes	Precision	Recall	F1	
YBP	Low	0.82	0.89	0.85	YBL	Low	0.80	0.83	0.81	YBT	Low	0.85
	Mid	0.83	0.78	0.80		Mid	0.86	0.74	0.79		Mid	0.81
	High	0.91	0.88	0.89		High	0.82	0.91	0.86		High	0.75
<b>Accuracy: 0.85</b>				<b>Accuracy: 0.82</b>				<b>Accuracy: 0.80</b>				

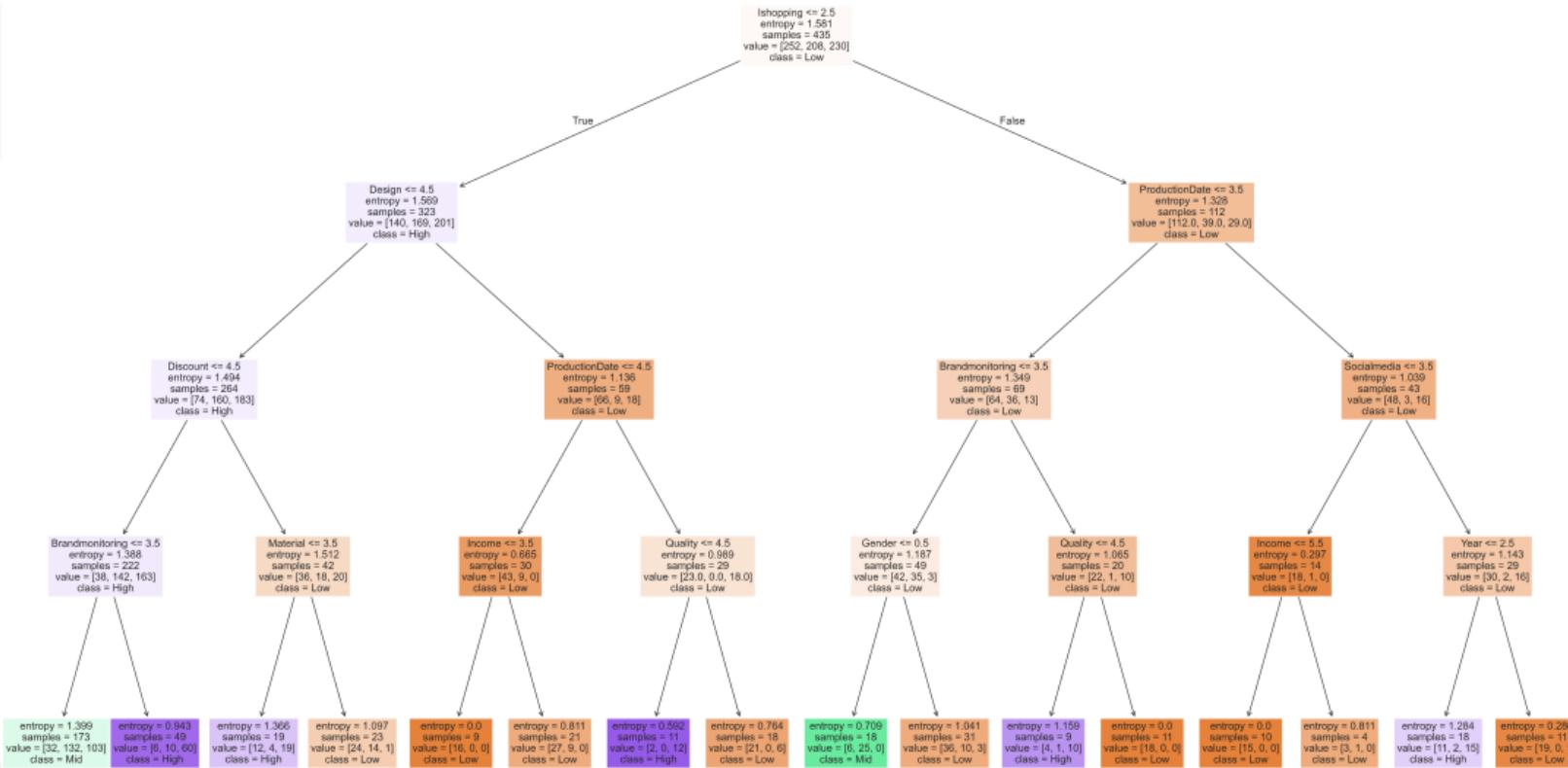
# Dataset and Implementation: BP Model Decision Tree



Dataset and Implementation: BL Model Decision Tree

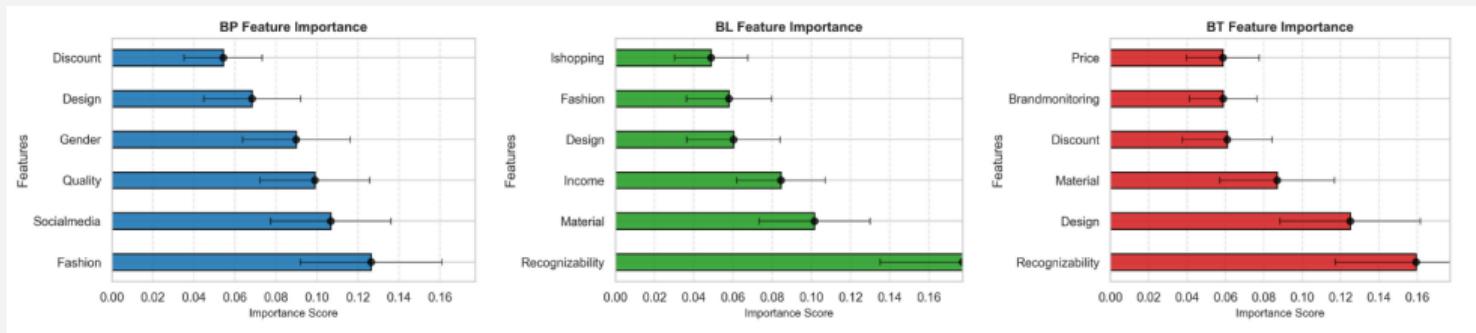


# Dataset and Implementation: BT Model Decision Tree



# Dataset and Implementation

## Feature Importance Plots;



- It is confirmed that BP is influenced by many factors (Ebrahim, 2013).
- Recognizability drives '**situational**' loyalty rather than preference (Oliver, 2010; Yang, et al., 2015; Chen, 2021).
- Social Media offers an effective marketing and perception enhancement opportunity (Pamuksuz, et al., 2021).
- Technological innovation and knowledge-based service offerings, strategic advantages, (Khan and Rahman, 2016),
- Designs that combine functionality and aesthetics instill confidence and increase '**proactive**' loyalty (Oliver, 2010).

## Results and Discussion

- The findings support previous research and contribute to the dynamics of the field,
- Online shopping platforms, Social Media, Age, Gender, Product Features,
- Artificial Intelligence Resources,
- Cost-Sensitive Learning, ADASYN, Tomek Links approaches can also be adopted.
- Lack of coefficient interpretation,
- A change of algorithm is of course also advisable,

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