

# Final Report – Food Delivery Classification Models

## ✓ Reporting and Insights

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### ◆ Model Comparison: Naive Bayes vs KNN vs Decision Tree

We evaluated three classification models using performance metrics such as accuracy, precision, recall, and F1-score. Below is the detailed comparison.

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#### Naive Bayes Classifier

Metric	Value
Accuracy	<b>98.33%</b>
Precision	0.93 (class 0), 1.00 (class 1)
Recall	1.00 (class 0), 0.98 (class 1)
F1 Score	0.97 (class 0), 0.99 (class 1)

#### Confusion Matrix:

```
[[14  0]
 [ 1 45]]
```

#### ✓ Highlights:

- Highest accuracy and balance across all metrics.
  - Excellent at predicting both classes.
  - Only 1 misclassification.
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#### K-Nearest Neighbour (KNN) – $k = 9$

Metric	Value
Accuracy	<b>96.67%</b>
Precision	1.00
Recall	95.65%

Metric	Value
F1 Score	97.78%

### Confusion Matrix:

```
[[14  0]
 [ 2 44]]
```

### ✔ Highlights:

- Very high precision (no false positives).
  - Slight drop in recall due to 2 false negatives.
  - Very strong overall performance, sensitive to choice of  $k$ .
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## 📊 Decision Tree Classifier

Metric	Value
Accuracy	76.67%
Precision	0.7667
Recall	100.00%
F1 Score	86.79%

### Confusion Matrix:

```
[[ 0 14]
 [ 0 46]]
```

### ⚠ Concerns:

- **Completely failed** to classify class 0.
  - **Recall = 100%** because it predicted all instances as class 1.
  - Biased and **not generalizing well** for imbalanced classes.
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## 📈 Visual Results to Include in Notebook

- ✔ Confusion Matrix heatmaps (for all 3 models).
  - ✔ ROC Curves for Naive Bayes and KNN.
  - ✗ Decision Tree not suitable for ROC due to poor performance.
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## 💡 Actionable Insights

🔍 Strengths and Weaknesses of Each Model:

Model	Strengths	Weaknesses
Naive Bayes	Fast, simple, highly accurate, interpretable	Assumes feature independence (may not hold)
KNN (k=9)	High precision, non-parametric	Slower with large datasets, sensitive to $k$
Decision Tree	Interpretable, easy to visualize	Severe overfitting, class bias

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✓ Recommended Model:

- ☐ Naive Bayes is recommended because:
    - It gives **the best accuracy (98.33%)**.
    - Low error rate**, especially important in critical decisions.
    - Balanced classification** across both classes.
    - Interpretable and lightweight, suitable for deployment.
  - ☐ KNN is a good backup option if dataset changes, but slower in real-time use.
  - Decision Tree should be avoided in current form due to biased predictions.
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📊 Final Summary Table

Model	Accuracy	Precision	Recall	F1 Score	Recommendation
Naive Bayes	98.33%	0.93/1.00	1.00/0.98	0.97/0.99	✓ Best overall
KNN (k=9)	96.67%	1.00	95.65%	97.78%	👉 Strong second
Decision Tree	76.67%	0.7667	100%	86.79%	✗ Not suitable