Machine Learning Model Performance Report

1. Classification

Pokémon Classification

Model Used: K-Nearest Neighbors (KNN)

Accuracy: 96%

Analysis: KNN performed exceptionally well in classifying Pokémon. This suggests that Pokémon data likely has well-separated clusters in the feature space, making KNN a suitable choice.

Recommendation: KNN is the best model for this dataset due to its high accuracy.

Game Rating Classification

Models Used: Gaussian Naïve Bayes (57%), Multinomial Naïve Bayes (83%), Decision Tree (Gini - 82%, Entropy - 83%)

Analysis:

- GaussianNB had the lowest accuracy, indicating that the assumption of normally distributed features may not hold.
- MultinomialNB performed significantly better (83%), suggesting that the categorical/discrete nature of the data aligns well with the multinomial assumption.
- Decision Trees performed similarly to MultinomialNB (82%-83%).

Recommendation: MultinomialNB and Decision Trees (Entropy) are the best choices for this dataset, given their high accuracy.

2. Regression

Video Game Sales Prediction

- **Model Used**: Single Linear Regression
- **Performance**:
  - Mean Squared Error (MSE): 0.3
  - R^2 Score: 0.9
- **Analysis**: The high R^2 score (0.9) indicates that the linear regression model explains 90% of the variance in the sales data, making it an excellent choice.
- **Recommendation**: Single Linear Regression is a strong predictor for video game sales and should be used for this task.

3. Clustering

Pokémon Clustering

- **Performance Metrics**:
  - Silhouette Score: 0.28
  - Davies-Bouldin Index: 1.33
- **Analysis**:
  - The Silhouette Score (0.28) indicates that the clusters are not well separated.
  - The Davies-Bouldin Index (1.33) suggests that the clusters have significant overlap.
- **Recommendation**: Clustering is not highly effective for this dataset. Feature engineering or trying different clustering algorithms may improve performance.

4. Neural Networks

Game Rating Prediction

- **Model Used**: Multi-Layer Perceptron (MLP)
- **Accuracy**: 86%
- **Analysis**: MLP outperforms all other classifiers for game rating prediction, achieving a high accuracy of 86%.
- **Recommendation**: MLP is the best choice for game rating classification, as it captures complex patterns in the data better than Naïve Bayes or Decision Trees.

5. Summary of Best Models

Dataset	Best Model	Accuracy/Performance
Pokémon Classification	KNN	96%
Game Rating Classification	MultinomialNB / Decision Tree (Entropy)	83%
Video Game Sales Regression	Linear Regression	$R^2 = 0.9$
Pokémon Clustering	Needs improvement	Silhouette Score: 0.28
Game Rating Neural Network	MLP	86%

Conclusion

- KNN is ideal for Pokémon classification.
- MultinomialNB and Decision Trees are best for game rating classification.
- Linear Regression works well for predicting video game sales.
- Clustering for Pokémon needs refinement or alternative methods.
- Neural networks (MLP) perform well for game rating prediction.