Summary:

This project applies an Artificial Neural Network (ANN) to the well-known Titanic dataset to predict passenger survival. The dataset, consisting of 891 rows, was fully preprocessed with no missing values. Features include both numerical (like age, fare) and categorical attributes (titles, embarkation points, cabin labels), all transformed using one-hot encoding and scaling for effective model training. The ANN was built from scratch using NumPy, allowing custom architecture, ReLU activation, and cross-entropy loss functions. Accuracy was used as the performance metric, and a decision boundary visualization was generated to provide interpretability. This end-to-end classification pipeline—from preprocessing to prediction and visualization—demonstrates a solid understanding of neural network implementation, feature engineering, and performance evaluation in machine learning.

1. **Dataset:** Titanic dataset with 891 preprocessed entries and over 68 encoded features.

2. **Preprocessing:** All missing values already handled; categorical features one-hot encoded; numerical features scaled.

3. **Model Used:** A fully custom-built Artificial Neural Network using NumPy (no external ML libraries).

4. **Architecture:** Configurable hidden layers (e.g., [4, 2]) with ReLU, tanh activation and final softmax/sigmoid layer.

5. **Loss Function:** Cross-entropy loss is used to optimize classification performance.

6. **Training:** Implemented using gradient descent with adjustable learning rate and epochs.

7. **Output:** Predicts survival (binary output) and computes accuracy for model evaluation.

8. **Visualization:** Decision boundary created using first two features to demonstrate class separation.

9. **Performance Metric:** Accuracy calculated using simple comparison of true vs. predicted labels.

10. **Educational Value:** Demonstrates foundational concepts like forward propagation, activation functions, loss computation, and visualization in a real-world scenario.