Theme of the Project: “Machine Learning in the Card Game Black Jack”

Identifying Your Business Goals

Our project aims to explore the application of machine learning in gambling games, specifically Black Jack, to develop a model that can make optimal decisions and achieve consistent wins.

Background

The authors have a strong interest in game theory and a scientific curiosity about whether it is possible to teach a machine to win in gambling games. Black Jack was chosen because it is a game that combines elements of probability, statistics, game theory, and combinatorics, making it an ideal testbed for machine learning algorithms. The goal is not merely to "get rich fast," but rather to investigate whether machine learning can provide strategic insights into such games.

Business Goals

1. Develop a functional machine capable of making decisions in Black Jack.

2. Achieve a win rate of at least 51% over a large sample of games.

Business Success Criteria

The project will be considered successful if:

1. A working model is created that can independently make decisions during the game.

2. The model achieves an average win rate of 51% or higher, demonstrating its ability to perform better than chance.

Assessing Our Situation

Inventory of Resources

A dataset of 900,000 games played in Black Jack, including variations in hands and game outcomes.

Access to computing resources for training machine learning models.

Background knowledge in machine learning, statistics, and game theory.

Requirements, Assumptions, and Constraints

Requirements:

Identify and implement the most effective machine learning algorithms for the problem.

Train and test the model on the dataset to evaluate its performance.

Assumptions:

The dataset is representative of the actual game conditions.

Black Jack's rules remain consistent and unaltered during testing.

Constraints:

Limited computational resources may restrict the complexity of the model.

Variability in Black Jack game rules could influence results if applied to different contexts.

Risks and Contingencies

Risk: The model may fail to achieve a 51% win rate due to the inherent randomness of the game.

Mitigation: Explore a variety of machine learning algorithms and optimize hyperparameters to improve performance.

Risk: The dataset may contain errors or biases.

Mitigation: Perform data cleaning and preprocessing to ensure accuracy and consistency.

Risk: Computational limitations may hinder the ability to train more complex models.

Mitigation: Use cloud-based resources or simplify the model architecture while maintaining effectiveness.

Terminology

Win Rate: The percentage of games won by the machine compared to the total games played.

Optimal Decision: A move that maximizes the expected value for the player based on available information.

Dataset: A collection of game outcomes used to train and evaluate the model.

Costs and Benefits

Costs:

Time required for data preprocessing, model training, and testing.

Computational resources for training machine learning algorithms.

Benefits:

Insights into how machine learning can be applied to strategic decision-making in gambling games.

Development of a functional model that demonstrates real-world applications of game theory and machine learning.

Defining Data-Mining Goals

Data-Mining Goals

Develop a model capable of making decisions in real-time based on Black Jack game data.

Analyze patterns in the dataset to determine strategies that lead to higher win rates.

Data-Mining Success Criteria

The model must achieve at least 51% win rate when tested on unseen game data.

The model must provide consistent and reproducible results, demonstrating that its decisions are based on learned patterns rather than chance.