

Machine Learning Tracks

TRACK 1: CLASH ROYALE

Tags: Machine Learning, Data Science, Game Analytics, Prediction Systems



The Problem Statement

The arena gates open. Two kings stand on opposite sides of the battlefield. Towers are loaded, elixir is ticking, and eight cards define everything that follows. In Clash Royale, victory is rarely decided by reaction speed alone. At the highest levels of play, deck composition, card synergies, and meta awareness determine the outcome long before the first card is placed. A single hard counter, an outdated archetype, or a poorly balanced deck can turn a seemingly strong lineup into an inevitable loss.

The Supercell's competitive analytics team wants to understand this hidden layer of strategy, not from intuition, but from data. You are hired as part of an AI research team tasked with building an intelligent deck evaluation system that can predict outcomes before the match even begins.

The Objective

Design and train a Machine Learning model that, given two Clash Royale decks, predicts which deck is more likely to win. Your model should not only learn card interactions and archetype strengths, but also adapt to the evolving nature of competitive gameplay, where balance changes, popular strategies, and win conditions shift over time. The goal is to simulate how a meta-aware competitive player evaluates matchups using data instead of experience.

Dataset

This dataset contains historical match data including player decks, match outcomes, card-level information and competitive gameplay records:

- <https://www.kaggle.com/datasets/s1m0n38/clash-royale-games>

Technical Deliverables

1. Deck Representation & Feature Engineering:

- Encode decks using meaningful features such as:
 - Card presence (binary vectors)
 - Average elixir cost

- Archetype indicators (beatdown, cycle, control, etc.)
- Synergy & counter signals

2. Model Development:

- Train a model to predict match outcomes:
 - Logistic Regression / XGBoost / Neural Network
- Output:
 - Win probability or binary winner prediction
- Ensure:
 - Prediction consistency when decks are swapped
 - Generalization to unseen matchups

3. Data Strategy:

- Encode decks using meaningful features such as:
 - Use recent matches only to reflect the current meta
 - Discard outdated balance patches and strategies
 - Apply proper train-test split to avoid data leakage

Brownie Points

Impress us with these advanced features (in order of importance):

1. Counter-Deck Recommendation:

- Given a single deck, predict or generate an opponent deck that would maximize the chances of winning against it.
- This task tests:
 - Understanding of hard counters
 - Strategic deck construction
 - Optimization or recommendation-based approaches

2. Card-Level Analytics & Visualization:

- Provide insights such as:
 - Win rate of individual cards
 - Which cards act as hard counters to a given card
 - Synergy graphs or matchup matrices
- Clear and intuitive visualizations are highly encouraged

3. End-to-End User Experience:

- Design a neat, modern UI that allows users to:
 - Input two decks and get win predictions
 - View card statistics and counters

- Interact with visual insights
- Bonus points for:
 - Hosting the application
 - Clean UX/UI design
 - Smooth model integration (Streamlit, Gradio, or custom frontend)

Evaluation Metrics

Your submission will be evaluated based on:

- Accuracy, Precision, Recall and F1-score (primary)
- ROC-AUC or win probability calibration (if applicable)
- Model generalization on unseen matchups
- Quality of feature engineering
- Clarity of reasoning and interpretation

Emphasis will be placed on how well your model performs on recent competitive patterns, rather than blindly fitting the entire historical dataset