Predicting Clash Royale Wins Through Deck Composition

(COMP3125 Individual Project)

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I. Introduction (*Heading 1*)

Clash Royale is a fast-paced, competitive mobile game built around strategic card selection and real-time decision-making. Each match is influenced not only by player skill, but also the structure of the deck itself. Elixir curve, troop types, spell choices, and the interactions between cards all are an important aspect to the game. Because the game is frequently updated, its meta shifts rapidly, creating natural uncertainty around which decks perform well and why. Data-driven analysis offers a way to cut through that noise by examining measurable relationships between card attributes, deck composition, and match outcomes.

This project explores how deck structure affects win rates by analyzing an existing card-level dataset sourced from an earlier version of the game. Although the dataset reflects an outdated meta, the underlying strategic principles remain consistent: certain card traits increase synergy, elixir management affects tempo and control, and card rarity often influences power but not necessarily effectiveness. By treating this as a historical snapshot, the analysis highlights broader patterns that continue to shape competitive play. The project also incorporates predictive modeling to estimate the likelihood of deck winning based on measurable features such as elixir cost, card types, and card statistics. The goal is to understand both *why* certain cards work well together and *how*

II. Datasets

A. Source of dataset (Heading 2)

The dataset used in this study originates from a publicly available Kaggle dataset titled *"Clash Royale Dataset"*. This dataset was last updated approximately eight years ago and captures card statistics from a history version of Clash Royale. While more recent, deck-level datasets were not available, this dataset provides detailed card attributes that allow for an analysis of how individual card properties may influence larger deck patterns.

No additional datasets or external API pulls were incorporated for this report. All analysis is based solely on the Kaggle dataset in its original form.

B. Character of the datasets

The dataset contains detailed attributes for a wide range of Clash Royale cards, including troops, spells, buildings, and spawner units. Each row corresponds to a single card and includes characteristics relevant to both gameplay strategy and statistic modeling. These attributes include *Elixir Cost, Card Type (Troops, Damaging Spells, Spawners, Defenses), Damage, Damage Per Second, Death Damage, Hitpoints, Shield Health, Spawn Health, Hit Speed, Spawn Speed, Range, Radius, Card Level and Spawn Level, and Maximum Spawned/Troops Spawned Counts*. These features provide a structural understanding of how cards behave in-game. Although the dataset does not directly include match outcomes or deck lists, the card-level statistics support higher-level analysis such as identifying what types of cards tend to be more powerful, which features correlate strongly with performance metrics, and how these characteristics may relate to deck-building strategy.

Because the dataset reflects a retired version of the game, some values no longer match the current live balances. This limitation is noted throughout the analysis.

III. Methodology

This study applies a combination of exploratory data analysis and predictive modeling to understand how card characteristics relate to overall deck performance. The methodology focuses on extracting meaningful patterns from the card-level attributes provided in the dataset.

A. Exploratory Analysis

Initial exploration includes computing descriptive statistics for elixir cost, damage values, hitpoints, and other numeric attributes. A usage frequency analysis identifies which types of cards (e.g., high-damage troops, low-cost cycle cards, defensive buildings) appear most commonly in the dataset and how their properties cluster.

B. Correlation Analsysis

A correlation heatmap is generated to evaluate the relationships between key numerical features such as damage, DPS, hitpoints, spawn rate, and elixir cost. This step highlights which attributes tend to co-vary and may influence strategic value. Strong correlations provide insight to broad card design patterns. For example, whether higher elixir cards consistently offer greater DPS or whether defensive units cluster around certain health or radius values.

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C. *Feature Engineering*

To support predictive modeling, the study constructs composite features that represent deck-building considerations including *Average Elixir Cost, Distribution of Card Types within a Deck, Total Damage Output (aggregated from individual cards), and Total hitpoints or Estimated Tankiness*.

These engineered features allow the model to approximate deck-level behavior despite working with card-based data.

D. *Predictive Modeling*

A logistic regression model is used to estimate the probability of winning a match based on deck composition. The dependent variable is the binary match outcome (win = 1, loss = 0). Independent variables include engineered features such as average elixir, card rarity, counts, card type distribution, and performance-related statistics derived from the dataset.

Logistic regression is chosen for its undestandability and suitability for binary classification problems. Coefficients from the model provide insight into which deck attributes most strongly influence match success. The model's limitations, particularly the lack of modern balance data, are acknowledged, but the process still demonstrates how predictive methods can be applied ot gameplay strategy.

IV. Results

In this section, present your findings using an appropriate method, such as equations, numerical summaries, or visualizations like charts and graphs. Clearly explain all results and provide guidance on how to interpret them. If any unexpected results arise, discuss possible reasons or contributing factors. To improve clarity and organization, consider using subsections (e.g., A, B) to separate different aspects of your results.

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A. *Result A*

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B. *Results B*

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C. *Results C*

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V. Discussion

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VI. Conclusion

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References

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[4] K. Elissa, “Title of paper if known,” unpublished.

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