VALORANT Match Performance Analysis

1. Introduction

Esports analytics has become an essential tool for understanding performance, strategy, and competitive advantage. In tactical shooters like **VALORANT**, match outcomes are influenced not only by raw aim but also by efficiency, consistency, team play, map dynamics, and economic management. This project analyzes professional match data from the **Valorant Champions Tour (VCT) Paris 2025** to identify which performance metrics are most strongly associated with winning.

The analysis focuses on four datasets: match outcomes, player performance statistics, map characteristics, and economy-related data. Using Python, pandas, numpy, and data visualization libraries, the study aims to answer a central question:

What measurable factors most clearly distinguish winning teams from losing teams in professional VALORANT matches?

---

2. Dataset Description

The following files were used in this analysis:

- **matches.csv**: Match-level information including teams, stages, and winners.
- **player_stats.csv**: Aggregated player performance metrics such as ACS, K/D ratio, KAST, ADR, and first kills.
- **maps_stats.csv**: Map-level statistics including frequency of play and attack/defense win percentages.
- **economy_data.csv**: Round economy data (pistol, eco, semi-buy, full-buy) with wins per category.

These datasets together allow analysis at multiple levels: match, player, map, and economy.

---

3. Methodology

The analysis followed a structured workflow:

1. **Data Cleaning and Preparation**
    - Converted percentage-based metrics (e.g., KAST) from strings to numeric values.
    - Engineered win/loss indicators at the player and team level.

    - Extracted win rates from economy columns stored as text (e.g., “6 (2)”).
2. **Exploratory Data Analysis (EDA)**
    - Examined distributions of key performance metrics.
    - Identified top-performing players and overall performance spread.
3. **Comparative Analysis**
    - Compared player performance metrics between wins and losses.
    - Evaluated economy round success for winning vs losing teams.
4. **Visualization**
    - Used histograms, violin plots, boxplots, scatter plots, and line graphs to communicate findings clearly.

---

4. Match Outcome Overview

Analysis of match results shows an uneven distribution of wins among teams, with a small number of teams securing a disproportionately high number of victories. Tournament stages also differ in structure, with group stages containing more matches and playoffs showing higher stakes and tighter competition.

This overview provides context for deeper performance analysis, helping explain why certain teams repeatedly appear in later stages.

---

5. Player Performance Analysis

5.1 ACS Distribution

The distribution of **Average Combat Score (ACS)** is right-skewed, indicating that while most players cluster around an average performance level, a small group of elite players achieve significantly higher impact scores.

5.2 Elite vs Average Players

A focused analysis of the top 10 players by ACS reveals relatively small numerical differences at the elite level. Zoomed horizontal bar charts highlight these subtle but meaningful performance gaps, which are often obscured in full-scale plots.

5.3 ACS, K/D, and KAST Relationship

Scatter plots of **ACS vs K/D ratio**, enhanced with **KAST as a color dimension**, show that the most impactful players combine: - High combat efficiency (K/D) - High round-to-round contribution (KAST)

This indicates that elite performance is not driven by kills alone but also by survivability, trading, and team play.

6. Performance vs Match Outcome

6.1 ACS: Win vs Loss

Comparative distribution plots show that players on winning teams have: - Higher median ACS - More consistent performance - Fewer extremely low-impact games

Line graphs of mean ACS further confirm a clear increase in performance when moving from losses to wins.

6.2 K/D Ratio: Win vs Loss

Winning teams also exhibit higher and more stable K/D ratios. Although distributions overlap, the overall shift toward higher efficiency for winning teams suggests that consistent positive trading is a key factor in securing victories.

---

7. Map-Level Context

Map statistics reveal that some maps are more frequently played and exhibit clear attack- or defense-sided tendencies. These characteristics provide important context for interpreting performance metrics, as certain maps naturally amplify aggressive play while others reward structured, defensive strategies.

---

8. Economy Impact Analysis

Economic performance plays a crucial role in match outcomes:

- Winning teams generally convert **pistol rounds** and **eco rounds** at higher rates.
- Successful eco-round conversions often correlate with overall match wins, highlighting momentum and resource efficiency.
- Full-buy round consistency further separates winning teams from losing ones.

These findings reinforce the importance of strategic decision-making beyond mechanical skill.

---

9. Key Findings

- Higher **ACS and K/D ratios** are strongly associated with match wins.
- **KAST** provides essential context, showing that consistency and team contribution matter alongside raw kills.

- Elite players form a small but highly impactful group that can significantly influence match outcomes.
- Map characteristics and economic efficiency meaningfully shape competitive results.

---

10. Limitations

- Player statistics are aggregated and do not capture round-by-round dynamics.
- Causation cannot be inferred; strong performance correlates with winning but does not guarantee it.
- Patch-level or agent-specific effects were not included in this analysis.

---

11. Conclusion

This analysis demonstrates that winning in professional VALORANT is driven by a combination of combat impact, efficiency, consistency, and economic management. While mechanical skill remains essential, teams that succeed consistently are those that maximize value across rounds, maps, and economy states. These insights highlight how data-driven analysis can deepen understanding of esports performance and competitive strategy.

---

12. Tools and Technologies

- Python
- pandas, numpy
- matplotlib, seaborn
- Jupyter Notebook
