

COUNTER-STRIKE

Strategic Insights from the
Counter-Strike: Global
Offensive Game Statistics

PLAY NOW

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CONTEXT & GOAL

Counter-Strike: Global Offensive (CS:GO) is a highly competitive first-person shooter game known for its strategic and skill-based gameplay. It involves two teams, **Terrorists** and **Counter-Terrorists**, competing in various objective-based game modes.

The most common mode is **bomb defusal**, where **Terrorists** aim to plant and **detonate a bomb at a specific site**, while **Counter-Terrorists** strive to prevent this or **defuse the bomb**.

CS:GO emphasizes teamwork, tactical thinking, and player skill, including accurate shooting and map knowledge. It's renowned for its multiplayer community, professional esports scene, and as a platform for developing quick decision-making and strategy skills.



Elimination in the CSGO



Elimination

In CS:GO, "elimination" refers to the act of a player killing an opponent, which is a fundamental aspect of gameplay.

Each round involves players trying to eliminate members of the opposing team.

Eliminating all members of the opposing team is one way to win a round, alongside completing objectives like bomb planting or defusal.

Map in CSGO



A map in CS:GO is a virtual battleground where teams of Terrorists and Counter-Terrorists compete.

Each map features unique layouts with bomb sites, tactical choke points, and varied terrain, requiring strategic planning and skillful navigation.

Maps are crucial for gameplay, influencing tactics and team strategies.

Weapon in CSGO



Weapon Menu

In CS:GO, weapons vary in type, price, and effectiveness.

From affordable pistols to costly rifles and sniper guns, each has distinct accuracy, recoil, and damage profiles, influencing strategy and economy management in-game.

Weapon choice reflects a player's role and strategy, balancing cost-effectiveness with tactical advantage in the team's overall approach.

Plant the bomb



Plant



Defuse

In CS:GO, the bomb is a critical object that Terrorists plant at designated sites to win rounds.

Counter-Terrorists must **defuse it within a time limit to prevent detonation** or they lose.

Its placement and defense shape round strategies, creating tense, tactical gameplay focused on site control and team coordination.



(a) General Attributes:

General Attributes refer to specific data points that help describe or summarize the state or progress of a game round. e.g. Round time left, Team score, Maps, Bomb planted, Round winners



(c) Grenades:

Each grenade type shows counts for CT and T possession (e.g., ct grenade hegrenade vs. t grenade hegrenade).

DATASET



(b) Team Vitality:

Health and Armor:

CT and T team combined vitality metrics.

Alive players:

Count of active players for both teams.

Team Economy:

Total in-game money for CT and T.

Gear:

Helmets and defuse kits count for both teams.



(d) Weapons:

Each weapon type reflects CT and T player counts holding it (e.g., ct weapon ak47 vs. t weapon ak47).

STORIES

The First Kill matters for both CT and T, because CT is defense role, we think first kill matters more to CT

There are rumors about which maps are easier for T or CT, i.e. called CT maps or T maps, we think it's not true

We think professional players are good at all weapons, e.g. even a pistol is good enough for pro player

We think planting the bomb is not necessary as defused a bomb lead to instantly lose and explosion of the location

First Kill

T maps & CT maps

Weapons

Plant the bomb

TARGET AUDIENCE AND ASSUMPTIONS

Target Audience

- **CSGO Players and Enthusiasts:** Individuals seeking insights into high-level play strategies and patterns.
- **eSports Analysts and Commentators:** Professionals seeking data-driven narratives and insights for broadcasts and articles.
- **Tournament Organizers:** Interested in understanding game dynamics to better organize and promote their events.
- **Game Developers:** Looking to gather insights for game balancing and future updates.

Assumption 1

- The data has been cleaned and is free from anomalies, inaccuracies, or biases and dataset represents the typical dynamics of high-level tournament play.

Assumption 2

- Snapshots can provide a comprehensive understanding of round dynamics.

A black and white photograph of a soldier in camouflage gear lying in a field of tall grass. He is wearing a beret and has a rifle across his chest. The background is filled with dense, textured grass.

Story1

A black and white photograph of a soldier in camouflage gear lying in a field of tall grass. He is wearing a beret and has a rifle across his chest. The background is filled with dense, textured grass.

First Kill

First kill prefers CT?

CTs are primarily in a defensive role, holding key areas and bombsites. The first kill allows them to maintain or strengthen their control over these critical parts of the map. With one less Terrorist, it's easier for CTs to defend bombsites, as Ts have fewer options for executing a coordinated attack.

Map Control: The first kill allows CTs to maintain control over key areas, making it harder for Ts to execute attacks.

Terrorist Offense: Reducing T numbers early limits their strategic options and attacking power, disrupting their plans.



Resource Conservation: CT equipment is costlier; a first kill helps preserve their resources, crucial for sustained defense.

Psychological Advantage: An early loss impacts T morale and momentum, crucial for their offensive strategy.



Technical Details

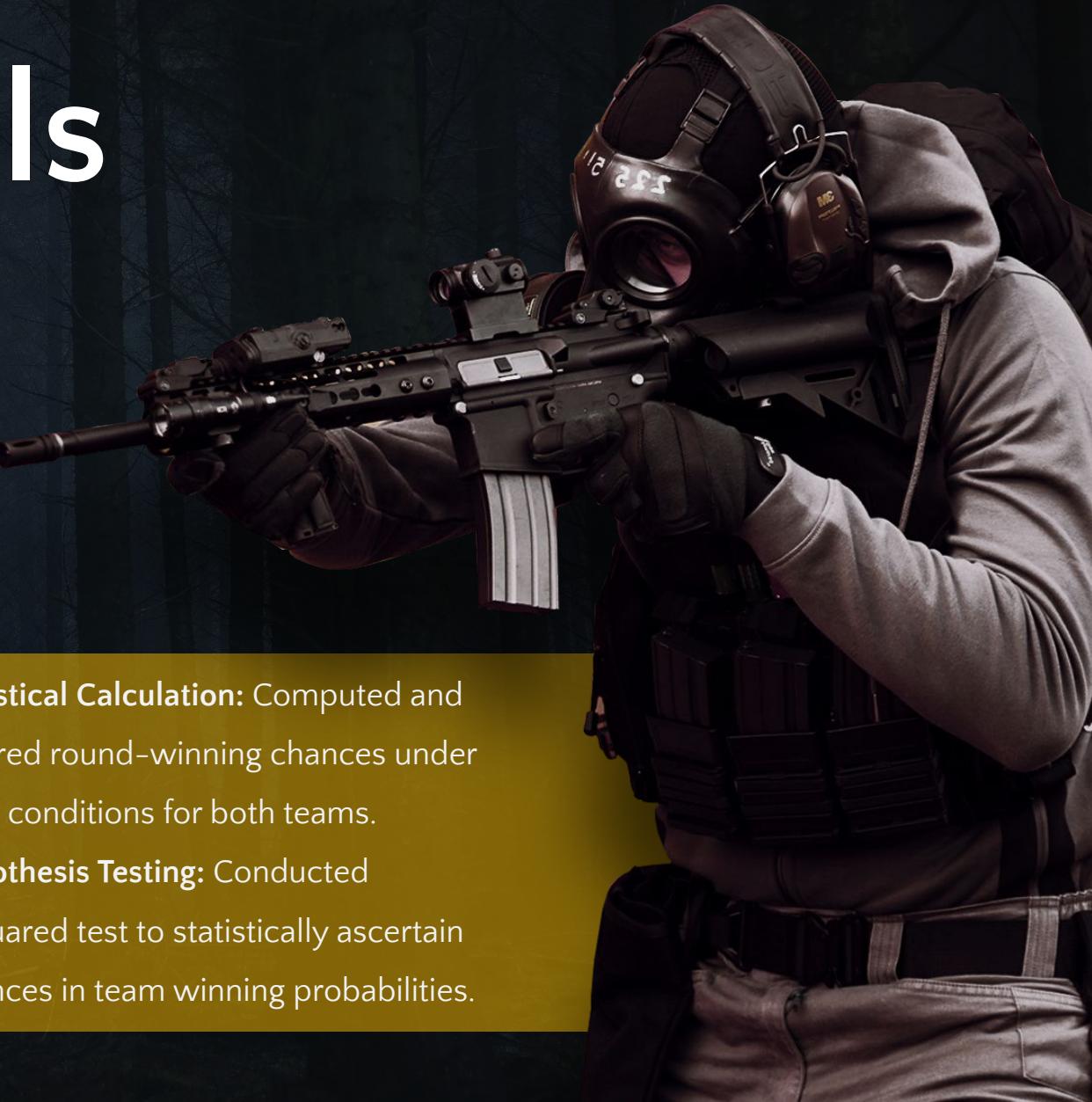
We conducted research on the impact of first kills on round-winning probabilities in a team-based game, dividing the teams into Terrorists (T) and Counter-Terrorists (CT). Our approach consisted of four key steps

1. Data Loading: Imported game dataset, processed for round-specific events like first kills and round outcomes.

2. Data Analysis: Analyzed winning probabilities based on first kill scenarios for Terrorists and Counter-Terrorists.

3. Statistical Calculation: Computed and compared round-winning chances under various conditions for both teams.

4. Hypothesis Testing: Conducted chi-squared test to statistically ascertain differences in team winning probabilities.



Data says otherwise

Terrorists, who aim to plant the bomb, can leverage the numerical advantage more effectively. They can exploit the CTs' need to split their defense across multiple sites, making it easier to attack a weakened bombsite.

Additionally, Terrorists can maintain a more flexible strategy even when a player down, as evidenced by their less drastic drop in win probability (29.5%) compared to CTs (25.49%) when not getting the first kill. This reflects the Terrorists' ability to execute planned attacks effectively despite a player disadvantage and capitalize on the CTs' need to rotate in response to their actions.

Probability of Counter-Terrorists winning given they got the first kill: **70.41%**

Probability of Counter-Terrorists winning given they did not get the first kill: **25.49%**

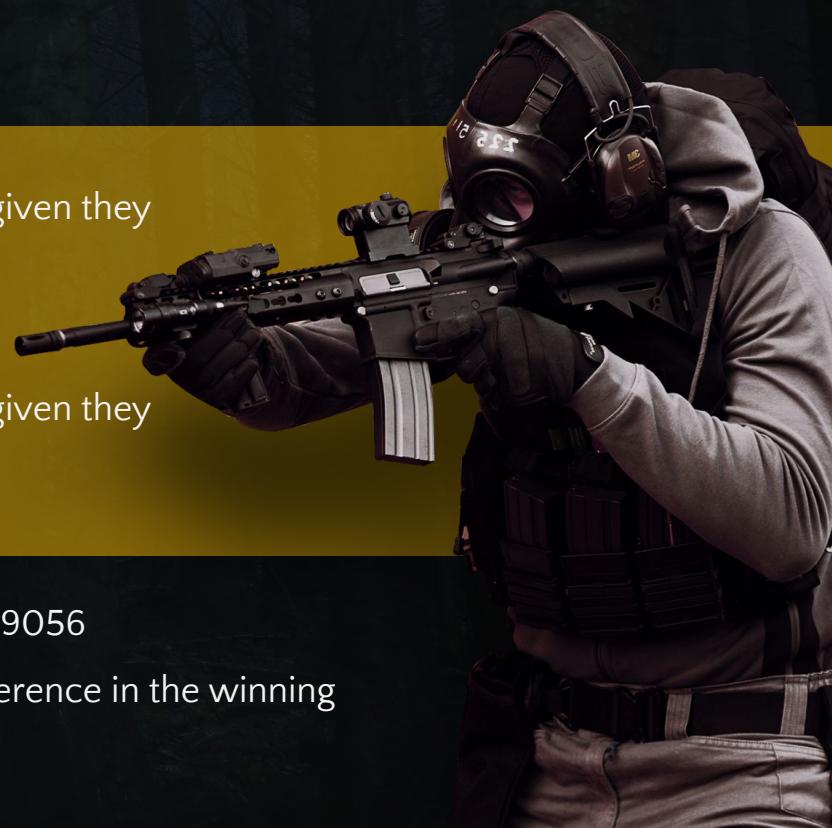
Probability of Terrorists winning given they got the first kill: **74.5%**

Probability of Terrorists winning given they did not get the first kill: **29.5%**

Chi-Squared: 14.648432075954144

P-value: 0.00012954236276209056

There is a **significant difference in winning probabilities in favor of T** (reject H₀ that there's no difference in the winning probabilities for terrorists and counter-terrorists when they get the first kill)

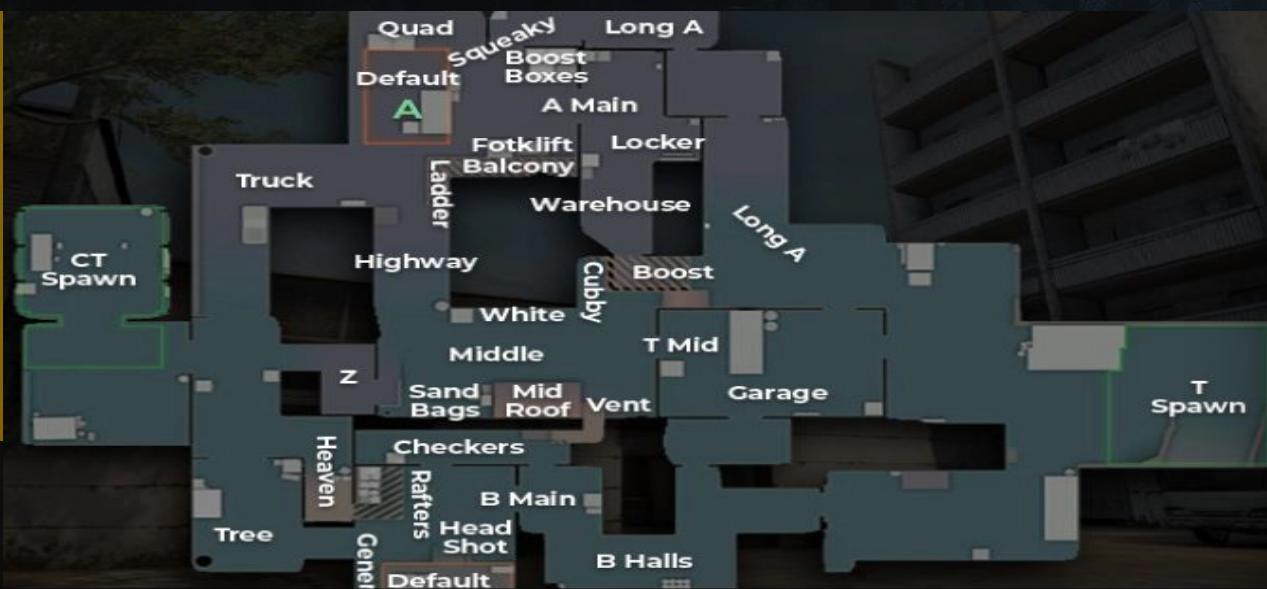




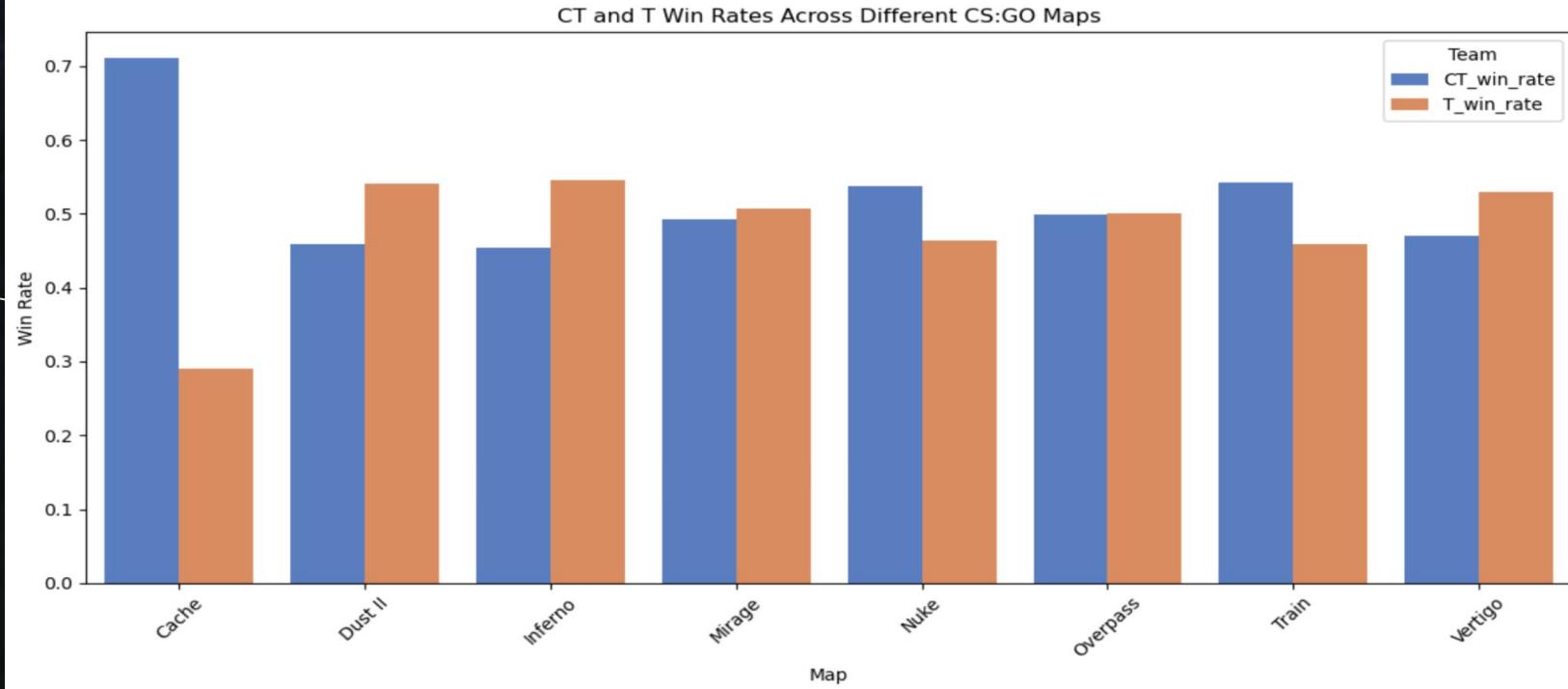
Story2 Maps

Are there so-called tmaps or ctmaps?

- The Chess Boards of CS:GO
- Each map: A unique battlefield
- Bomb sites: The heart of the conflict
- Architecture influences outcomes
- 'Tmaps' vs. 'CTmaps': Myth or Reality?



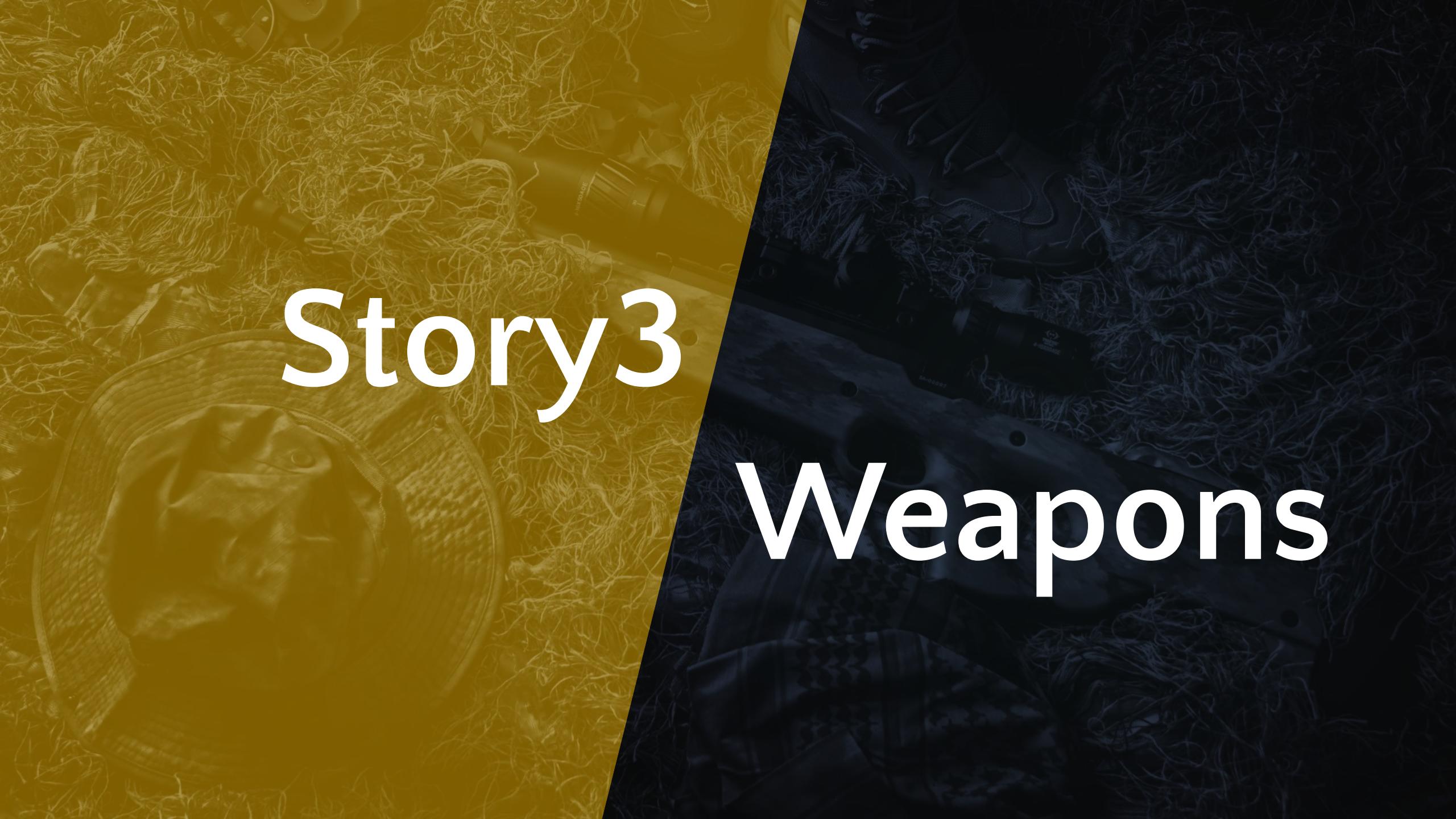
Conclusion



- Map biases in CS:GO exist
- CT or T advantages vary by map
- Strategic insights for competitive play

Technical Details

- Data Sourcing and Preparation:
 - Sourced from extensive datasets of match outcomes.
 - Refined map identifiers to their widely recognized names for audience comprehension.
- Analytical Methodology:
 - Aggregated wins per map to discern patterns in team successes.
 - Computed win rates to establish a baseline for CT and T side advantages.
- Visualization and Interpretation:
 - Leveraged Python's robust libraries (Pandas, Matplotlib, Seaborn) to manipulate and display data.
 - Designed clear, comparative bar charts to illustrate disparities in win rates across maps.
- Strategic Insights:
 - Analyzed data trends to pinpoint maps with inherent team biases.
 - Derived strategic considerations for players and teams based on map-specific performance metrics.

A photograph of a person from the waist up, wearing a camouflage jacket with visible text "FIREHOUSE" and "100007" on the sleeve, and a dark beret. They are standing in a field of tall, dry grass. The background is a solid blue.

Story3

Weapons

Are weapons important in the game?

- Assumption: Many people believe professional players are good at almost every weapons, so weapons they used will not affect the game results.
- The total value for weapon can indicate whether a team has invested more in armaments
- In each round, players from both sides have the opportunity to purchase new weapons during the first 20 seconds of the round.



Are weapons important in the game?

- Yes, weapons are important even in professional games.
- Teams with higher value weapons are **almost three times** more likely to win than teams with lower value weapons.
- Also, this rule applies to all maps.



weapon_value	CT Higher	T Higher
round_winner		
CT	6978	2624
T	2084	7016



Technical Details for ‘Weapons’ Story

- Data Transformation
 - Collect weapon prices into a dictionary
 - Add a new column to calculate and store the total value of weapons for each side.
 - In each round, identify the checkpoint where the total value is the highest among all checkpoints. This value will represent the total value for that round.
 - Add a new column called ‘weapon_value’ to indicate which team has a higher total value of weapons.
- Data Analysis
 - Count the number of rounds won by each side, categorized by weapon_value
 - Count the number of rounds won by each side on each map, categorized by weapon_value
 - Draw conclusions.

A photograph of a person from the side, facing right. They are wearing a dark baseball cap and a dark jacket. The background is a field of tall, dry grass. The image is split vertically down the center, with the left side having a yellowish tint and the right side being dark.

Story4

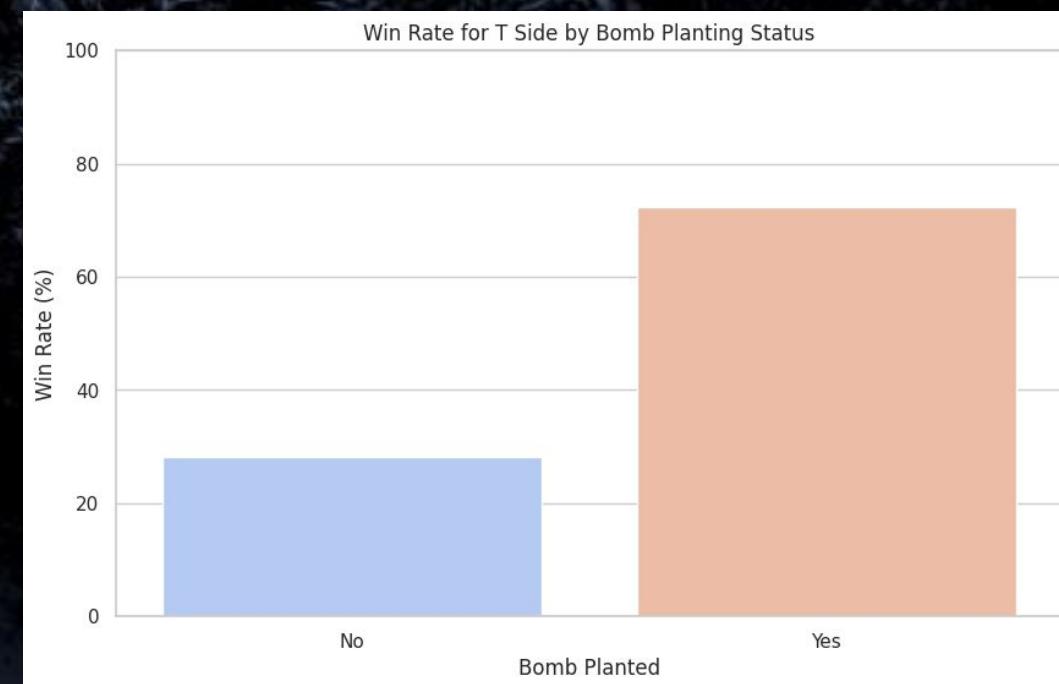
Bomb
Planting

Does T side have higher probability of winning the round by planting the bomb?

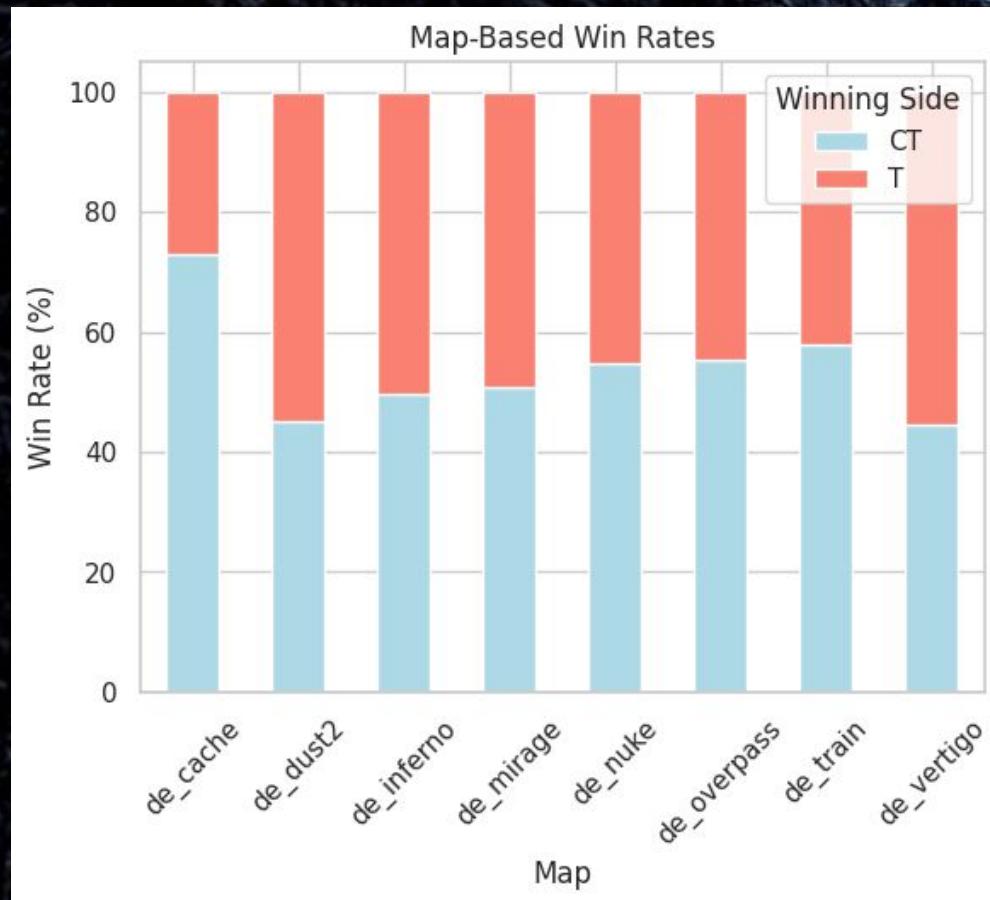
Basic calculation

According to historical data, we found out that T got 72.45% chance of winning the round if they successfully planted the bomb.

round_winner bomb_planted	CT	T
False	71.728749	28.271251
True	27.551020	72.448980



In fact, ...



As we can see, for each competition map, CT side has high trend of winning the game. It indicates the importance of planting the bomb if T side want to win the game and have higher competitive advantage with CT side.

Prediction of winning the round in the future?

- Use Random Forest Classifier and classified by CT and T.
- Model Accuracy: 0.899
- Use model to predict the probability.
 - If T plant the bomb, they got 72.9% chance to win. Otherwise, they only got 33.4% to win the game, which is far lower than planting the bomb.

The accuracy is: 0.8989637305699482

		precision	recall	f1-score	support
	CT	0.88	0.93	0.91	206
	T	0.92	0.86	0.89	180
accuracy				0.90	386
macro avg		0.90	0.90	0.90	386
weighted avg		0.90	0.90	0.90	386

The probability of T side winning the round with planted bomb is: 0.729

The probability of T side winning the round without planted bomb is: 0.334

Technical Details

- Feature Selection
 - Group dataset by CT Score, T Score and map.
 - Choose round_winner as the target feature and remaining features as predictors.
- Data Transformation
 - Identifies which columns are categorical and numerical.
 - Two types of transformations: standard scaling for numerical columns and one-hot encoding for categorical columns.
- Model Selection
 - The dataset is split into training and testing sets (80% train, 20% test) and the Random Forest model is trained on the training dataset.
 - Calculates the accuracy of the model and prints a classification report, which includes metrics like precision, recall, and F1-score for each class.

SUMMARY

First kill prefers the T, but even without it, T is more flexible than the CT, **offense role is resilient on first kill**

Yes, there are so called bias in the winning probability of a map, i.e. **Maps do have flaw in terms of fairness**

Weapon value difference still play an important role, even for **professional** players, **money is important**

Out of our surprise, **planting the bomb is extremely necessary** for T to win with probability over 70%

First Kill

T maps & CT maps

Weapons

Plan the bomb



THANK
YOU

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Dataset Link: <https://www.kaggle.com/code/abj2000/csgo-round-winner-prediction-88-accuracy>

CSGO Website: <https://www.counter-strike.net/>