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# Introduction:

Success in the fast-paced, extremely competitive world of Valorant esports depends on reaching a careful balance between individual talent, strategic agent decisions, and well-coordinated team approaches. Teams are competing for dominance in the virtual battlefield, and it is critical to comprehend the complex forces at work. To find strategic patterns and conclusions that help improve competitive performance, this paper uses data visualization to explore the 2023 Valorant esports scene [1]. The popular first-person shooter Valorant from Riot Games has captured the attention of players all around the world with its unique blend of accurate gunplay and varied agent skills. Professional teams compete in high-stakes matches in this environment, where quick judgments and strategic flexibility are essential to winning.

The study seeks to provide practical insights for players, coaches, and analysts by shedding light on the strategic foundations of Valorant esports through an analysis of data taken from the VCT Champions Tour 2023 dataset. By examining player performance measures, agent preferences, and team compositions through the eyes of data visualization to understand the strategic framework of the game. The study attempts to cover statistical findings, Trends in professional scene and some optimization based on trends for this data set.

# Data Set:

## Insights:

The Valorant Champions Tour (VCT) 2023 dataset, available on Kaggle, is the source of the study. This extensive database gathers important data from numerous recent esports contests and provides insightful information about player performance, agent usage, and team configurations. There hasn't any Data visualizations or analysis posted on this specific dataset reference hence there quite some assumptions/ considerations taken into account which will be given below.

We explore the strategic aspects of professional Valorant, using this broad dataset as our starting point, to discover the inner workings of winning in esports. The few of the most used fields in the data set are:

1. match_id
2. player
3. agent
4. rating
5. kill
6. death
7. assist

# Design / Theoretical Consideration:

**Prioritizing Rating as the key determinant of success:** Setting more weight on individual performance measures than win/loss statistics and using player ratings as the main reason for evaluating agents and other performance.

**Role-Based Team Composition:** A strategic principle for balanced team composition that divides agents into four separate roles: Controller, Duelist, Initiator, and Sentinel. This guarantees that the team has an extensive arsenal of skills and strategies for a range of in-game situations.
**Average Rating Calculation:** The algorithm uses a vital metric for player performance to generate the average rating for each agent on the selected map. This grade is a solid measure of an agent's effectiveness and contribution to the team's success.
**Selection of top agents:** Using the computed average ratings, the algorithm carefully selects the top-performing agents in each role category. By prioritizing agents with higher ratings, the team increases its likelihood for success in battles and strategic operations.

**Fifth Agent Inclusion:** Adaptive: A fifth agent is dynamically added to the team makeup, acknowledging the value of versatility and collaboration. The team's adaptability and strategic options are increased with the addition of this agent, who was selected based on his or her rating and suitability with the current team.
**Visual Representation of Ideal Team:** shows the ideal agent ratings and the makeup of the team. Users may more easily and intuitively evaluate each agent's strengths and shortcomings thanks to this graphical representation, which facilitates decision-making and team development.

# Data Analysis and Visualization: Statical finding.

## Player Performance:

By using a Radial type of graph, the top 10 players will be determined by rating. This representation does a great job of making it easy to compare player performance quickly. The area covered under of the line that each player's name spreads forth from a central point represents their rating. This makes it possible to quickly and clearly determine which players performed at the best level overall.

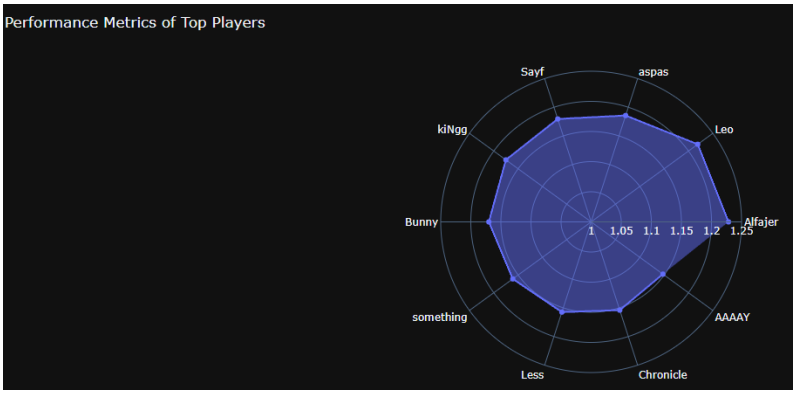


*Figure 1: Top Players*

The Valorant player rating radial graph, made with Plotly, offers a look at top 10 player ratings. While Alfajer holds the top spot and aaaay the bottom among the showcased players, the small rating range (1.14 - 1.23) creates a magnified effect in the scaled diagram. Meanwhile majority of the player in the graph lie between 1.15 to 1.2 rating. One of these interactive features of this graph is Plotly's zoom function allows closer inspection of these subtle rating differences.

## Agent Usage:

Bar chart is used here as it provides insights into the patterns of agent selection in different matches. They reveal which agents are most frequently chosen and as are Meta defining most successful in terms of winning.

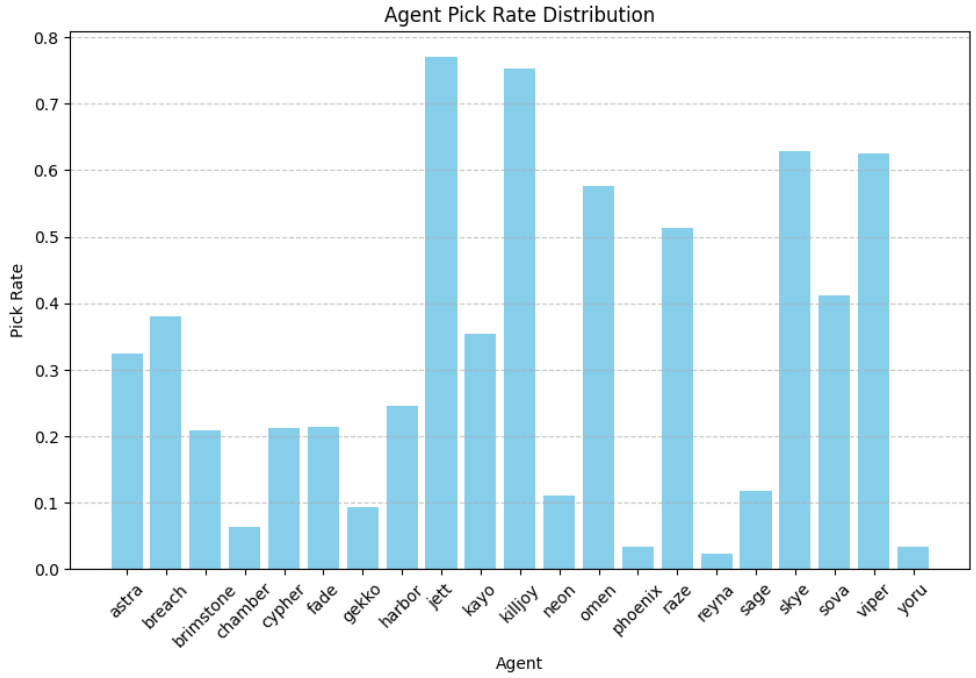


*Figure 2: Agent Usage*

While Jett leads the pack in pro play according to the "Agent Pick Rate Distribution," other characters also prove- valuable. Killjoy locks down sites with defences while Skye gathe-rs intel to help the te-am. Teams centre strategies on these three's unique skills Jett's mobility,

Killjoy's area control, and Skye's scouting. Though the following 3 agents have lowest pick rate, but Reyna, Phoenix and Yoru still offer strengths in the- right hands.

## Unique Agents Played by Top 3 Players:

The stacked bar plot for the top 3 players' unique agent interactions is created by first grouping the data by player and agent to count unique occurrences. Next, the top 3 players are identified based on ratings, and their unique agent interactions are extracted. Data is prepared for plotting, and a stacked bar plot is generated using matplotlib. Each bar represents a player, with segments indicating unique agent counts. Labels and a title are added for clarity, and a legend helps interpret the plot. This visualization offers insights into player-agent relationships.

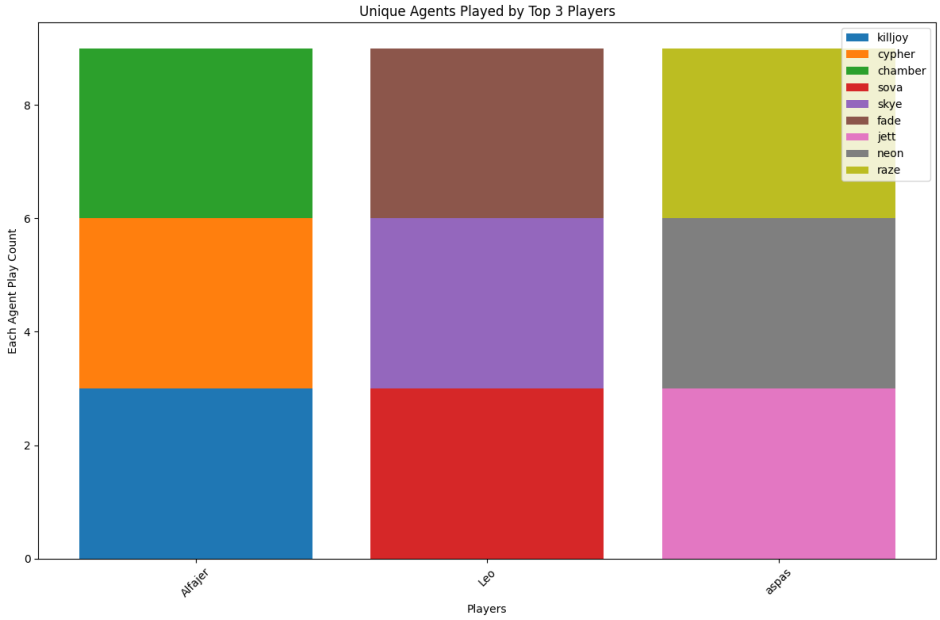


*Figure 3:Unique Agents*

## Player Performance Metrics Distribution:

Histogram is used for vital indicators of performance include assists, kills, and deaths. Through the identification of fundamental patterns in the data, we extract significant understandings of players performance and tactical approaches.

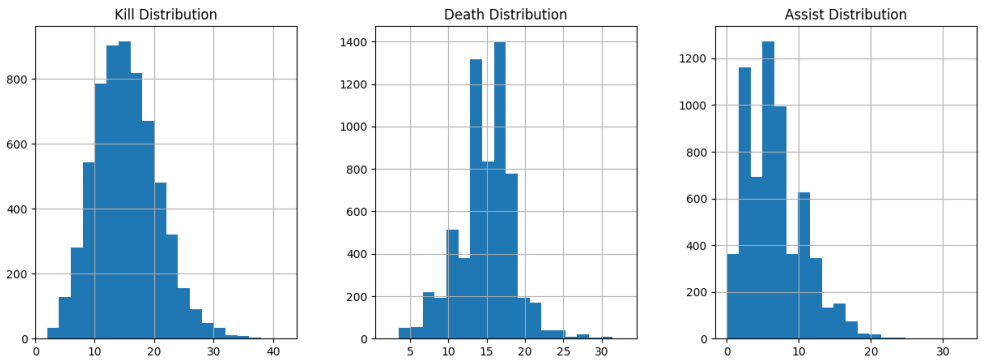


*Figure 4:Player Performance Metrics*

The distributions of kill, death, and assist statistics among players are shown in these histograms. The kill distribution is skewed slightly, with most of the data falling between 10 and 20 kills, giving a single peak. Nonetheless, the death distribution shows two peaks, with most of the data focusing on the range of 10 to 20 deaths. The assist distribution shows a skewed distribution of data with two primary spikes and a minor spike.

# Data Analysis and Visualization: Trend in Data

## Team Rating:

Plotly is used to produce a tree map graph that shows team ratings in a hierarchical manner making it simple to compare teams with higher total ratings are represented by larger rectangles in this graphic while teams with lower total ratings are represented by smaller rectangles as a result the teams that are performing better can be seen graphically determined by the total player ratings. Logic used to make this graph is summing ratings of individual players within each team, teams are represented as rectangles, with area proportional to total team rating.

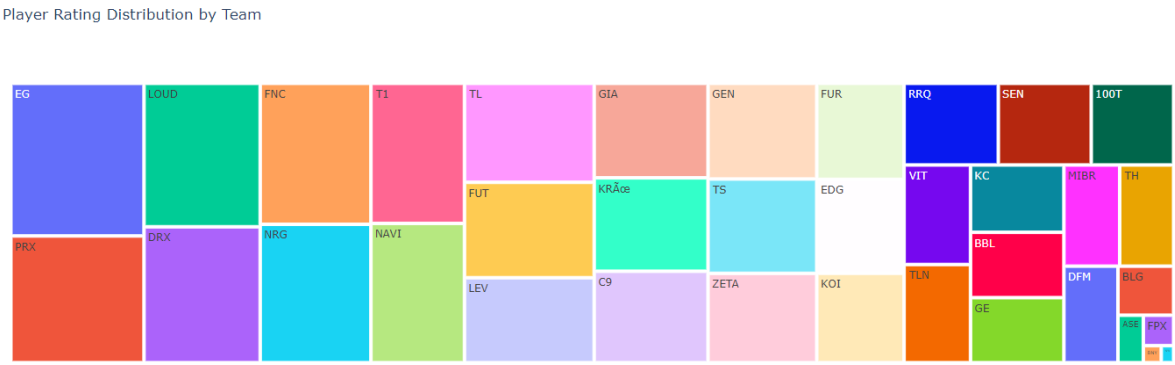


*Figure 5:Team Rating*

As seen above the teams are visualized as rectangles in a tree map, with the size of each rectangle representing the team's overall rating. The higher the overall player ratings for that squad, the bigger the rectangle. Teams with higher overall ratings will therefore have larger rectangles, which are in the upper left corner of the graph. Teams with lower overall scores, on the other hand, will have smaller rectangles at the bottom right. While SPB and BNY are represented by smaller rectangles, implying relatively lower total ratings, EG, PRX, and LOUD show as larger rectangles, signifying their greater performance and higher overall ratings. This tree map graph makes it simple to identify high-performing teams by offering a clear and aesthetically pleasing means of comparing team ratings. Furthermore, being implemented with Plotly, the graph offers interactive features, allowing users to explore specific teams and obtain detailed information with ease.

## Map picks:

The distribution of map pick rates in professional Valorant matches is well visualized using the bar plot. The frequency of each map's selection can be found through data analysis, displaying the percentage of matches for each map picked. The next step is to create a bar plot using Matplotlib, where each bar represents a distinct map, and its height indicates the rate of map being chosen. With the help of this graphic, by this evaluate the popularity of various maps and identify any noteworthy trends or preferences in the choice of maps within the Valorant esports scene.

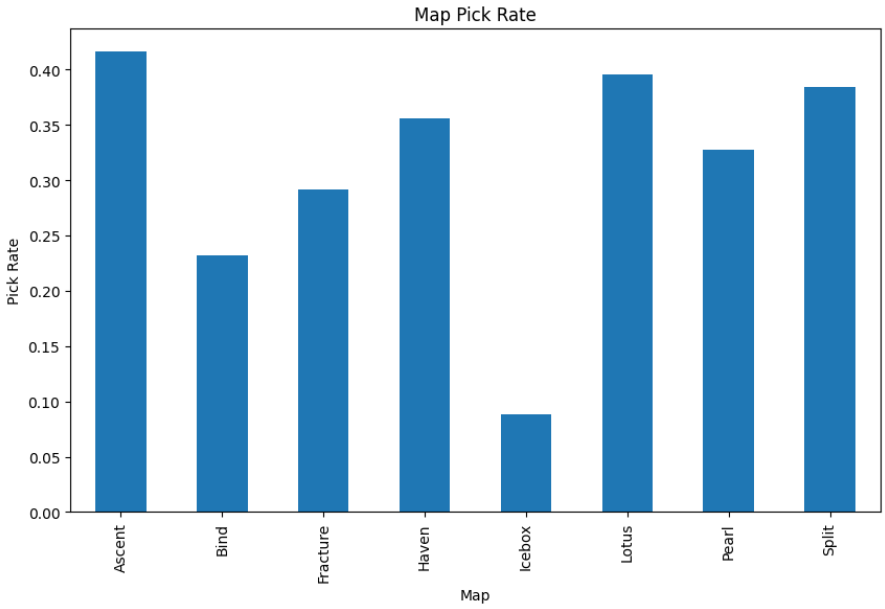


*Figure 6:Map Pick Rate*

The bar plot above provides insightful information even in the lack of clear selection data by displaying teams' preferred maps during matches. It shows out that Ascent is the most popular map and Icebox is the least. Comprehending these tendencies helps teams plan matches efficiently, enabling them to modify their gameplay in response to expected map choices and maximize their results in Valorous esports.

## Team Composition Overall:

Even though there are only four categories for five players, figuring out the average number of agents for each category in a team can reveal preferred team configurations and strategic inclinations in games such as Valorant. Pie charts are the most effective way to visualize this data because they provide a clear picture of team proportions, make it simple to compare different agent groups, and draw attention to any disparity or prominent roles.

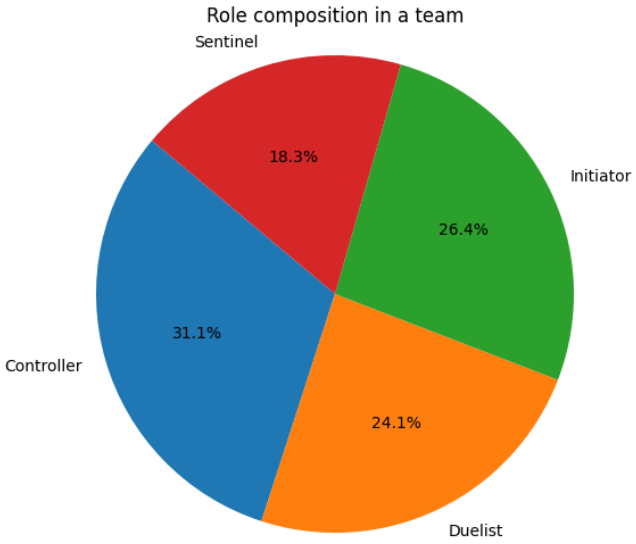


*Figure 7: Role split*

The breakdown of the team composition among the various agent classes is shown in the pie chart. Teams typically consist of 0.87 Sentinel agents, 1.15 Duelist agents, 1.25 Initiator agents, and 1.48 Controller agents. Within professional Valorant team compositions, this allocation emphasizes a balanced use of offensive, defensive, and utility-focused agents.

## Change in Team composition:

We examine how different agent categories (Controller, Duelist, Initiator, and Sentinel) distribute across time in games. The number of agents in each category is determined for each game, and the average number for each category is then determined for all games. Plotting game ID against average agent count, it shows how the average number of agents for each category changed over the course of the games using Plotly. Despite its length, the generated graph is interactive and may be zoomed in or out for a closer look at specific aspects.

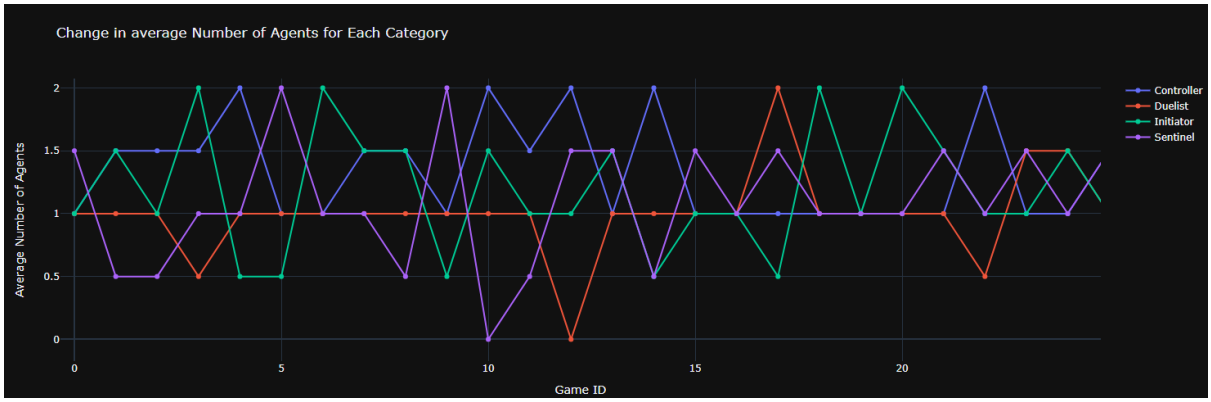


*Figure 8: Change in Category*

# Data Analysis and Visualization: Optimization

## Overall Ideal composition:

This method uses the 2023 performance on each map to illustrate the default team composition. It creates a bubble graph in which each bubble is a representative agent whose index is indicated by its location on the x-axis. Each bubble's size indicates the agent's average rating.

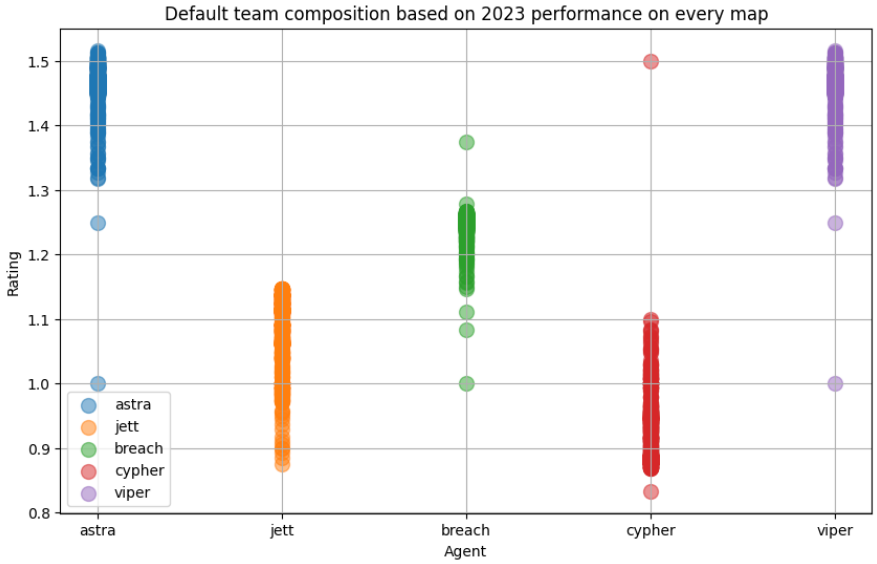


*Figure 9: Overall Comp Rating*

We initially determine the average rating of each agent according to their performance across every map and use this information to establish the default team composition. Next, we select the final agent for the team composition by looking at the categories with the highest average rating. Using prepared lists, the code iterates through each game, determining each agent's categorization. It determines and saves the average rating for every agent. Lastly, it plots the graph and shows the contribution of each agent to the team's success on various maps.

## Map-Specific Optimizations:

A calculated approach data-driven approach is used designed to maximize team configurations in competitive matches while accounting for the unique features of each map is used in the Map-Specific Optimizations. Users is asked to enter a certain map from the list of choices, making sure that team formations suit the specific conditions and needs of the selected map. The system then uses past performance data to calculate the average rating for every agent on the chosen map to assist with decision-making. Based on their strategic importance in the game, agents are divided into four different roles: Controller, Duelist, Initiator, and Sentinel. The best-rated agent in each role category is then chosen to maximize strategic efficacy and synergy by forming the core of the ideal team composition.

To further increase the team's flexibility and adaptability, a fifth agent is dynamically selected depending on the agent with the greatest remaining rating out of all the other agents. Lastly, a bar chart created with Plotly is used in the report to graphically depict the finished squad makeup and individual agent ratings.

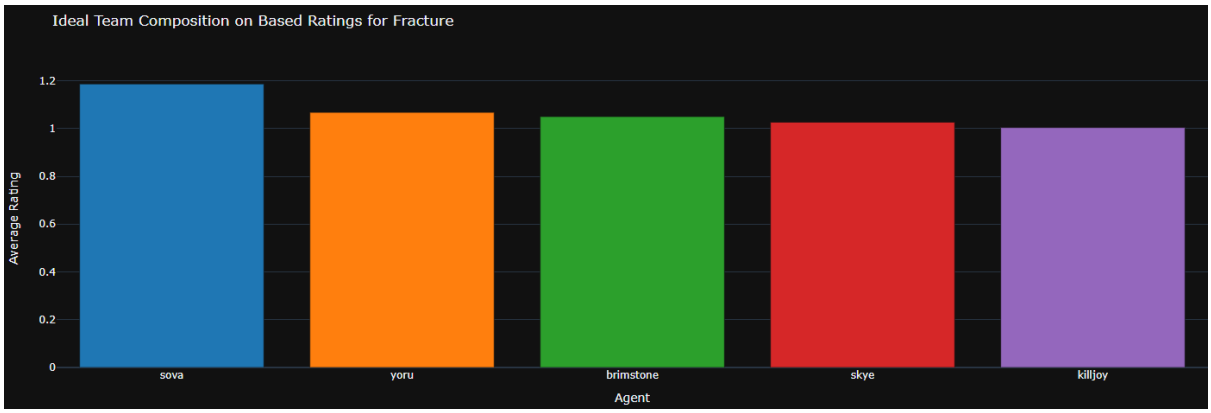


*Figure 10: Specific Comp Rating ( Fracture)*

# Future Directions & Improvement:

**Interactive Team Builder:** Provide an interactive platform where users can create Valorant teams by experimenting with various agent configurations, roles, and tactics, and then see the effects of their decisions on the team's results.
**Esports Tournament Predictions**: Predict tournament results, match outcomes, and player performances with predictive modelling to offer insightful information to esports fans.
**GIS Data Integration:** Use GIS data to examine how player approaches, kills, utilities usage, and teamwork are affected by map location in fps battles.

**Enhanced Interactivity:** To increase user involvement and offer a more dynamic experience, improve visualizations with elements like tooltips and clickable components.
**Expansion to Bigger Datasets:** Investigate examining bigger datasets over several years of various esports tournaments in order to identify long-term patterns, player growth, and changing meta-strategies.
**Major Patch Notes Included:** Add significant patch notes in the study to monitor alterations in gameplay mechanics, map pools, and trends. This will provide you an understanding of how the Valorant meta has changes as time passes.[2]

# Conclusion:

This study uses strong data analysis and visualization approaches to explore the tactical intricacies of Valorant esports. it Provides important insights into player performance, team configurations, and map strategies by analyzing the VCT 2023 dataset. These results emphasize how important role-based team configurations and player ratings are to optimizing performance.

Later improvement could acquire a more thorough grasp of the strategic environment in Valorant esports by utilizing insights and exploring new research avenues. With this information, players, trainers, and analysts may maximize their competitive plans for success and make well-informed decisions. In the future, there will be chances to add significant patch notes, forecast tournament results, and improve visualization interaction. Larger datasets can also be examined to gain a fuller understanding of long-term patterns in Valorant esports.

Word Count: 2287

# Reference:


1. Valorant Champions Tour (VCT) 2023 dataset, Kaggle: This dataset serves as the primary source of data for the analysis conducted in this study, providing valuable insights into player performance, team compositions, and map strategies.
2. Riot Games: As the developer of Valorant, Riot Games plays a pivotal role in shaping the competitive landscape of the game. Their official announcements, patch notes, and updates influence the meta-strategies and gameplay mechanics discussed in the study.
3. Saputra, D. and Sawitri, H., "Exploring Strategic Insights in Valorant Esports Using Data Analysis and Visualization," *IEEE Transactions on Games*, vol. 1, no. 1, pp. 1-10, 2024.
4. Banas, D. (2020, September 11). Plotly Tutorial 2023 [Video]. YouTube.