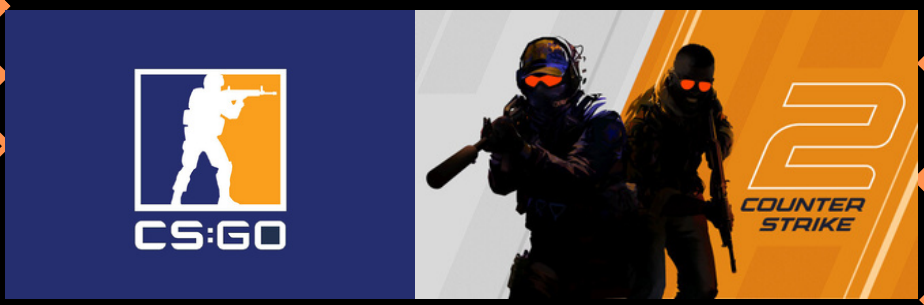
2024

CSGO & CS2 COMPTETITIVE LANDSCAPE

PROCESS BOOK



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Introduction

Intro

CSGO is a multiplayer online competitive first-person shooter game, which has matured into a highly competitive e-sport with a plethora of leagues, including the renowned Majors, as well as BLAST Premier, IEM Extreme Master, ESL Pro, Flashpoint season, and others. With numerous secondary events, there are thousands of participating teams, and peak viewership can reach millions, making it incredibly popular. We have collected match data from the past few years and visualized it in an engaging and intuitive manner, showcasing information about players, in-game weapons, and maps. We believe this will offer both seasoned viewers fresh insights and newcomers a glimpse into the thrilling world of CSGO.

Goal

The goal is to guide the user through a comprehensive view of the competitive Counter-strike esports landscape. Just like traditional sports where people get attached to teams in tribal-like behavior and elevate players to an almost god-like status, e-sports fans also have their superstar teams and players. Since this game has been around for a long time, users will be able to get to know these players and teams, and what some of their accomplishments are across a small time window. In addition to the players and teams, we want users to know about the game itself, and what more represents a first-person shooter game than the guns and their effects on the players in the game.

Target Audience

This website is for anyone who feels interested in Counter-Strike. We strive to cater to the needs of both casual players exploring information of the game in an attractive way and hardcore fans looking to find detailed statistics of the game.
As one of the most popular first-person shooter(FPS) video game, Counter-Strike has become a cornerstone of the esports community since its initial release in 1999. It is a true milestone in FPS game history, which has a large influence on more than one generation of FPS game fans. However, there's no existing website that meets the need to have informative, interesting and interactive visualizations of the game. Our website is such a website for every CS fan.

Design

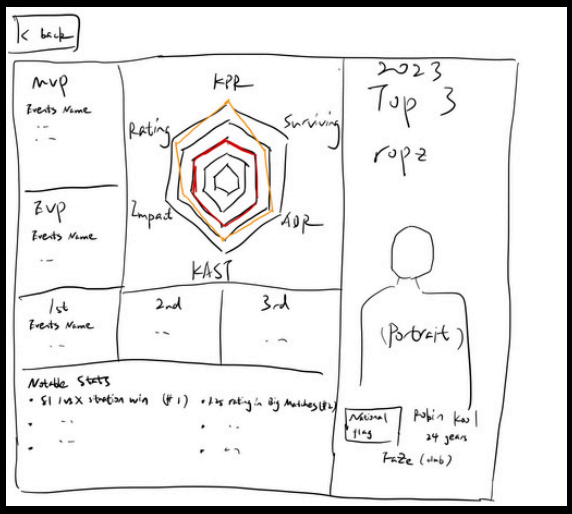
Brainstorming
We started off with many different ideas that ended up being represented already, such as basketball, football, animes, and movies. We found that other people had already done many great projects visualizing data from these fields. We decided to seek something else. We looked at protein data visualization as it seemed like something that hasn't been looked at, and had a lot of potential, especially with the exponential rise of newly discovered proteins as time goes on, and the interesting challenge of representing proteins in a 3d format. After looking into the data a bit more, it looked like it wasn't going to be easy to get access to organized data, and we would have to go through a lot of effort. So we moved on to the idea of the game Counter-Strike, which we all were familiar with. This seemed like a common interest that we could work on together.

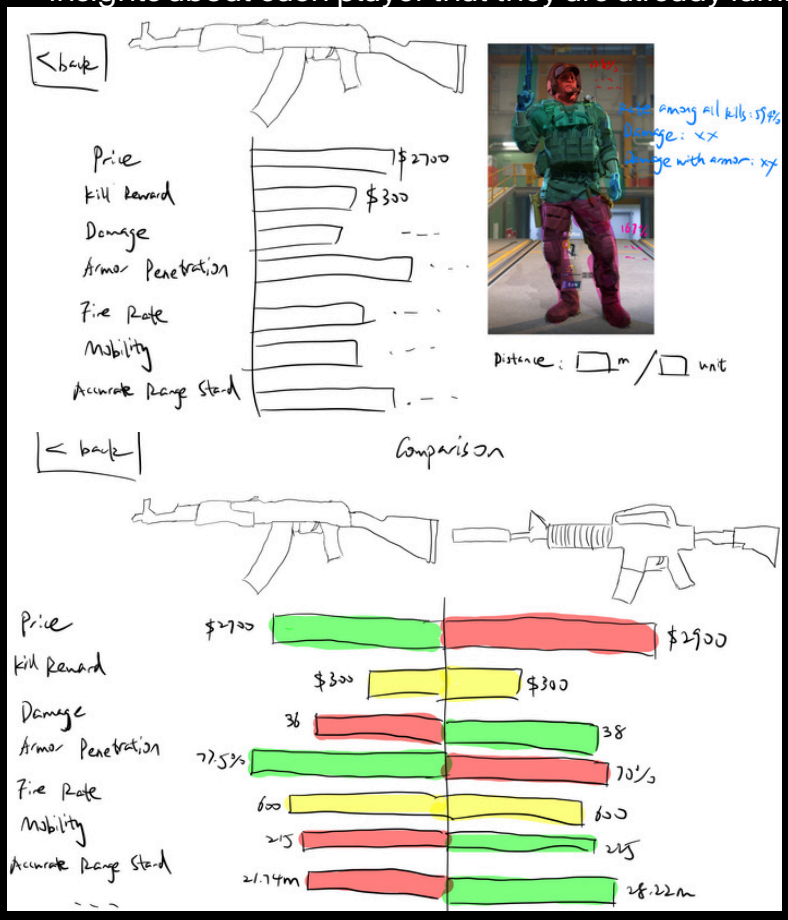
Dataset
Initially, we found a dataset of professional CSGO matches on Kaggle, which was quite comprehensive, encompassing the four datasets mentioned in milestone 1, including player statistics for each match, map data, match outcomes, and more. While these data were sufficient for visualizing map-related information, we sought additional datasets to visualize weapon data and individual player statistics.
For dataset of weapons, we found a CS2 Weapon Spreadsheet done by BlackRetina and SlothSquadron including almost any detail that we need. Finally, we wanted some representative data of the individual players but couldn't find public datasets. So we built our own by collecting data from the HLTV website's top 20 lists for the stats and achievements of the players. Those were then formatted neatly into JSON to be used for the data visualizations. The top 10 players from 2018 to 2020 are represented along with their teams, nationalities, notable achievements, etc.

Design of the three visualizations
Since our website's target audience is for all people that are interested in Counter-Strike, we want to present three different aspects of the game: Top players, Weapons and Maps. Check next page for more details.

Design

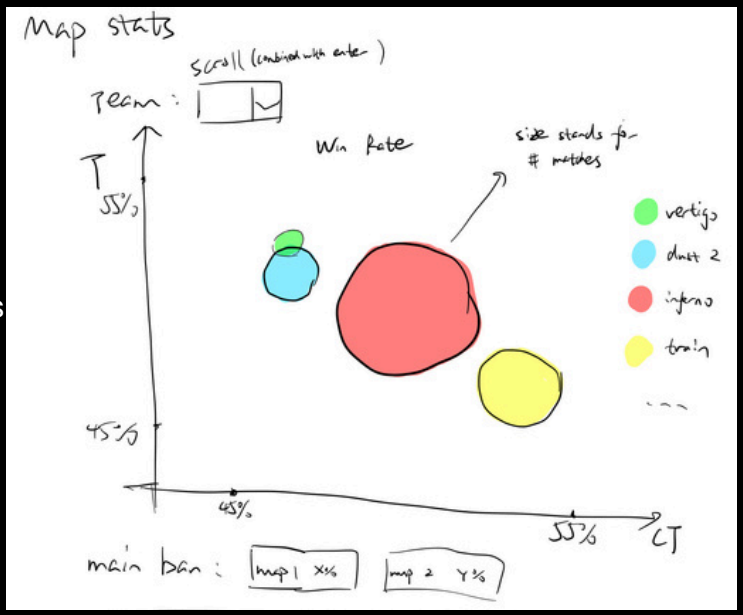
The way we designed to display the top players was inspired by HTTV and some video creators. After selecting the top player from ID and active year, a chart like this will be shown. On the right side, the basic information of the player is displayed. The hexagon represents six representative dimensions(with explanation) to measure player's performance. Red hexagon represents the average among all players, while the orange hexagon represents this specific top player. Awards, honors and notable features of the player in this year will also be listed. This visualization could help new players get to know top players. At the same time, hardcore players can also have deeper insights about each player that they are already familiar with.





For the weapons section, since each weapon has different characteristics, we selected seven attributes that can largely represent each weapon's features. After selecting the weapon that the user is interested in, a bar chart and an agent(figure) will be shown. The bar chart includes the seven attributes selected. When you put your mouse on each body part of the agent, the corresponding information will be shown next to your mouse. For example if you put your mouse in the red region (head), the damage taken by this weapon with and without armor will also be calculated based on distance. You can enter the distance and the damage will be updated based on that automatically. For comparison, after selecting two weapons, a double-sided bar chart will be shown. This section is very informative for every fan of Counter-Strike. Because even the pro players cannot remember every detail of each weapon. It is very straight forward because bar chart is chosen for this part. Besudes, it is quite interesting when users place mouse on the agent as if it's really in the game.

For the Maps section, we choose bubble chart as the way to visualize. We decide to integrate professional teams' performance with map statistics so that users can know the map statistics from high level matches, and get a glimpse of each teams' performance on each map at the same time. After selecting the team and year, the x-axis stands for the win rate when the team plays as CT and the y-axis stands for the win rate when the team plays as T. The bubbles with different colors stand for different maps. The size of the bubbles indicates the number of matches player by the team within the year. What's more, the most disliked maps of the team will also be shown with ban rate or number of bans.



Top 10 Players

Presentation of the visualization

This visualization is intended to give users a detailed overview of the top 10 players, allowing them to get to know these players one by one over the period of 2018 to 2020. This goes for basic information about them like their first and last names, username, their country of origin, their ranking in the year, and the team they are a part of. In addition, there is a list of awards, like MVP awards (Most Valuable Player) given to the standout player in a tournament. This is usually a player that had the most significant impact on their team's success. Another awards list is EVP (Exceptionally Valuable Player) given to players who perform exceptionally well but may not have been the absolute best player in the tournament. In addition, there is a section detailing the team achievements where a player's team was placed, first, second, or third in tournaments. The central part is a radar chart that shows the player's stats (shown in orange), while comparing them to the average of the top 20 players (shown in blue). These stats are abbreviated: KPR - Kills per round (average), Surviving - the % of rounds the player survives, ADR - average damage per round dealt by the player, Impact - a player's influence in rounds, Consistency - how consistently a player performs well over time, and finally Rating - a comprehensive stat that combines various factors such as skills, death, damage, multi-kills, clutches, etc.

Technical Details

This chart was built using the d3.js library along with HTML, CSS, and Javascript. The visualization relies on a global state that holds which year is selected as well as which player. The state is changed through setter functions that are triggered whenever the year or player is changed by the user.

Challenges

There were two main challenges faced when building this visualization.

1. No publicly available dataset had the information we wanted to display as is, it was scattered throughout different webpages in the HLTV website. This meant that we had to go through this website and build the dataset ourselves which was time-consuming and prone to errors. We reduced our original goal of 20 players per year down to 10.
2. There were too many HTML elements that had to change everytime one of our variables was changed (year or player), so managing that was a bit difficult to develop, until we adopted the strategy of the global state that can only be changed through two functions that ensure everything is changed correctly.

Usage/Functionality

Users are able to select the year for which they want to see the top 10 players and select which player within this year they would like to see detailed information about. This selection prompted the main visualization to change the information to display the selected player of the selected year.

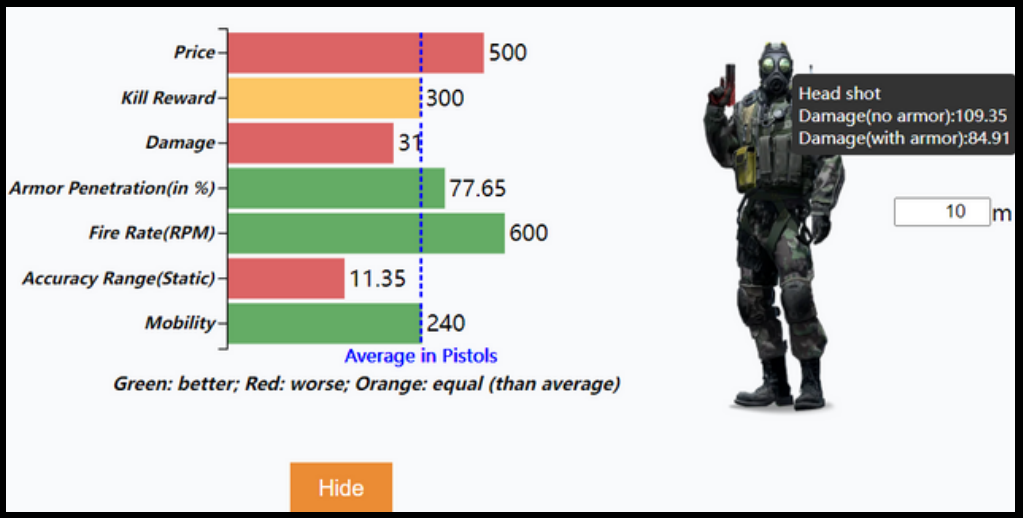
Weapons

Presentation of the visualization

This section aims to give detailed statistics about the weapons available in the game, including price, kill reward, damage, armor penetration(in %), fire rate(RPM), accurate range(when stand still) and mobility, which are the seven most representative characteristics of weapons. Different types of weapons have different advantages and disadvantages. For example SMGs (Submachine guns) are cheaper than Rifles, and with higher mobility and fire rate. However their damage and armor penetration are much worse than Rifles. Therefore, we divide this section into four subsections according to the four weapon types in CS (Pistols, SMGs, Rifles and Heavies). In each subsection, the weapons' name and image are displayed in grids. When user feels interested in one specific weapon, one can click on the image and more details will be shown. The details will be discussed in Usage/Functionality. Below the four subsections, there's also a "Weapon Comparison" part to directly compare the statistics of two selected weapons of any type.

Technical Details

This chart is built with the d3.js library along with HTML, CSS, and Javascript. As normal, HTML includes the basic structure and CSS contains the styles for classes and elements. In Javascript, functions for showing the grids, charts, comparison, moveTooltip(for showing damage when mouse is on the agent) etc. are implemented.



Challenges

There were two main challenges faced when building this visualization.

1. The data for this section is from a view-only google sheet. Images also need to be downloaded one-by-one. So the data collection and reorganization is time-consuming.
2. This section includes many calculation like average and the damage shown on the agent(changing with distance, different armor penetration and headshot multilplier). It needs to be careful and needs a lot of verifications.

Usage/Functionality

In each of the four categories, user can click on the weapon image that he/she is interested in. Then three things will be shown. The first is a bigger version of the selected image. The second is a bar chart displaying the seven attributes of the selected weapon. The average line for this category will also be shown. If the selected weapon performs better than the average in one attribute, the color of that bar would be green. Or if it's worse, the bar would be red and if it's equal the bar would be yellow. The third thing displayed is an agent. When a user put the mouse on different part of the agent's body, the corresponding damage done by the selected weapon will be shown. The User can also modify the shooting distance next to it, so that the damage will be updated when the user put the mouse on the agent again. The damage is calculated based on the weapon's damage, armor penetration, headshot multiplier, and range modifier. For the comparison part, the user can select any two of the weapons(not necessarily in same category), and a double sided bar chart would be shown, so that the user can compare the various values of the two weapons more intuitively.

Map Statistics

Presentation of the visualization

This visualization aims to showcase the win rates of different teams on different maps as Counter-Terrorists (CT) and Terrorists (T), as well as to determine the most frequently banned maps by analyzing their ban selections. To better understand this dataset, let's briefly introduce the rules of CSGO matches. While the ban selection rules for maps may vary slightly across different events, years, and match stages, the general practice is for each team to ban 2 to 3 maps. For this analysis, we're using data from 2015 to 2020, during which the map pool underwent changes. The maps included in all analyzed matches are 'Overpass', 'Nuke', 'Train', 'Cobblestone', 'Vertigo', 'Cache', 'Dust2', 'Mirage', and 'Inferno', totaling 9 maps. In each match, both teams take turns playing as T and CT sides, with sides switching after the first half.

Technical Details

The map data is primarily presented through a bubble chart, built using HTML to establish the basic framework. This includes the title, subtitle, search bar, dropdown menu, bubble chart, time slider, and the least favored maps by each team, with all applicable options displayed if multiple. The CSS file adjusts the styles to ensure the overall webpage appears harmonious and appealing. The JavaScript script includes the map data interface, directly reading the data file saved in JSON format after being processed by Python. It then populates the team names in the dropdown menu, filters the corresponding data based on input from the search bar, dropdown menu, and time slider, and finally utilizes d3 to draw the bubble chart.

Challenges

1. Due to the vast number of teams, manual dropdown input isn't feasible. Thus, dynamic population directly from the original data is essential.
2. Similarly, with many teams in secondary leagues, a search box aids in finding popular teams. The bubble chart is updated based on any changes in the dropdown menu, search box, or time slider. To avoid confusion, when using the search bar, the dropdown menu should be cleared, and vice versa. And this may also clear the dropdown menu, so it takes some time to update bubble chart, dropdown menu and search box correctly.
3. When drawing the bubble plot, multiple bubbles may overlap, making it difficult to discern. Therefore, a feature is added to highlight the selected map when the mouse hovers over a specific map in the legend. Initially, there were some difficulties due to unfamiliarity with callback functions, but they were ultimately resolved by consulting the relevant usage instructions for d3.

Usage/Functionality

New viewers who haven't watched matches before can select teams through the dropdown menu, while seasoned viewers can directly search for teams of interest using the search bar. After selecting the year, they can view the win rates of the selected team on different maps for the chosen year. Each bubble represents a map, with the horizontal axis indicating the T-side win rate and the vertical axis indicating the CT-side win rate. The size of the bubble represents the number of matches played on that map. If interested in a particular map, hovering the mouse over the corresponding map in the legend on the right will highlight it. Finally, the maps most frequently banned by the selected team will be displayed along with a preview.

What we get

Through this project, we not only became more familiar with tools like d3, HTML, CSS, and JavaScript, and gained a solid understanding of front-end web development, but we also learned how to connect our data visualization with the target audience. We effectively showcased the data in a more intuitive and engaging manner for our audience. Additionally, our skills in data processing have improved significantly.

Future work

For the top 10 visualization, the most basic improvement is expanding the dataset because data already exists, but having it in a computer-readable format is the problem. Tools such as web scraping and AI to extract structured data from unstructured text could make it much easier. Another feature could be to select to players to compare stats, or even the same player across different years to see their evolution.

For the weapons visualization, there are two potential improvements. First is more techniques can be applied so that the bar chart can look more fancy and advanced. Now it is informative and straight forward but not super impressive. Second, the agent that shows damage when user puts mouse on can be improved to 3D and able to move by itself.

For the maps visualization, the layout, chart colors, and overall visual effects of the page can be further refined, and adding some CSGO elements would make the page more cohesive. Additionally, I believe it might be beneficial to include actual maps rather than just preview images. These could be used to display in-game map-related statistics, such as common locations for skirmishes, represented as heat maps.

Peer Review

Gerard

- Exploratory Data Analysis (EDA) in milestone 1
- Website skeleton for milestone 2
- Visualization 1 - Dataset creation
- Visualization 1 - Design and coding
- Parts of the process book

Haochen

- Text in milestone 1
- Ideas&sketches&plans for all three visualizations in milestone 2
- Visualization 2 - Data collection and selection
- Visualization 2 - Design and coding
- Parts of the process book

Jiaxin

- Dataset in milestone 1
- Ideas about visualizations and part of report of milestone 2
- Visualization 3 - Dataset cleaning and processing
- Visualization 3 - Design and coding
- Parts of the process book