Analysis of Team Fortress Two Game Log Metrics to Determine "What Success Looks Like"

Authors:
Phil Dontje
David Walker

Advised by:
Dr. Ruth Vanderpool
TMATH342 Applied Topology

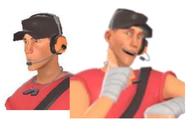
Abstract: This project looks to **identify some metrics of success for a team in a game** using TDA outside of more obvious reasoning, e.g. capturing points. Additionally, we looked to see what other types of interesting data points we might discover when combing through over 30,000 game logs.

About the game: Team Fortress Two is an online multiplayer first person shooter video game that was first released on the Steam gaming platform in 2007. Since then, the video game has maintained enough of a following to remain a popular and continuously played game on the platform. The goal of the game is to capture control points by defeating enemy gamers.

TF2 has nine playable classes, but only four are typically played in a 6 versus 6 match:

- **2 Soldiers:** Able to use explosives to deal large damage and maneuver quickly around the map at the cost of health.

- **2 Scouts:** Very mobile with speed and double jump. Uses a shotgun to finish off weak enemies and hit airborne targets.

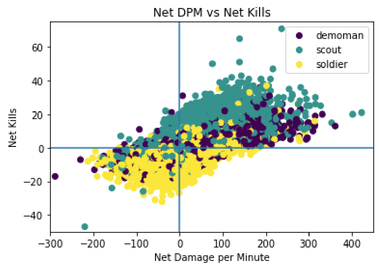


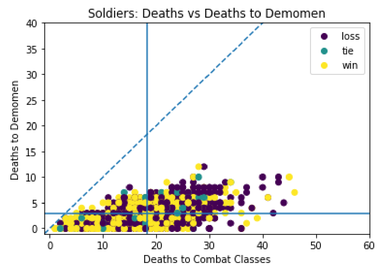
- **1 Demoman:** Explosives expert able to plant traps and deal large amounts of damage. Uses these explosives to deny enemies from standing in specific areas.

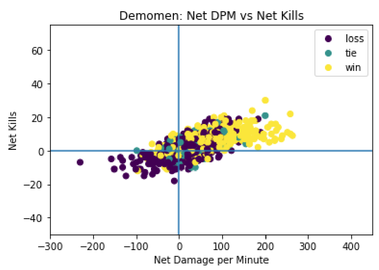
- **1 Medic:** Heals teammates and builds "ubercharge" which gives temporary invincibility when activated, but has low combat ability. Medic is a big target in the game due to these abilities.

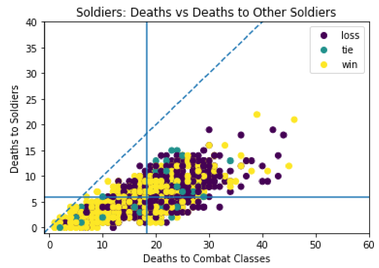
Analyzed Metrics:
- **Kills:** Number of kills a player gets in a single game, split via classes (e.g. medic kills, scout kills, etc.)
- **Deaths:** Number of times a player died in a single game, split via classes (e.g. deaths to scout, deaths to soldier, etc.)
- **Damage Per Minute (DPM):** Average amount of damage a player dealt to other players, per minute, in a single game
- **Damage Taken per Minute (DTM):** Average amount of damage a player received from other players, per minute, in a single game

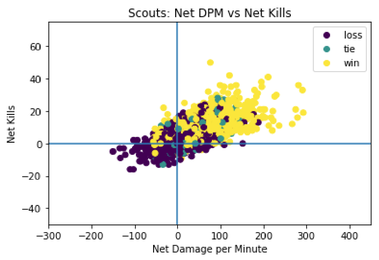
Methods: First we looked at net damage dealt and received vs each class to determine which character class overall is the best to use, and has the highest success rate in games. Also, **by looking at our data we discovered that games where the soldiers were killed more often by scouts resulted in a victory for the opposing team.** We then analyzed this by class to see if the numbers stayed consistent.

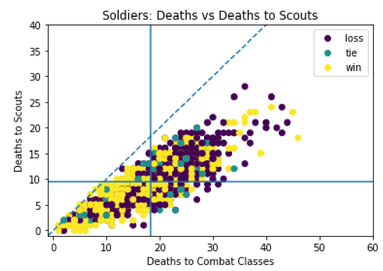


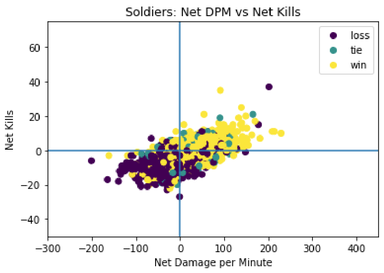






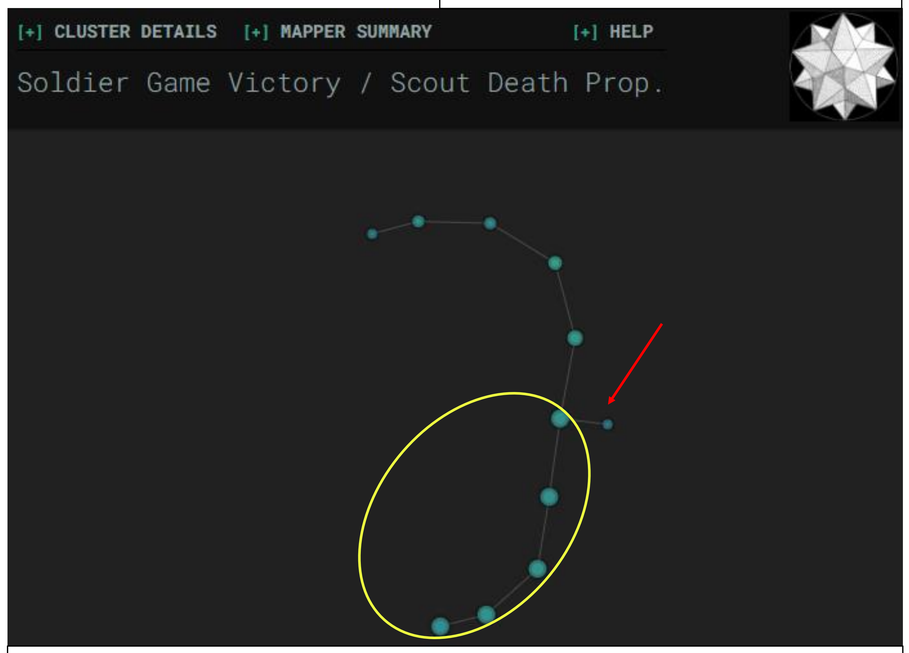






Initial Analysis: The soldier graphs stood out as being the worst with regards to net damage and net kills along with the largest number of wins with "suboptimal" statistics. We tried to see if there was any reasoning behind this. **One insight we sought to prove was that soldiers were dying a lot to scouts**. We looked to confirm the results in the scatterplots by projecting the multidimensional data into Kmapper with **random samples of 5000** game logs.

In this data set and the Kmapper of the data set below, we see the **instability of the data** giving us some outliers, but **not enough clear visual evidence to fully validate our original prediction based on the parameters we set here.** In all three Kmapper graphs, we sampled 5000 random games from the larger population of 30,000. Both red arrows in the smaller graphs depict our outlier clusters.



Conclusion: Once we looked at Soldier game victory and losses in proportion to deaths by scouts , **we saw a validation of our results** from the scatter plot in this final Kmapper graph above. **The highlighted yellow circle of clusters shows that soldiers are losing games in which their proportion of deaths to scouts is greater than 53% on average. The one outlying cluster, denoted by the red arrow shows a game where the team won, even though 57% of the soldier deaths were caused by scouts.** What is also interesting, is the fact that scouts make up 40% of the damage dealing classes on a team, and they are, on average, **causing soldier deaths more than 40% of the time.** Another interesting point about this Kmapper graph, is that clusters appearing above the spur depict games in which teams won, even though many of these still show the proportion of soldier deaths to scouts over 40%. We can see based on the size, that these instances are fewer in number.

Contributes to Mathematics Major SLOs: 5,6,7

References:
Clement, J. (2023, March 27). Team Fortress 2 peak players on steam 2023. Statista. https://www.statista.com/statistics/1056510/team-fortress-2-number-players-steam/
Howarth, J. (2023, January 18). How many gamers are there? (New 2023 statistics). Exploding Topics. https://explodingtopics.com/blog/number-of-gamers#
Recharge Gaming League. (2016). The largest Team Fortress 2 (TF2) league. RGL.gg. https://rgl.gg/
Team Fortress Two/Steam. (2016). Team Fortress 2 stats. logs.tf. https://logs.tf/