

# In-Depth Statistical Analysis and Survivability of PlayerUnknown's Battlegrounds

## Extended Abstract

Group: 02

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## ABSTRACT

PlayerUnknown's Battlegrounds is a battle royale game-mode that will put up against 99 other players on a remote island for a winner-takes-all showdown. Players enter the island and try to locate weapons and supplies in a tactical battlefield that forces players into a shrinking playzone.

## CS CONCEPTS

- Data mining, aggregation, plotting, correlation, data analytics



Figure 1: The official banner for PlayerUnknown's Battlegrounds

## 1 Problem Statement

A complex problem that players run into before every game is where to eject from the plane and which site to land. Our focus in this project will be to optimize player choices within the early, middle, and late game. Early game decisions such as areas to drop will greatly increase a player's ability to survive towards mid game. By analyzing the areas where players die the most, we can see areas to avoid, allowing players a higher probability of making it past the 40 players left mark. We will look at distance traveled to see if travelling more often will give a player a higher chance of surviving. This can affect player behavior during the middle and end of the game. If travelling decreases a players chance of surviving, we can draw the conclusion that "camping" can be an efficient method to win the game. We can also do analysis of weapons to help players choose an arsenal that best fits their needs. We will aggregate weapon and death data to determine which weapons are most efficient at long range. We can also see which weapons have the most kills at the end of the game, so that players can determine what weapon they should have to win the battle royale.

## 2 Literature Survey

- “PUBG Analytics: Final Circle”

<https://www.kaggle.com/skihikingkevin/final-circle-heatmap>

This data mining project plotted a heat map of the frequency of where the final circle appears.

- “PUBG Data Analysis”

<https://www.kaggle.com/chegeerland/pubg-data-analysis>

This project explored where most people jump out in PUBG. Findings indicate that most players jump near military base, school, prison, and the northern cities.

- “PUBG 50 Million Death Map”

<https://public.tableau.com/profile/stewart.uyeda#! /vizhome/pubg50mildeathmap/pubg50mildeathmap>

This project explored where the deaths occurred during the game. They plotted a interactive Tableau heat map that steps through game time and illustrate the locations of deaths.

## 3 Proposed Work

First we will search for data containing null entries where there should be an entry and remove such instances. Then, we will split entries between the two different maps, because the two different maps have two different sets of weapons, and the location data is map specific. We can look at a lot different events, and so we can separate the data into the appropriate forms.

Our work will involve data manipulation in order to separate the large data set into relevant subsets. We will calculate the effectiveness of weapons using statistical analysis methods discussed in class. We will use players' location data to find the “hot” areas of the map and to find the distance between the players.

For drawing a conclusion on weapon effectiveness, we will look at entries from solo matches, in order to remove uncertainty in the data. This is because the game allows players to get back up after getting “knocked out” in games with teammates, and the cause of death will not reflect what knocked them down in the first place. Thus, we will be uncertain of a certain weapon’s actual effectiveness in the game. Therefore, we will only look for games in which the players do not have duplicate placements when data mining for weapon effectiveness.

We will use values such as killer\_position\_x, killer\_position\_y, and victim\_position\_x, victim\_position\_y in order to create heat maps of “hot” areas on each of the maps. We can also use these values as a method of gauging the effective range for each weapon type. We will publish heatmaps and player locations overlayed over the map of the play area.

Our work will use Jupyter Notebook in conjunction with the Pandas and Numpy modules to reveal such things about the matches in Player Unknown’s Battlegrounds.

After data cleaning and plotting, we will use the visuals and calculations to infer some key points from our data. For example, from our data, we can mine that snipers are more likely to kill for long distances. We can mine information such as the best weapon to use if a player wants to accrue the most kills, areas to avoid with high victim placements, areas to land to avoid killer positions, and much more.

## 4 Dataset

The original dataset:

<https://www.kaggle.com/skihikingkevin/pubg-mat-ch-deaths/data>

This csv / xlsx document contains the first 1 million entries from the Kaggle PUBG death dataset:

<https://github.com/jatr6994/csci4502/blob/master/PUBG%20Death%201million.xlsx>

The dataset contains information regarding:

**match\_id:** nominal string

**map:** ordinal string

**time:** interval integer

**killed\_by:** nominal string

**killer\_name:** nominal string

**killer\_placement:** ordinal int

**killer\_position\_x:** interval Int From 0 to 800000

**killer\_position\_y:** interval Int

**victim\_name:** nominal string

**victim\_placement:** ordinal int

**victim\_position\_x:** interval int

**victim\_position\_y:** interval int

## 5 Evaluation Methods

- Finding the best weapons for use early game
- Average range of kills with each gun
- Heat maps of kills vs deaths?
- Average heatmap of casualties for each map
- Common weapons for players in top 10

## 6 Tools

We will be using:

- Anaconda/Python
  - High-level programming language focused on statistical analysis. We

will be using this tool for most of our calculations.

- Jupyter Notebook
  - Open-source web application that allows us to create and share live code, equations and visualization of data. Most of our presentation will be done through a Jupyter Notebook. Our code, explanations, and plots can all be shown through a notebook.
- Tableau
  - Will be used to also visualize our data if necessary. Tableau is an easy to use drag and drop application used to create visualizations.
- Matlab Plot
  - Allow us to give visuals of our data. We will import Matlab Plot into our Jupyter Notebook and use it to plot important aspects of our data frame.
- Pandas
  - Used to read in our dataset and store it into a dataframe. Allows for easy data cleaning and processing. We will use Pandas' functions to process and clean our dataset. Pandas provides us with functions that easily remove NaN values as well as outliers or values that just don't make sense.
- Numpy
  - Fundamental python library used for scientific computing. It contains tools that are useful for algebra and arrays.
- Scipy
  - Python-based software for mathematics, science and engineering.
- Other Python libraries as needed

## 7 Milestones to Do

- Analyze deaths according to position dropped. Analyze survival rates depending on position dropped.
- Statistical analysis on most efficient weapons, distance of bullets travelled, most popular guns.
- Consider using data from the “Aggregate” dataset which can be found on Kaggle to elaborate more on our findings.
- Calculate correlation between player distance travelled and player placement/rank.
- Calculate correlation between player walking distance and player placement/rank.
- Calculate the correlation between number of assists, dmg, and kills.
- Mine data from our plots and calculations to create an overall guide at the end of our Jupyter Notebook.
- More to come

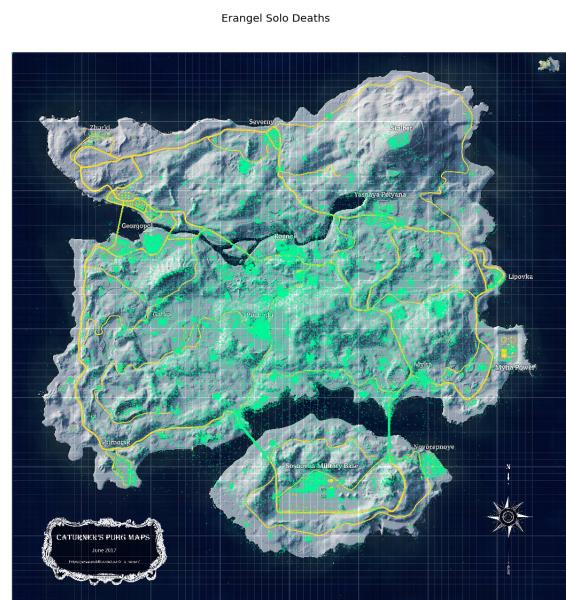
## 8 Milestones Completed

- Clean and process data based on solo games
- Clean and process data based on maps
- Clean and process weapon data to remove null positions
- Cleaned outliers from victim and killer positions (i.e. a punch with a distance of 2000 units)
- Got data on most popular guns
- Got weapon data for each map
- Got weapon data for average distance killed for each weapon.
- Plotted and overlay of victim positions over the respective maps.
- Plotted the frequency of each weapon used on a victim on respective maps

- Plotted the average range of each weapon use on a victim on respective maps.
- Statistical analysis on most efficient weapons, distance of bullets travelled, most popular guns.

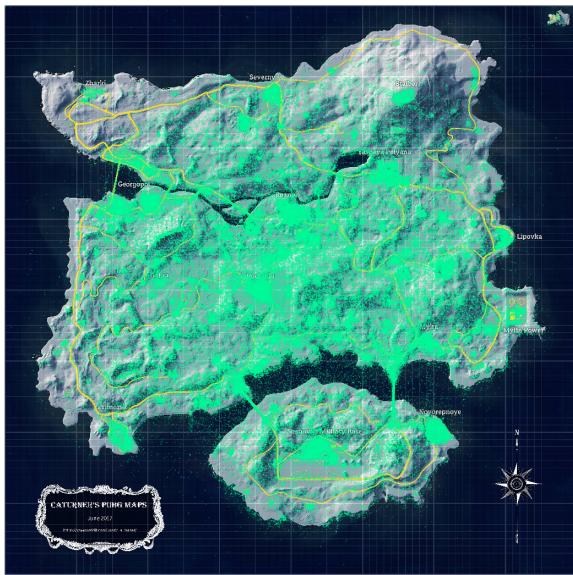
## 9 Results So Far

- Heat map using a scatter plot to show where the most common deaths occur for the Erangel map for solo matches.



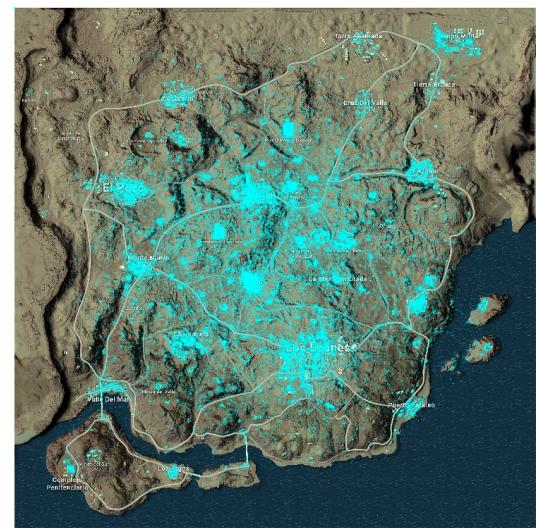
- Heat map using a scatter plot to show where the most common deaths occur for the Erangel map for all matches in dataframe

Erangel Deaths (Not just solo)



- Heat map using a scatter plot to show where the most common deaths occur for the Miramar map for all matches in dataframe

Miramar Deaths (Not just solo)

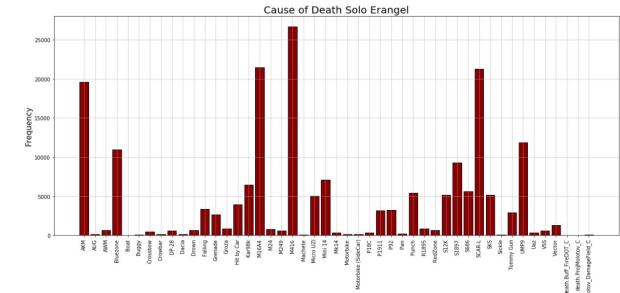
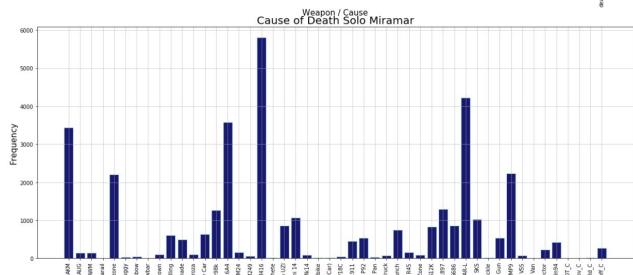


- Heat map using a scatter plot to show where the most common deaths occur for the Miramar map for solo matches.

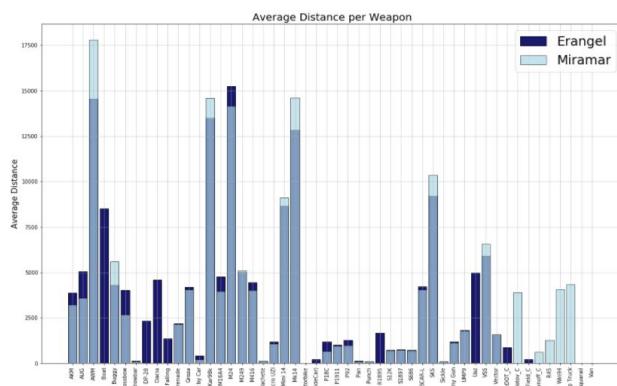
Miramar Solo Deaths



- We used the panda dataframe to plot the most popular weapons in each map. Popular weapons are based on how many kills a particular weapon accrues.



- We also calculated the average distance each weapon kills a victim. We did this by calculating distance based on the given killer and victim's x and y positions. We plotted both graphs on top of each other to see which weapons kill with which range. From an initial glance, it is obvious that weapons falling under the sniper class have the longest average range.



## 10 Summary of Peer Review Session

Differentiate ourselves from the other two PUBG groups as well as communicate with them to help each other mine data. Set a clear problem statement and how to go about finding correlations within the data.

## ACKNOWLEDGMENTS

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## REFERENCES

TBA