

# Data Analysis and Visualisation of PlayerUnknown's Battlegrounds Data

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**Abstract**—This work aims to do exploratory data analysis on PlayerUnknown's Battlegrounds game data, from player data to telemetry data. We present here basic statistics as well as heat maps with the density of items and actions in parts of the maps.

**Index Terms**—PUBG, games, data analysis, data visualisation, telemetry data

## I. INTRODUCTION

In a battle royale game, strategies such as positioning and weapon selection are important variables that can determine the outcome of a match. In this report, we use the game PlayerUnknown's Battlegrounds as a test bed to analyse and study these types of players' behaviours for a better understanding of players' performances and what happens in an average match.

### A. PlayerUnknown's Battlegrounds

PlayerUnknown's Battlegrounds (PUBG) is a battle royale game, where 100 players drop from an aeroplane into an island and battle to death until there is only one player or team alive. The game has two modes, first-person (fpp) and third person (tpp), where fpp maps can only be played in first-person and tpp maps can both be played in first or third-person. The game also allows for single-player, duos, and teams of three or four. A variety of weapons and attachments (magazine extenders, red dots, scopes, and others) can be found scattered around the map, as well as items for healing, bulletproof vests, and helmets.

The data included information from seven maps, with their names being Baltic\_Main aka Erangel, Savage\_Main aka Sanhok, Chimera\_Main aka Paramo, Range\_Main aka Camp Jackal, Desert\_Main aka Miramar, DihorOtok\_Main aka Vikendi, Summerland\_Main aka Karakin. Throughout this work, we'll be using the first name, which is the name used in the data.

Baltic\_Main is an 8X8km map with 51.47% land and 48.53% water. This was the first map released and was used as a test subject for what worked and what didn't. Desert\_Main was the second map released, with 8X8km, being 80.59% land and 19.41% water. After that, Savage\_Main, a 4X4km map, with 49.26% land and 50.74% water was released. The fourth map was DihorOtok\_Main, a 6X6km map with 40.29% land and 59.71% water. Summerland\_Main was the fifth map

release, with 2X2km, the same size as Range\_Main, which is a training map, designed with everything a player might need to learn the game mechanics. The last map is Chimera\_Main, a 3X3km map.

For this analysis, Range\_Main was excluded, since it's a training map where anyone can enter at any time, as well as Summerland\_Main and Chimera\_Main, since those maps were released not a long time ago and don't have much data available.

## II. DATA COLLECTION

To collect the data, the official API<sup>1</sup> was used. They offer player, match, telemetry, and player lifetime data, as well as a few more restricted information (player season data and leaderboard data). We focused on match, telemetry, and player lifetime data in this work. Match and telemetry data can be downloaded freely, without limitations, whereas player data has a limit of 10 calls per minute. The server only keeps match, player, and telemetry data from the last 14 days.

The data was collected between the 30th of May and the 14th of June. Match, telemetry, and player data were downloaded into a separated json. The downloaded data was compromised of 53,718 matches, which resulted in 3,902,016 players' information (player might appear in more than one match), 8,517 lifetime players information, and 1260 matches telemetry data which resulted in information from 142,433 parachute landings, and 3,344,648 items pickup. This data was later read and added into an SQLite database for ease of access.

### A. Match Data

Match data included the following information:

- id: a unique ID used only inside the database;
- matchId: the unique ID of the match;
- createdAt: the day the match started;
- shardId: which platform the game happened (in this case, all games were on Steam);
- isCustomMatch: if the match was customised (in this case, all games weren't customised);

<sup>1</sup><https://developer.pubg.com/>

- matchType: the type of match, being arcade, custom, event, official, or training;
- duration: the total duration of the game;
- gameMode: the type of game, being duo, duo-fpp, solo, etc;
- titleId: identifies the studio and the game;
- mapName: in which map the game happened (Baltic\_Main, Desert\_Main, DihorOtok\_Main, Erangel\_Main, Range\_Main, Savage\_Main, or Summerland\_Main);
- seasonState: in which point is the season, being closed, prepare, or progress;
- assetsId: link to the telemetry.json file;
- rosterId : unique ID of the roster the player was in;
- participantId: the player ID for the match;
- DBNO: Down But Not Out, how many times the player knocked down an enemy;
- assists: how many assists the player had;
- boosts: how many boosts the player used;
- damageDealt: how much damage the player dealt;
- deathType: the type of death of the player (alive, byplayer, byzone, suicide, or logout);
- headshotKills: how many headshot kills the player inflicted;
- heals: how many heals the player used;
- killPlace: the player rank based on kills;
- killStreaks: how many kill streaks the player had;
- kills: how many total kills the player had;
- longestKill: the longest (distance) kill a player had;
- name: the display name of the player;
- playerId: the player's account number;
- revives: how many times the player revived a teammate;
- rideDistance: distance the player travelled in a vehicle;
- roadKills: how many kills the player inflicted using a vehicle;
- swimDistance: distance the player swam;
- teamKills: how many teammates the player killed;
- timeSurvived: the total time the player survived in a match;
- vehicleDestroys: how many vehicles the player destroyed;
- walkDistance: distance the player walked;
- weaponsAcquired: how many weapons the player acquired;
- winPlace: the rank in which the player finished the game.

Some of this data was never used, like shardId, titleId, and seasonState, but was interesting enough to be added for the prospect of using it in the future.

### B. Player Lifetime Data

Player Lifetime data was divided into four categories: lifetime solo, lifetime solo-fpp, lifetime duo, lifetime duo-fpp, lifetime squad, and lifetime squad-fpp. All the categories have the following information:

- id: a unique ID used only inside the database;
- player\_id: the player's account number;

- assists: how many assists the player had;
- boosts: how many boosts the player used;
- dBNOs: how many times the player knocked down an enemy;
- dailyKills: number of kills during the most recent day played;
- dailyWins: number of wins during the most recent day played;
- damageDealt: how much damage the player dealt;
- days: how many days the player played;
- headshotKills: how many headshot kills the player had;
- heals: how many heals the player used;
- kills: how many kills the player had;
- longestKill: player's longest kill;
- longestTimeSurvived: longest time survived in a match;
- losses: how many matches the player lost;
- maxKillStreaks: the longest kill streak the player had;
- mostSurvivalTime: longest survival time the player had;
- revives: how many the player revived teammates;
- rideDistance: total distance travelled in vehicles;
- roadKills: number of kills while in a vehicle
- roundMostKills: highest number of kills in a single match
- roundsPlayed: number of rounds played;
- suicides: number of self-inflicted deaths;
- swimDistance: total distance swam;
- teamKills: number of times the player killed a teammate;
- timeSurvived: total time survived/
- top10s: number of times the player made it to the top 10;
- vehicleDestroys: number of vehicles destroyed;
- walkDistance: total distance walked;
- weaponsAcquired: total number of weapons acquired;
- weeklyKills: number of kills from the most recent week played;
- weeklyWins: number of wins from the most recent week played;
- wins

### C. Telemetry Data

Telemetry data was divided into two different categories: Parachute Landing, and Item Pickup.

- Parachute Landing is where the player landed. It has the player ID as well as the xyz coordinates where the player landed and the distance travelled;
- Item Pickup has the player ID, xyz coordinates, if it's inside a blue or red zone, the state of the game, the id, category, and subcategory of the item, and how many were there.

## III. DATA ANALYSIS

Since the idea was to explore whatever came from the data, only a few goals were set, being averages between players, averages between matches, and where players prefer to land. After gathering the data, we evaluated that we could gather data from the top 10 players of each match and infer their average preferences, being weapons used, if cars were used, and others. As said before, Range\_Main, Summerland\_Main,

and Chimera\_Main were excluded from this analysis. Some game modes, like zombie and esports, were excluded as well, and only traditional (single, duo, and squad) matches were used.

#### A. Match Data

To analyse match data, the first thing done was to calculate the averages between all the data. The values were separated between game modes and can be found from Table I to Table VI. For solo matches. there are no DBNO values, assists, revives, nor team kills.

Some of this data was interesting to evaluate. We can see that in bigger maps, the players tend to use vehicles more often but don't roadkill other players. The survival time is also higher in bigger maps. In squad modes, the players tend to pick up more weapons than duos or solos, as well as use heal items, revive more teammates, and deal more damage. Solos had a higher ride distance in vehicles lower than squad but higher than all the others.

From all the modes is possible to see that road kills, team kills, and vehicle destruction are quite rare.

TABLE I  
MATCHES AVERAGES - SOLO

	Baltic	Desert	Savage	DihorOtok	Average
boosts	1.54	1.60	1.15	1.27	1.41
dmgDealt	112.95	116.56	114.95	115.45	114.99
hsKills	0.21	0.22	0.19	0.23	0.21
heals	1.52	1.38	0.91	1.14	1.26
killStrk	0.46	0.46	0.48	0.47	0.46
longKill	20.48	25.09	13.99	17.32	19.74
rideDist	1095.62	1202.47	157.01	524.42	798.21
roadKills	0.03	0.02	0.01	0.01	0.02
swimDist	45.26	4.93	26.36	3.79	20.13
timeSurv	747.19	822.74	558.28	665.57	710.62
vehicDest	0.02	0.02	0.01	0.01	0.01
walkDist	1050.42	1214.29	816.16	955.46	1027.10
weapAcq	3.10	3.51	2.52	3.03	3.08

TABLE II  
MATCHES AVERAGES - SOLO-FPP

	Baltic	Desert	Savage	DihorOtok	Average
boosts	1.41	1.43	1.08	1.20	1.33
dmgDealt	116.07	118.77	116.10	118.64	116.75
hsKills	0.21	0.21	0.19	0.23	0.21
heals	1.40	1.23	0.86	1.10	1.19
killStrk	0.47	0.47	0.49	0.8	0.47
longKill	19.28	22.57	13.36	16.52	18.55
rideDist	695.63	694.30	80.43	286.80	558.74
roadKills	0.01	0.01	0.00	0.00	0.01
swimDist	63.16	6.61	29.63	4.66	24.97
timeSurv	672.21	728.53	508.30	599.71	654.79
vehicDest	0.01	0.01	0.01	0.00	0.01
walkDist	977.75	1158.09	744.39	908.14	973.67
weapAcq	2.43	2.64	2.11	2.44	2.62

Another possible analysis is viewing player kills within a box plot. The graphic for the maps with all the game modes

TABLE III  
MATCHES AVERAGES - DUO

	Baltic	Desert	Savage	DihorOtok	Average
DBNO	0.60	0.59	0.56	0.56	0.42
assists	0.18	0.17	0.14	0.13	0.11
boosts	1.77	1.60	1.02	1.09	1.33
dmgDealt	131.02	131.37	120.44	122.36	117.43
hsKills	0.22	0.21	0.18	0.21	0.21
heals	2.00	1.60	1.05	1.38	1.21
killStrk	0.52	0.53	0.54	0.54	0.48
longKill	23.97	28.64	16.50	20.49	18.78
revives	0.14	0.13	0.098	0.097	0.009
rideDist	1398.29	1322.44	151.12	484.05	576.44
roadKills	0.01	0.01	0.00	0.01	0.01
swimDist	22.97	5.40	26.77	6.24	24.46
teamKills	0.01	0.01	0.00	0.00	0.000
timeSurv	766.48	816.76	524.96	646.22	656.10
vehicDest	0.02	0.02	0.02	0.02	0.01
walkDist	1053.68	1213.30	811.85	1013.72	975.23
weapAcq	3.55	3.53	2.55	2.59	2.65

TABLE IV  
MATCHES AVERAGES - DUO-FPP

	Baltic	Desert	Savage	DihorOtok	Average
DBNO	0.60	0.60	0.59	0.60	0.34
assists	0.18	0.18	0.17	0.18	0.10
boosts	1.52	1.49	1.01	1.16	1.32
dmgDealt	135.60	137.82	129.12	132.65	126.18
hsKills	0.22	0.22	0.21	0.23	0.22
heals	1.95	1.65	1.13	1.52	1.40
killStrk	0.54	0.56	0.55	0.55	0.51
longKill	24.62	27.51	17.97	21.10	21.01
revives	0.15	0.15	0.12	0.14	0.08
rideDist	1090.64	1043.91	131.25	423.15	639.39
roadKills	0.01	0.00	0.00	0.00	0.01
swimDist	34.42	3.44	18.90	2.32	19.34
teamKills	0.01	0.00	0.00	0.00	0.00
timeSurv	724.59	766.49	524.28	623.28	660.83
vehicDest	0.01	0.01	0.02	0.01	0.01
walkDist	1062.24	1187.41	863.03	985.70	1004.74
weapAcq	3.23	3.39	2.85	3.19	2.93

TABLE V  
MATCHES AVERAGES - SQUAD

	Baltic	Desert	Savage	DihorOtok	Average
DBNO	0.86	0.87	0.80	0.83	0.68
assists	0.32	0.32	0.26	0.28	0.23
boosts	2.18	2.36	1.18	1.41	1.64
dmgDealt	151.72	155.62	128.29	135.25	135.67
hsKills	0.22	0.22	0.19	0.21	0.21
heals	2.14	2.04	1.15	1.60	1.63
killStrk	0.53	0.53	0.54	0.53	0.52
longKill	30.99	34.98	19.16	24.22	25.41
revives	0.22	0.22	0.15	0.18	0.15
rideDist	1472.13	1493.11	118.47	502.51	892.64
roadKills	0.01	0.00	0.00	0.00	0.01
swimDist	43.52	3.63	28.81	4.65	20.76
teamKills	0.01	0.01	0.01	0.01	0.01
timeSurv	812.82	837.94	556.17	688.00	722.88
vehicDest	0.02	0.01	0.01	0.01	0.01
walkDist	1160.18	1270.82	961.15	1104.40	1103.25
weapAcq	3.56	3.71	2.76	3.08	3.23

TABLE VI  
MATCHES AVERAGES - SQUAD-FPP

	Baltic	Desert	Savage	DihorOtok	Average
DBNO	0.81	0.81	0.78	0.81	0.53
assists	0.28	0.26	0.26	0.27	0.17
boosts	1.84	1.90	1.14	1.33	1.42
dmgDealt	131.31	134.54	123.58	127.25	127.5
hsKills	0.19	0.20	0.18	0.20	0.21
heals	1.92	1.69	1.15	1.57	1.48
killStrk	0.51	0.51	0.53	0.52	0.51
longKill	27.36	30.68	19.06	22.75	22.75
revives	0.18	0.18	0.14	0.16	0.11
rideDist	1465.40	1503.58	181.86	718.84	788.58
roadKills	0.01	0.01	0.00	0.01	0.01
swimDist	50.34	3.89	25.45	3.73	20.42
teamKills	0.01	0.01	0.01	0.01	0.01
timeSurv	837.03	876.83	600.04	30.52	704.82
vehicDest	0.02	0.02	0.02	0.01	0.01
walkDist	1176.85	1311.18	1021.24	1116.32	1069.69
weapAcq	3.44	3.62	3.07	3.40	3.12

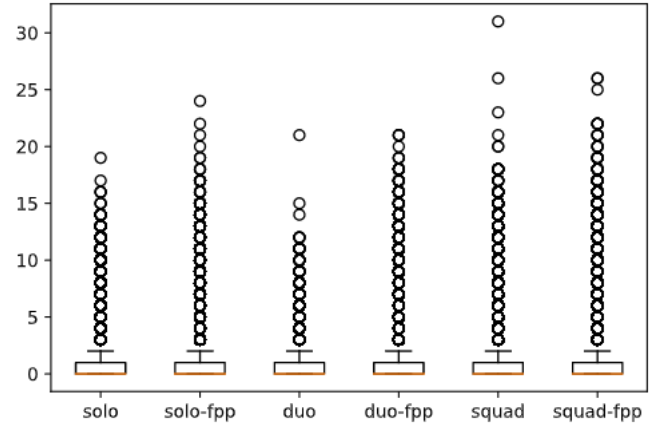


Fig. 2. Kills in the Desert\_Main map.

can be seen from Figure 1 till Figure 4. In all the graphs we can see outliers that might skew the data. This type of visualisation might be used with all the available data, but we'll keep only this one so it's not cluttered.

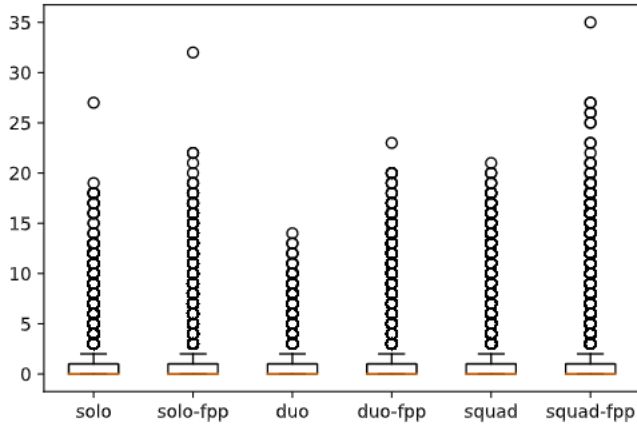


Fig. 1. Kills in the Baltic\_Main map.

### B. Player Lifetime Data

With lifetime data, we gathered the averages between the players. This generated Table VII, Table VIII, and Table IX. As stated before, solos don't have DBNOs nor revives.

From the data, we can see that players play more solo and duo matches on fpp mode and more squad matches on tpp. As we can see, both duo and duo-fpp matches have 0 wins, and we think this might be an error from the PUBG server. The same for wins on solo, revives and hsKills on duo, and vehicDestr on squad and squad-fpp.

### C. Telemetry Data

1) *General statistics:* From telemetry data, we can see which weapons the players pick up more and which weapons the players don't pick up. The game has 61 weapons, including

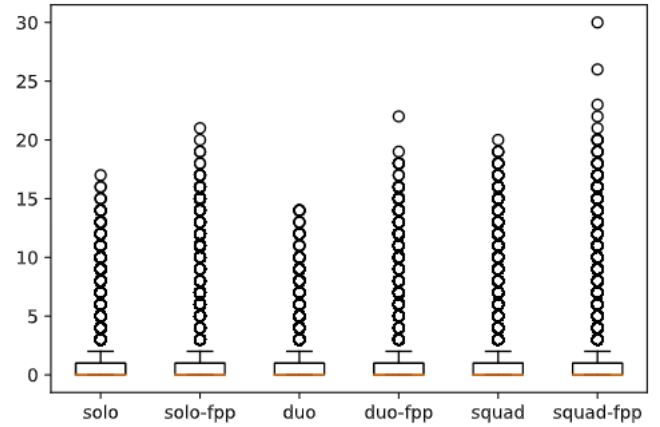


Fig. 3. Kills in the Savage\_Main map.

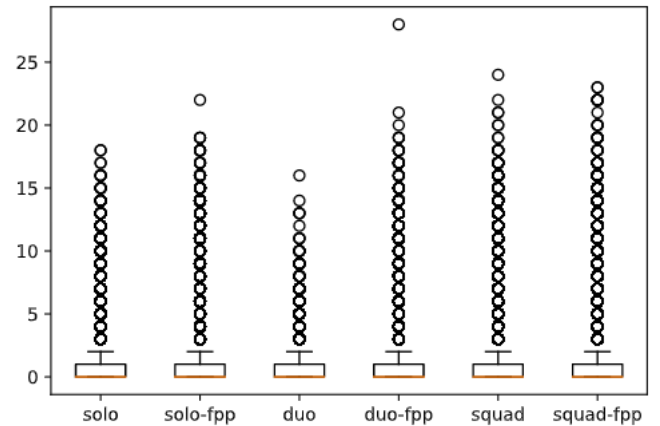


Fig. 4. Kills in the DihorOtok\_Main map.

TABLE VII  
PLAYER LIFETIME AVERAGES: SOLO AND SOLO-FPP

	solo	solo-fpp
assists	2.65	28.24
boosts	140.33	1434.67
dmgDealt	6092.08	58519.95
hsKills	7.94	95.32
heals	104.15	1466.33
kills	36.19	371.80
losses	106.79	999.21
rideDist	89127.70	913362.40
rndPlayed	106.79	1001.85
swimDist	565.54	6074.18
timeSurv	75171.72	728544.21
top10s	8.83	128.86
vehicDestr	0.88	9.71
walkDist	114136.77	1152108.77
wins	0.00	2.65

TABLE VIII  
PLAYER LIFETIME AVERAGES: DUO AND DUO-FPP

	duo	duo-fpp
assists	3.53	5.23
boosts	28.24	55.65
dBNOs	2.65	16.00
dmgDealt	735.12	3202.84
hsKills	0.00	10.18
heals	18.53	82.42
kills	4.41	21.53
losses	10.59	45.12
revives	0.00	5.77
rideDist	8007.08	53968.01
rndPlayed	10.59	45.12
swimDist	12.99	26.37
timeSurv	7828.94	31270.37
top10s	4.41	12.18
vehicDestr	0.00	0.12
walkDist	12658.95	44940.01
wins	0.00	0.00

TABLE IX  
PLAYER LIFETIME AVERAGES: SQUAD AND SQUAD-FPP

	squad	squad-fpp
assists	6.18	4.29
boosts	40.60	13.22
dBNOs	11.47	6.52
dmgDealt	2509.97	905.26
hsKills	3.53	1.17
heals	42.36	9.76
kills	10.59	7.93
losses	45.89	4.35
revives	5.30	0.59
rideDist	36027.01	19844.50
rndPlayed	47.66	4.58
swimDist	239.55	4.83
timeSurv	29084.06	5190.89
top10s	8.83	2.64
vehicDestr	0.00	0.00
walkDist	46380.09	7397.04
wins	1.77	0.47

grenades and melee weapons.

Smoke bombs are the players' favourite, being picked up 10,436 times.

- 1) Item\_SmokeBomb: 10,436;
- 2) Item\_Grenade: 7,807;
- 3) Item\_Molotov: 3,744;
- 4) Item\_FlashBang: 3,298;

The HK416 is the favourite long-range weapon, being picked up 3,225 times. The pan, a melee weapon, is the third most picked-up weapon, with 2,542 pickups.

- 1) Item\_HK416: 3,225;
- 2) Item\_AK47: 2,912;
- 3) Item\_Pan: 2,542;
- 4) Item\_M16A4: 2,222;
- 5) Item\_BerylM762: 1,866;
- 6) Item\_UMP: 1,786;
- 7) Item\_SCAR-L: 1,369;
- 8) Item\_SKS: 1,354;
- 9) Item\_Winchester: 1,216;
- 10) Item\_UZI: 1,175;

The ten least used weapons all come from drops, so they are not widely available throughout the map and end up being picked up less.

- 1) Item\_Groza: 75;
- 2) Item\_AUG: 67;
- 3) Item\_Mk14: 65;
- 4) Item\_AWM: 60;
- 5) Item\_MG3: 44;
- 6) Item\_L6: 33;
- 7) Item\_Duncans\_M416: 10;
- 8) Item\_Mads\_QBU88: 7;
- 9) Item\_Lunchmeats\_AK47: 5;
- 10) Item\_Julies\_Kar98k: 2;

Bellow, we can see the number of times an item was picked up. This includes healing items, backpacks, armours, and helmets. We can see that players pick up more level 2 armours, helmets, and backpacks.

- Item\_Bandage: 125,035;
- Item\_FirstAid: 163,929;
- Item\_MedKit: 10,762;
- Item\_PainKiller: 126,002;
- Item\_EnergyDrink: 167,483;
- Item\_AdrenalineSyringe: 11,815;
- Item\_Back\_Lv1: 45,542
- Item\_Back\_Lv2: 56,002
- Item\_Back\_Lv3: 27,691
- Item\_Armor\_Lv1: 4,923;
- Item\_Armor\_Lv2: 7,344;
- Item\_Armor\_Lv3: 2,302;
- Item\_Head\_Lv1: 5,254
- Item\_Head\_Lv2: 7,876
- Item\_Head\_Lv3: 996

2) *Parachute Landing Spots*: With the Parachute Landing info, we could obtain heat maps with the most landed spots. For ease of visualisation, only 1,000 random landings were



used. The maps can be seen from Figure 5 to Figure 8. The average player travels 257.02 meters while parachuting.

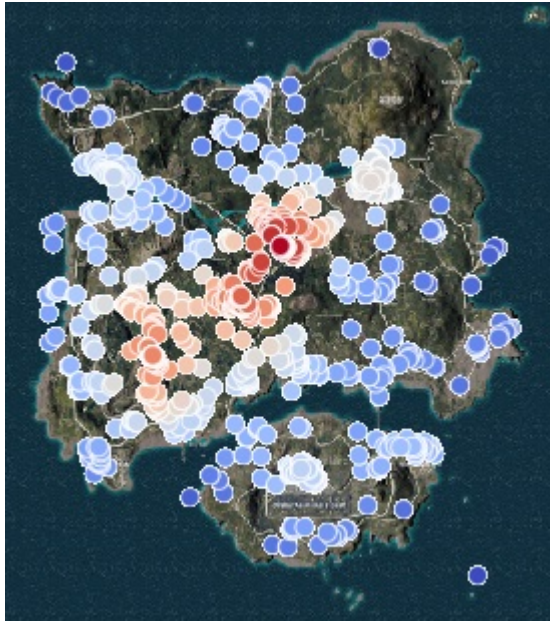


Fig. 5. Parachute landings in Baltic\_Main.

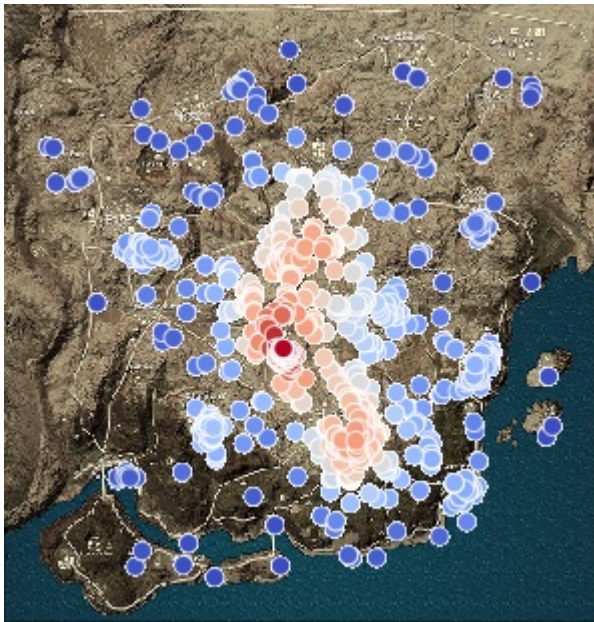


Fig. 6. Parachute landings in Desert\_Main.

3) *Weapon Pickup Spots:* We can also visualise from Figure 9 to Figure 12, the spots where the players pickup the most common weapon from each map.

#### IV. CONCLUSION

From this work, we can see that analysis of game data is a wide field with a lot of possibilities. We only scraped the surface, and in future works, we can search for key factors



Fig. 7. Parachute landings in Savage\_Main.

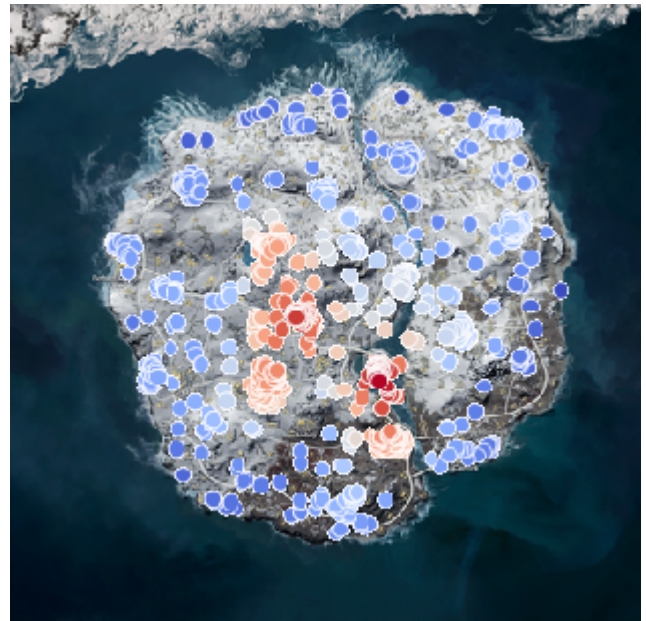


Fig. 8. Parachute landings in DihorOtok\_Main.

to identify bots and hackers, the probability of reaching the top ten, which weapons are used by the top ten players, the average distance travelled by the winners, where most shots are shot at the beginning of the game, and much more.

#### REFERENCES

- [1] El-Nasr, M.S. and Drachen, A. and Canossa, A., "Game Analytics: Maximizing the Value of Player Data," Springer London, 2013.





Fig. 9. HK416 in Baltic\_Main.



Fig. 11. HK416 in Savage\_Main.

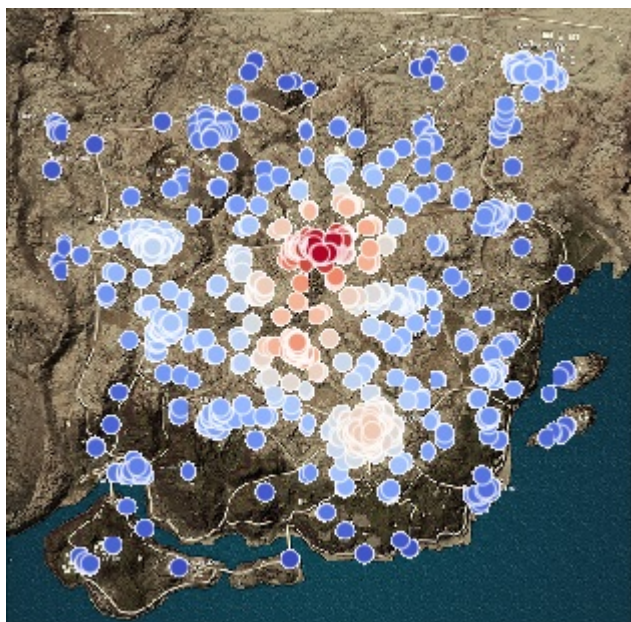


Fig. 10. Pan in Desert\_Main.

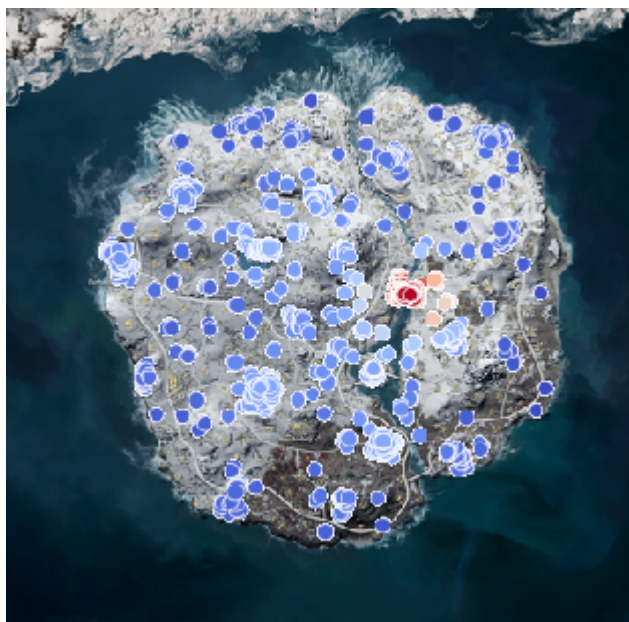


Fig. 12. Pan in DihorOtok\_Main.