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POWER CREEP ANALYSIS ON GENSHIN IMPACT USING CORRELATION-BASED APPROACH

Moses Sinanta P.W.J.
Universitas Sebelas Maret
mosessinanta@student.uns.ac.id

Abstract

Power creep is a phenomenon in game design where newer content outperforms older content over time. Genshin Impact, a game developed by miHoYo, releases new characters every version or patch, leading to speculation about whether power creep exists in the game. This research aims to determine whether power creep exists in Genshin Impact by analysing the correlation between character release version or patch and tier list rankings using statistical methods. The dataset was compiled from five tier list from five different Genshin Impact guide websites, with rankings standardized. Pearson Correlation and Linear Regression were applied to assess the relationship between release version or patch and character rankings, with additional separate analyses for four-star and five-star characters. The overall analysis showed a moderate correlation ($r = 0.349$). Power creep was primarily observed among five-star characters ($r = 0.518$), while four-star characters showed no such trend. The regression model supported this, indicating that newer five-star characters tend to have higher rankings than older ones.

Key words: Pearson Correlation, Linear Regression, Genshin Impact, power creep.

INTRODUCTION

Power creep is a phenomenon in game design where newer content outperforms older content over time. This phenomenon usually happens in live-service games that receive updates, which developers use to encourage players to invest in the newer content [8]. However, this might also shift the game's balance, where older content is invalidated by the newer content [6].

Genshin Impact, developed by miHoYo (and continued by HoYoverse), is a live-service RPG game that regularly introduces new characters with each patch update. These characters vary in elemental abilities, weapon types, skills (talents), etc. [1]. As a result, each character in the game offers unique synergies in combat and exploration, making them distinct.

Figure 1 Genshin Impact illustration

Due to the constant release of new characters, the community often speculates that power creep exists in Genshin Impact [4]. Many players argue that older characters struggle to compete with newer ones in high-level

content, such as the Spiral Abyss [7]. However, such claims are anecdotal, and a more systematic approach is needed to determine whether power creep in Genshin Impact is real.

This research aims to quantify power creep by statistically analysing character rankings across different sources. Using Pearson correlation and other statistical metrics, we assess whether character strength is correlated with its release version or patch. A simple regression model is applied to visualize the overall trend, providing a clearer picture of whether power creep exists in Genshin Impact.

The structure of this research article can be explained as follows. The Theoretical Basis explains Pearson Correlation and Linear Regression, followed by Methodology, which explains the data processing and calculation. The Results and Evaluation explain the results based on the evaluation metrics used, followed by the Conclusion, which summarizes the main findings and provides suggestions for future research.

THEORETICAL BASIS

Pearson Correlation is a statistical measure developed by Karl Pearson [11]. It is a linear correlation coefficient for measuring the relationship between two variables [10]. It produces a value between $[-1,1]$, where -1 suggests a perfect negative correlation, 1 suggests a perfect positive correlation, and 0 suggests no correlation between the two variables.

Pearson Correlation coefficient r can be written as:

$$r = \frac{\sum_{i=1}^{n}(x_i - \mu_x)(y_i - \mu_y)}{\sqrt{\sum_{i=1}^{n}(x_i - \mu_x)^2} \times \sqrt{\sum_{i=1}^{n}(y_i - \mu_y)^2}}$$

where x_i and y_i are individual data points for variables x and y, and μ_x and μ_y are the average values of respective variables.

The p-value is a statistical measure of the significance of an observed correlation [9]. A low p-value (usually around < 0.05) suggests that the correlation is statistically significant and unlikely to have occurred by chance. On the other hand, a high p-value suggests that the observed relationship may be due to random variation rather than a trend.

The t-score is a statistical measure for determining whether a sample statistic significantly differs from a population parameter or another sample statistic [2]. In the context of Pearson Correlation, the t-score is calculated to assess the strength of the relationship between two variables. It also helps determine the statistical significance of the correlation through the p-value.

The t-score can be written as:

$$t = r \times \sqrt{\frac{n-2}{1-r^2}}$$

where the p-value is then obtained from the t-distribution [5].

Linear Regression is a statistical method used to model the relationship between a dependent variable and one or more independent variables [3]. In its simplest form, Linear Regression is applied when only one independent variable influences the outcome. For example, in this research, the character release version or patch (timeline) represents the independent variable, while the character average rating represents the dependent variable.

Linear Regression can be written as:

$$y = \beta_0 + \beta_1 x + \varepsilon$$

where y represents the dependent variable, β_0 represents the intercept or the value of y when $x = 0$, β_1 represents the slope, x represents the independent variable, and ε represents the error term.

METHODOLOGY

The dataset used in this research was compiled from five different Genshin Impact guide websites, each ranking characters based on their overall combat performance. These websites include Game8 [12] (abbreviated G8), GameWith [13] (abbreviated GW), GenshinBuilds [14] (abbreviated GB), Genshin.gg [15] (abbreviated GG) and GenshinLab [16] (abbreviated GL). The rankings were then averaged to create a standardized score for each character (see Table 1).

Some characters may be mentioned twice in a tier list because they can fill multiple roles in the game. A popular example is Mavuika, a

character who can fill the main damage and sub-damage dealer roles. In this case, the said character's score will be based on their highest rank.

Table 1 Tier list score standardization

Rank	G8	GW	GB	GG	GL
SS	10.0	10.0	10.0	10.0	10.0
S	8.3	8.3	8.0	8.0	8.3
A	6.7	6.7	6.0	6.0	6.7
B	5.0	5.0	4.0	4.0	5.0
C	3.3	3.3	2.0	2.0	3.3
D	1.7	1.7	-	-	1.7
N/A	-	-	1.0	-	-

Certain characters were excluded from the dataset. Traveler (in any element) was removed because, while the character can switch between different components, its base stats and level progression remain the same, making it difficult to classify fairly with the other characters. Additionally, the newest character released on Version 5.4 Moonlight Amidst Dreams, Yumemizuki Mizuki, was not included because some tier list sources had not yet ranked her, which could lead to incomplete or biased data.

Adjustments were also made for GB, as some characters were completely absent from the list. For these characters, a default score of 1.0 was assigned. This adjustment assumes that they belong to the lowest possible ranking tier.

Genshin Impact versions or patches were converted into numerical values for statistical analysis. Different update cycles follow varying patterns; for example, version 1.x patches only go up to 1.6, while version 2.x patches go up to 2.8. For this reason, a normalized versioning system was applied to represent patch numbers in a sequential number format.

A Pearson Correlation test was then performed to examine the relationship between Genshin Impact versions or patches and character rankings. A positive correlation would suggest evidence of power creep, whereas a weak or negative correlation would suggest no such trend.

The dataset was segmented into four-star and five-star characters to assess whether power creep affects character rarities differently. Separate Pearson Correlation tests were applied to each rarity group. This segmentation allows for a more detailed comparison of power creep trends within different tiers of character rarity.

A Linear Regression model was applied to analyse the data further and observe the trend of character strength over time. If the slope (β_1) of the regression line is positive, this would indicate a general increase in power level over time, strengthening the existence of power creep in Genshin Impact. On the other hand, a near-zero or negative slope would suggest that character strength has remained stable or declined over time.

RESULTS AND EVALUATION

The Pearson Correlation coefficient for all characters (overall) is 0.349, showing a moderate positive correlation between a character's release version or patch and their tier list ranking. This result suggests that newer characters have slightly higher rankings than older ones, showing some evidence of power creep. However, the correlation is not particularly strong, meaning other factors may influence character rankings.

The p-value for all characters (overall) is 0.001, below the standard significance threshold of 0.05. This result suggests that the observed correlation is statistically significant and unlikely to have occurred by chance. Therefore, increasing rankings over time is not random, and newer characters are systematically stronger in character tier lists.

The Linear Regression equation for all characters (overall) is:

$$y = 5.179 + 0.067x$$

The positive slope of 0.067 shows that, on average, each successive Genshin Impact version or patch introduces characters that rank slightly higher than those from previous patches.

For the four-star characters, the Pearson Correlation coefficient is 0.093, which is relatively weak. This result suggests little to no correlation between the release version or patch and their tier list ranking within the four-star characters. This result also means that four-star

Table 2 Results across different dataset variants.

Dataset variant	Pearson Correlation (r)	p-value	Intercept (β_0)	Slope (β_1)
All characters	0.349	0.001	5.179	0.067
Four-star characters	0.093	0.554	4.712	0.017
Five-star characters	0.518	100×10^{-6}	5.889	0.083

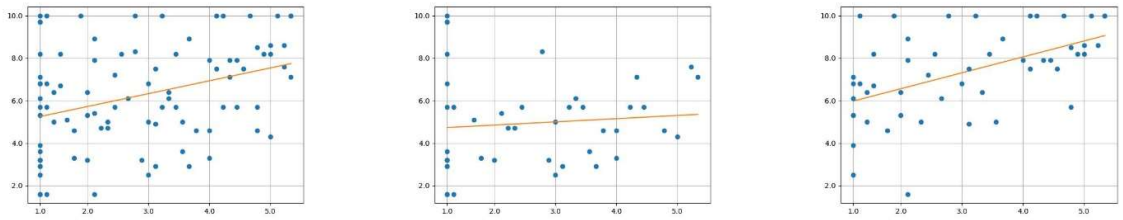

Figure 2 Scatter plot of character release version and tier list ranking average, with a Linear Regression trend line. The left side is for the case of all characters (overall), the centre is for the case of four-star characters, and the right side is for the case of five-star characters.

characters have remained relatively balanced over time.

The p-value for four-star characters is 0.554, much higher than the standard significance threshold of 0.05. This result shows that the observed correlation is not statistically significant. The weak correlation result could be due to random variation rather than a real trend.

The Linear Regression equation for four-star characters can be written as:

$$y = 4.712 + 0.017x$$

The positive slope of 0.017 shows that, on average, each successive Genshin Impact version or patch introduces four-star characters that rank slightly higher than those from previous patches. However, it is relatively small, to the point of ignorable in practice.

On the other hand, the Pearson correlation for five-star characters is 0.518, much stronger than that for all characters (overall) and four-star character variants of the dataset. This result suggests that five-star units are more likely to be rated higher than the older ones. It also shows that power creep in Genshin Impact is more pronounced among five-star characters.

The p-value for five-star characters is 0.000 (100×10^{-6} upon closer inspection), much lower than 0.05. This result strengthens the idea that newer five-star characters are systematically rated higher. In other words, this confirms the existence of power creep in Genshin Impact among five-star characters.

The Linear Regression equation for five-star characters can be written as:

$$y = 5.889 + 0.083x$$

The positive slope of 0.083, higher than the slope for all characters (overall) and the four-star characters variant of the dataset, shows that, on average, each successive Genshin Impact version or patch introduces five-star characters that rank higher than those from previous patches.

CONCLUSION

This research analysed the existence of power creep in Genshin Impact, which shows a moderate positive correlation overall ($r = 0.349$ and p-value $= 0.001$). These results suggest that newer characters are rated higher than older ones. In terms of rarity, four-star characters showed little to no correlation ($r = 0.0.093$ and p-value $= 0.5554$), while five-star characters showed a strong correlation ($r = 0.518$ and p-value $= 100 \times 10^{-6}$). The Linear Regression results further confirmed

this trend, suggesting that newer five-star characters are generally stronger or more highly rated than older ones.

Future research could explore a more detailed comparison between characters with similar attributes, such as their role in the game. For example, the comparison between Jean and Kaedehara Kazuha, who are both Support Anemo Sword users, or Yoimiya and Lyney, who are both damage-dealer Pyro Bow users. Additionally, segmenting characters based on different stat scaling, such as ATK-based, DEF-based, and such, could uncover whether certain archetypes experience more power creep than others.

APPENDIX

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