Pokemon Net - A network that analyzes Pokemon battles

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1 Introduction

As a group who grew up playing Pokémon, we're fascinated by the competitive dynamics that make its world so engaging. Each Pokémon has unique strengths, weaknesses and abilities; understanding how they interact in battles is part of what makes the Pokémon universe so fascinating. Revisiting it through a data-driven lens lets us explore which Pokémon truly stand out and how different types and attributes impact their performance.
In this project, we aim to translate our personal interest into a structured, formal exploration, investigating the relationships and interactions between Pokémon in a battle-focused framework. Specifically, we analyze a dataset of Pokémon to simulate battles, create a fully connected network, and observe patterns that define Pokémon strength and performance across various contexts.

2 Problem and Motivation

Our analysis is structured around several interrelated research objectives aimed at understanding competitive dynamics within the Pokémon dataset. To begin, we evaluate battles between all Pokémon included in the dataset to establish a comprehensive competitive hierarchy. This overarching analysis allows us to determine which Pokémon consistently emerge as stronger across the board, highlighting those with broad competitive advantages. Additionally, this approach helps us identify Pokémon that, while not dominant in every scenario, exhibit unique strengths or vulnerabilities that distinguish them from the rest

To deepen our insights, we extend our analysis by focusing on specific subgroups within the Pokémon universe. These subgroups could be defined by shared characteristics such as type (e.g., Fire, Water, Grass), generation, … By narrowing the scope in this way, we aim to uncover nuanced patterns that might be obscured in an all-inclusive analysis. For instance, certain Pokémon may excel within their type group or against particular opponents while underperforming in a broader context. This approach enables us to balance a high-level understanding of overall competitive dynamics with a more detailed exploration of specialized interactions.

3 Dataset

For our analysis of Pokémon battle dynamics, we used a dataset we found on a public repository on GitHub [1]. The dataset, titled *Pokemon.csv*, contains comprehensive information about Pokémon characteristics, such as stats, types, and classifications. The size of the dataset is approximately 44 kb so it is lightweight, but it provides sufficient depth and variety to simulate battles across different Pokémon types and categories, allowing us to explore strengths, weaknesses, and patterns in Pokémon interactions.

3.1 Dataset Format

The considered dataset has 800 rows and 13 columns for each record:

- "#" (`int`): index of the given Pokémon in the PokéDex (alternative forms of the same Pokémon have the same index).
- "**Name**" (`string`): name of the Pokémon in the given row.
- "**Type 1**" (`string`): main type of the given Pokémon.
- "**Type 2**" (`string`): secondary type of the given Pokémon.
- "**Total**" (`int`): number that stores the sum of all the numerical features of the Pokémon:
  $Total = HP + Attack + Defense + Sp.\ Atk. + Sp.\ Def. + Speed$
- "**HP**" (`int`): "Health Points" of the given Pokémon, i.e. its life points.
- "**Attack**" (`int`): the amount of damage a Pokémon deals when it makes a physical attack.
- "**Defense**" (`int`): the Pokémon's ability to withstand a physical attack.
- "**Sp. Atk.**" (`int`): the amount of damage a Pokémon deals when it makes a special attack.
- "**Sp. Def.**" (`int`): the Pokémon's ability to withstand a special attack.
- "**Speed**" (`int`): the Pokémon's speed, this number decides who attacks first in a battle.
- "**Generation**" (`int`): generation to which the Pokémon belongs ([1..6]).
- "**Legendary**" (`bool`): bool indicating whether a Pokémon is classified as "Legendary".

	#	Name	Type 1	Type 2	Total	HP	Attack	Defense	Sp. Atk	Sp. Def	Speed	Generation	Legendary
0	1	Bulbasaur	Grass	Poison	318	45	49	49	65	65	45	1	False
1	2	Ivysaur	Grass	Poison	405	60	62	63	80	80	60	1	False
2	3	Venusaur	Grass	Poison	525	80	82	83	100	100	80	1	False
3	3	VenusaurMega Venusaur	Grass	Poison	625	80	100	123	122	120	80	1	False
4	4	Charmander	Fire	NaN	309	39	52	43	60	50	65	1	False

Table 1: Head of the dataset

3.2 Preprocessing

To carry out a comprehensive analysis on the Pokémon dataset, various preprocessing steps were necessary to prepare the data for different types of investigations. First, we removed the first column labeled #, as it was irrelevant to our analysis. Additionally, some Pokémon entries lacked a secondary type, which we marked as “None” to handle missing values consistently across the dataset.

Our analyses were organized into specific investigations, each targeting a distinct aspect of the Pokémon dataset:

- **Entire Dataset Analysis**: retain the entire dataset without modifications to identify the Pokémon with the highest number of battle wins.
- **Pokémon Type Analysis**: make a separate analysis for each type of the Pokémons, grouping the dataset by the "Type 1" attribute and identifying the strongest Pokémon within each type.
- **Generational Analysis**: perform an analysis of the strongest Pokémon across generations, we segmented the data by generation and focused on Pokémon that win more battles in each group.
- **Excluding Legendary and Altered Forms**: perform an analysis excluding legendary Pokémon and the altered forms (e.g., Charizard MegaCharizard X, …), as they typically exhibit significantly higher stats, which could skew the analysis.

These preprocessing steps enabled targeted analysis for each objective, yielding clear and relevant insights from the dataset.

3.3 Network Creation

We designed our network by defining each Pokémon as a node and establishing a directed and weighted edge between every pair of nodes to represent a battle between the Pokémon. This directed edge indicates the outcome of each battle, with the arrow pointing from the winning Pokémon to the losing one.
We define the weight associated with the edge as the difference between 1 and the ratio of the rounds each Pokémon takes to win the battle.
We decided to use directed edges because we wanted to display the win-loss relationship between the two Pokémon and we use weighted edges because Pokémon battles aren’t solely determined by their individual traits and may be influenced by external factors, so we opted to use weighted connections to allow the coefficient of victory in each battle to vary.
Therefore, we created a fully connected graph in which every Pokémon is connected to all the others.

To determine the structure of the battle between two Pokémon, we used the official formula created by the Pokémon developers, which is computed in this way [2]:

$$Damage = \left(\frac{\left(\frac{2*level}{5}+2\right)*power*\frac{Attack}{Defense}}{50} + 2\right) * modifier \quad (1)$$

in which the Attack and the Defense are defined for each pokemon, the level of the Pokémon is always 50 since the statistics of the Pokémon are based on this value. We defined the power of the Pokémon move equal to 80 and the modifier is influenced by many factors, but the only one we know from the dataset is computed by the relation between the types of the two Pokémon.

In the battle it is important to consider the types of both Pokémon, as there are specific strengths and weaknesses between them. For instance, a Fire-type Pokémon is more effective against a Grass-type Pokémon, but less effective against a Water-type Pokémon.

Using the official type chart provided by the Pokémon developers [3], we created a dictionary to store the interactions between all Pokémon types. In this dictionary, we assigned a multiplicative factor of 0.5 if a Pokémon is weak against another, a factor of 2 if it has a type advantage, a factor of 0 if it cannot affect the opposing Pokémon, and a factor of 1 if there are no specific type interactions.

Since each Pokémon can have up to two types, our analysis needed to account for the presence of a possible second type. Specifically, the final modifier is calculated as the product of the modifiers generated by the interactions between each type of the two Pokémon.

Before the battle between the two Pokémon takes place, we determined which of the two would attack first based on their speed statistics. This way, the faster Pokémon is chosen to be the first to attack.

Since each Pokémon has two types of attacks (physical attack and special attack, as well as physical defense and special defense), we first calculated the ratio between the physical attack of the first Pokémon and the physical defense of the second Pokémon, and similarly, the ratio between the special attack and the special defense. In this way, each Pokémon inflicts damage based on which of the two ratios is higher, using the most effective attack type against the opponent.

We then calculated the damage each Pokémon inflicts on the other based on the previous formula (1). Since the multiplier related to type interactions could be 0, we might encounter a situation where one Pokémon does not inflict any damage to the other. In this case, we assigned the victory to the Pokémon that is able to deal damage, with the victory weight set to 1. If neither Pokémon is able to attack the other, we then analyzed their “Total” stats and award the victory to the one with the higher stats. In this case, the weight was calculated as the difference between 1 and the ratio of the Total stats. If the Total stats are equal, we compute two directional edges between the two pokemon as they both win but with the weight set to 0, since there is no true winner.

When the damage dealt by each Pokémon is greater than 0, we then calculate the number of rounds required for each Pokémon to win the battle and we award the victory to the Pokémon that required the lower number of rounds. The rounds are defined as the ratio between the "HP" of the second Pokémon and the damage dealt by the first Pokémon. We decided that the victory would go to the Pokémon that defeats the other in the fewest number of rounds, and we defined the weight as the difference between 1 and the ratio of the rounds each Pokémon takes to win the battle.

If both Pokémon require the same number of rounds to win, we gave the victory to the faster Pokémon, but we set the weight to 0.3, as the victory was not overwhelming. The value 0.3 was chosen because the value of 0.5 represents an overwhelming victory (since this means that a Pokémon wins a battle using half the number of moves required by its opponent to win), so we decided to use a smaller value for this weight since it is not a strong win.

Instead if we have two Pokémon with the same speed we compute two directional edges between the two pokemon as they both win.

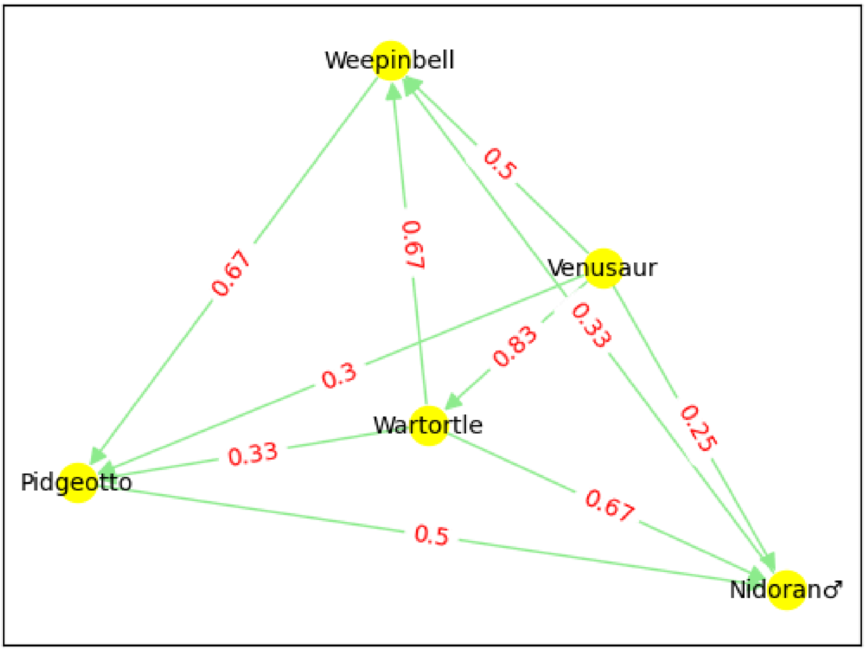

Figure 1: Directed weighted graph

4 Validity and Reliability

This network utilizes a Pokémon database found online, this database is fully accurate and faithful to the data regarding the Pokémon released by the creators [4], which inherently adds credibility and reliability to the information. The simplicity of the framework lies in its reliance solely on Pokémon data, such as names, types, and statistics, without any additional elaboration or external data sources.
Our database could be expanded by adding Pokémon from subsequent generations, but our study is limited to Pokémon from up to the sixth generation.

This approach ensures that the framework is easily reproducible and adaptable for use by any organization. By using publicly available data and open-source tools, the project is transparent and accessible.

Since the data in the database has not been altered in any way by our actions and we have not influenced the results through manipulations, we have obtained a versatile framework that can be easily implemented, and anyone can reproduce our study.

5 Measures and Results

In this chapter, we applied several measures to evaluate the quality of our model, exploring various aspects of the network to gain insights and valuable information. As detailed in the preprocessing section, we have divided our dataset into multiple subgroups highlighting different aspects and collecting results for each of them. In Section 5.1, we introduce each metric used to evaluate our networks, providing a brief definition followed by an explanation of its application to our case.

In Section 5.2, we apply these metrics to the networks and analyze the results.

5.1 Metrics description

Here the metrics we use for the evaluation of the network:

- **IN-DEGREE**: in-degree represents the number of incoming edges to a node, indicating the count of nodes that point to the node under analysis. In our network, this metric specifically refers to the number of Pokémon that the analyzed Pokémon defeats in battle.
  We also implemented the "**In-degree weighted**" that is calculated as the sum of the weights of the incoming edges.
- **OUT-DEGREE**: out-degree represents the number of outgoing edges from a node, indicating the count of nodes to which the analyzed node points. In our network, this metric refers specifically to the number of Pokémon that emerge victorious in battles against the Pokémon being analyzed.
  As we have done with "in-degree", we implemented the "**Out-degree weighted**".

- **PAGERANK**: our network is structured so that the edges point from the Pokémon that wins the battle to the one that loses, a strong Pokémon, which defeats many others, would accumulate a lower PageRank score. This is because PageRank in this setup favors nodes that are pointed to by many others, which signifies defeat in our network's context. Consequently, a weaker Pokémon, being defeated by many others, would have a higher PageRank score, as it receives more incoming connections. This setup inverts the traditional interpretation of PageRank, where high scores usually indicate prominence or strength.
- **HUB and AUTHORITY**: hub and authority scores are metrics used to identify the influence or importance of nodes in a directed network.
  In our analysis, the Pokémon with high hub scores are those that perform consistently well against opponents, while those with high authority scores are considered important benchmarks of strength that other powerful Pokémon target and defeat. In our network Pokémon with the highest "hub score" are the ones with higher "out-degree", and Pokémon with the highest "authority score" are the ones with higher "in-degree".
- **CLOSENESS CENTRALITY**: the closeness centrality is measured as:

$$C(u) = \frac{n-1}{\sum_{v=1}^{n-1} d(u, v)} \tag{2}$$

  where $d(u, v)$ is the weight between node u and node v. In our network, the Pokémon that have higher "closeness centrality" are the ones that have a lower weight, since it is at the denominator. Having a lower weight means that the ratio between the rounds each Pokémon takes for winning is a higher number, so the numbers of the two rounds are closer and the overall battle is more closed.
- **RECIPROCITY**: in a directed network, reciprocity occurs when, for a directed edge from node A to node B, there is also a directed edge from node B to node A, creating a mutual connection.
  Global reciprocity in a directed network quantifies the proportion of reciprocal edges (mutual connections) relative to the total number of directed edges in the network. It can be expressed mathematically as:

$$Global\ Reciprocity = \frac{Number\ of\ reciprocal\ edges}{Total\ number\ of\ directed\ edges} \tag{3}$$

  In our network, global reciprocity represents the percentage of battles that result in a tie, where a reciprocal directed edge exists between two Pokémon.
- **CLIQUE**: a clique is a set of nodes within an undirected network such that every member of the set is connected by an edge to every other. Since we have a directed graph during this analysis we don't consider the direction of the edges.
  In our network, the analysis through cliques could highlight various aspects that link Pokémon together, such as: grouping by type, legendary Pokémon cluster, evolutionary relationships, weakness and vulnerability patterns or type and performance clusters. Based on how our problem is structured, the only aspects that might be interesting are the last two, so we compute the analysis of Clique trying to evidence these aspects.

5.2 Datasets results

5.2.1 Whole Dataset

The table below reveals that Out-Degree, Weighted Out-Degree, Low PageRank and Hub Score are the metrics that highlight the most powerful Pokémon. These metrics consistently feature the same top three Pokémon, with Arceus ranking first across all of them. The second and third positions also largely include the same Pokémon.

	1st	2nd	3rd
Out-Degree	Arceus: 7.89×10^{2}	Regigigas: 7.79×10^{2}	Slaking: 7.71×10^{2}
Weighted Out-Degree	Arceus: 5.18×10^{2}	Kyurem Black Kyurem: 5.14×10^{2}	Regigigas: 5.10×10^{2}
Low PageRank	Arceus: 1.91×10^{-4}	Regigigas: 1.94×10^{-4}	Slaking: 1.99×10^{-4}
Hub Score	Arceus: 2.50×10^{-3}	Regigigas: 2.45×10^{-3}	Kyurem Black Kyurem: 2.43×10^{-3}

Table 2: Whole Dataset Top-3

Additionally, the table below indicates that the metrics of In-Degree, Weighted In-Degree, PageRank, and Authority Score are particularly effective in identifying the less powerful Pokémon within the network. These metrics consistently spotlight the same three Pokémon (Happiny, Feebas, and Magikarp) repeatedly occupying the top three positions, though sometimes in a slightly varied order. Collectively, these metrics emphasize their relative importance while indicating that, in the broader context of network influence, these Pokémon do not hold the highest levels of power.

	1st	2nd	3rd
In-Degree	Happiny: 7.98×10^{2}	Feebas: 7.95×10^{2}	Magikarp: 7.94×10^{2}
Weighted In-Degree	Feebas: 6.60×10^{2}	Magikarp: 6.56×10^{2}	Happiny: 6.51×10^{2}
PageRank	Magikarp: 1.6×10^{-2}	Happiny: 1.0×10^{-2}	Feebas: 0.9×10^{-2}
Authority Score	Feebas: 3.02×10^{-3}	Magikarp: 3.01×10^{-3}	Happiny: 2.99×10^{-3}

Table 3: Whole Dataset Last-3

The Pokémon in the Top-3 position, measured with the Closeness Centrality, represents the Pokémon that face the battles by computing a number of rounds as similar as possible to that of its opponent, making the challenge more competitive.
In contrast, the Pokémon in the Last-3 positions are those who win or lose with a very low number of moves compared to the number of moves that the opponent has to do, suggesting they are very powerful or very weak. So, from this last consideration, it can be observed that the weakest Pokémon (Feebas and Magikarp) are those that tend to lose battles in a very limited number of turns, highlighting their relatively low strength and effectiveness.

	1st	2nd	3rd
Closeness Centrality	Kecleon: 3.16	Wigglytuff: 3.13	Vigoroth: 3.12
Low Closeness Centrality	Feebas: 1.40	Magikarp: 1.41	Groudon: 1.63

Table 4: Whole Dataset Closeness Centrality

Global Reciprocity measures the proportion of battles that end in a tie compared to the total number of edges. This metric has a small value of 0.91%, suggesting that a very low number of battles end in a tie. This outcome indicates that there are few Pokémon with identical attributes. The limited number of ties can be attributed to certain Pokémon types neutralizing each other's attacks, leading to an equal outcome in the battle.

Global Reciprocity	0.0091

Table 5: Whole Dataset Global Reciprocity

Finally, we decided to study the cliques generated from the undirected graph, filtering the edges to keep only the reciprocal ones, and we retained only the subgraphs that are strongly connected.
From our graph, we obtained 410 different cliques with a size ranging from 3 to 5 elements, this indicates a mix of smaller and moderately large interaction groups, with no overwhelmingly large cliques.
Some cliques seem to reflect thematic or biological groupings, like type affinities, but in all the groups there is always a Pokémon that has a different type from all the others :

- Water and Ground themed nodes: ['Piplup', 'Mudkip', 'Phanpy', 'Sandshrew'] the first two are Water and the last two are Ground
- Psychic-themed nodes: ['Slowking', 'Cofagrigus', 'SlowbroMega Slowbro'] but 'Cofagrigus' is Ghost

Or other clique shows similarity about the legendary aspect, like:

- ['Tauros', 'Latios', 'Latias'], but 'Tauros' is not legendary

Certain nodes appear in multiple cliques, suggesting they are highly connected or central in the network. In particular we have searched for the top 5 Pokémon that appear the most in multiple cliques. Assess which Pokémon act as "bridges" between different cliques, suggesting a central role in the network.

Zorua	20
Houndour	16
Cloyster	14
Horsea	13
Sandslash	13

Table 6: Top 5 most frequently Pokémon

Zorua (20 appearances) is the clear leader in clique participation, indicating it plays a highly central role in connecting different groups. Its frequent appearance suggests it may act as a hub, crucial for bridging otherwise disconnected subgroups or forming dense local clusters. Zorua’s dominance could reflect weak but widespread connections or fewer, stronger ties across several groups.

5.2.2 Dataset without Legendary and Altered form Pokémon

In this section, we analyze the dataset excluding Legendary Pokémon and altered forms, reducing the total number of Pokémon to 671. The goal of this analysis is to identify the most powerful Pokémon that are easily accessible in the game, without the reliance on Legendaries and altered forms, which are harder to obtain. The table below demonstrates that Slaking ranks first in all strength metrics, underscoring its dominance (its position at the top was also evident in previous analyses).

Additionally, the table not only confirms the consistency of these metrics but also reinforces the reliability of our analysis. By showing consistent results across different strength measurements, the table highlights that the ranking of Pokémon is stable and not influenced by fluctuations in any metric.

	1st	**2nd**	**3rd**
Out-Degree	Slaking: 6.64×10^2	Snorlax: 6.58×10^2	Lickilicky: 6.34×10^2
Weighted Out-Degree	Slaking: 4.45×10^2	Snorlax: 4.11×10^2	Cresselia: 4.01×10^2
Low PageRank	Slaking: 0.2×10^{-3}	Snorlax: 0.2×10^{-3}	Lickilicky: 0.3×10^{-3}
Hub Score	Slaking: 2.9×10^{-3}	Snorlax: 2.7×10^{-3}	Cresselia: 2.7×10^{-3}

Table 7: Dataset without Legendary and Altered form Pokémon Top-3

From the second table below, we can observe that the Pokémon in the top positions remain largely unchanged from the previous analysis, as no weak Pokémon were included among the Legendary or altered forms. While the exact rankings may vary slightly, the overall distribution of the weakest Pokémon is consistent.

	1st	**2nd**	**3rd**
In-Degree	Magikarp: 6.70×10^2	Feebas: 6.69×10^2	Happiny: 6.69×10^2
Weighted In-Degree	Feebas: 5.46×10^2	Magikarp: 5.43×10^2	Happiny: 5.39×10^2
PageRank	Magikarp: 10.4×10^{-3}	Diglett: 7.9×10^{-3}	Feebas: 7.1×10^{-3}
Authority Score	Feebas: 3.5×10^{-3}	Magikarp: 3.4×10^{-3}	Happiny: 3.4×10^{-3}

Table 8: Dataset without Legendary and Altered form Pokémon Last-3

The table incorporating the Closeness Centrality measure evaluates the same underlying concept as the previous table of this metric. While the Pokémon listed may differ slightly, the overall interpretation remains consistent with the prior analyses.

	1st	**2nd**	**3rd**
Closeness Centrality	Kecleon: 3.46	Vigoroth: 3.46	Rotom: 3.44
Low Closeness Centrality	Meloetta: 1.85	Magikarp: 1.64	Feebas: 1.60

Table 9: Dataset without Legendary and Altered form Pokémon Closeness Centrality

Finally, the *Global Reciprocity* in this case is slightly higher, likely because the removed Pokémon were the stronger ones that rarely resulted in ties. Now, battles that end in a tie represent a slightly larger proportion of the total, though still a low value at 1%.

Global Reciprocity	0.0106

Table 10: Dataset without Legendary and Altered form Pokémon Global Reciprocity

5.2.3 Division by type

For this analysis, we chose to display no tables, given the dataset's composition of 18 distinct types. Instead, here are the key insights that emerged considering also observations from the previous tables:

- Many of the highest-ranked Pokémon are legendary or have powerful mega or primal forms, such as MewtwoMega Mewtwo Y for Psychic, RayquazaMega Rayquaza for Dragon, and KyogrePrimal Kyogre for Water. This reflects an emphasis on associating legendary Pokémon with the peak power of each type, underscoring their prominence within the game.
- The lowest-ranked Pokémon, like Sunkern for Grass, Feebas for Water, and Caterpie for Bug, often represent early-stage or lower-evolution Pokémon. This suggests that each type is given a range that allows for both entry-level and expert-level gameplay.
- Types like Psychic, Dragon, and Steel, traditionally considered more powerful in the game, show an emphasis on very high-ranked Pokémon such as MewtwoMega Mewtwo Y, RayquazaMega Rayquaza, and Dialga. Types like Bug and Fairy, which are often seen as less dominant in competitive play, maintain a more moderate distribution of power with Pinsir and Xerneas at the top, still strong but relatively less overpowering than legendary Pokémon in other types.

5.2.4 Division by generation

The dataset includes a column indicating the generation of each Pokémon, covering six generations in total. For our analysis, we focused on examining the Pokémon with the highest out-degrees and in-degrees within each generation, using these as markers for "strongest" and "weakest." This approach allowed us to observe trends across generations, offering insights into the game's design evolution and the creators' choices.
This trend analysis suggests an intentional progression in design, balancing each generation with both powerful and accessible Pokémon, potentially to maintain challenge levels and variety across the game. The strongest and weakest Pokémon across the entire dataset come from different generations, suggesting that each new generation introduces Pokémon in a way that preserves the overall distribution balance.

Generation	Top Out-degree	Top In-degree
1	Mewtwo	Magikarp
2	Suicune	Sunkern
3	Slaking	Feebas
4	Arceus	Happiny
5	KyuremBlack Kyurem	Patrat
6	Zygarde50% Forme	Scatterbug

Table 11: Division by generation Top-1 and Last-1

6 Conclusion

The analysis done before provided an extensive exploration of Pokémon battle dynamics through a fully connected, directed, and weighted network model. By simulating battles among all Pokémon in the dataset and applying a variety of network metrics, we identified patterns of strength, weakness, and interactions that highlight both expected and surprising results. In this chapter we highlight the key conclusions from the study done before.

Metrics and consistency

Metrics such as Out-degree, Weighted Out-degree, and Hub scores effectively underlined the most dominant Pokémon, consistently positioning Pokémon like Arceus and Slaking as top performers. Conversely, metrics like In-degree, Weighted In-degree, authority score and PageRank consistently spotlighted weaker Pokémon such as Feebas and Magikarp. This consistency underscores the reliability of the chosen network metrics for evaluating battle performance.

Strength and weakness trends

Legendary and altered-form Pokémon overwhelmingly dominate strength metrics, confirming their superior stats and roles in gameplay. Excluding these Pokémon provided insight into more accessible options, with Slaking and Snorlax emerging as powerful non-legendary contenders. Weak Pokémon consistently include early-stage and unevolved species, reflecting their intended role as fundamental steps in a player's progression.

Type and Generation Dynamics

Analysis by type revealed expected hierarchies, such as Psychic, Dragon, and Steel types dominating, while Bug and Fairy types remained more moderate.
The division by generation demonstrated balanced power distributions, with each generation introducing both strong and weak Pokémon, maintaining the competitive variety within the game.

Battle Characteristics

Closeness centrality highlighted Pokémon that tend to engage in more balanced and competitive battles, where the number of moves required to win closely mirrors that of their opponents.
Global reciprocity revealed that ties were exceedingly rare, with only a small percentage of battles resulting in mutual victories. This finding emphasizes the vast diversity in Pokémon attributes, abilities, and interactions, which contribute to the dynamic and varied nature of battles in the Pokémon universe.

Clique generation

Overall, we have not been able to identify clear or consistent guidelines by which certain Pokémon are grouped together. There is no single criterion that links all the Pokémon in the provided groups, such as type, evolution, or other characteristics. However, some groups show similarities in terms of evolutions, battle roles, or natural themes, but there is no fixed rule explaining how they are grouped.

7 Critique

Since we decided to structure our network as a fully connected network, in which each node, represented by a Pokémon, was connected to all other nodes in the system, meaning each Pokémon encountered all the others, we found it challenging to select the right metrics to study our system.
Many metrics proved to be uninteresting or redundant in a graph of this type, like the betweenness centrality, assortativity or similarity.

Another issue we encountered while analyzing our dataset was the absence of all the moves and abilities that Pokémon can have. This limitation made our study quite restricted and not fully reflective of the actual gameplay experience.
On the other hand, it was practically impossible to expand our database to include this missing information, as each Pokémon can learn dozens of different moves, some of which may differ from the Pokémon's type. This would result in thousands of possible combinations, making it unfeasible to manage.

An example of inaccurate analysis in our network, due to the lack of moves and abilities, can be seen with the Pokémon Slaking. It frequently appears in the top three strongest Pokémon; however, upon closer examination, we discover that it has an ability that forces it to rest after every round. This limitation significantly weakens its performance in battles, meaning it is not as strong as our analysis initially suggested.

Overall, we still consider this analysis to be valuable, as it highlights interesting aspects regarding the identification of the strongest or weakest Pokémon by looking solely at their physical characteristics.

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