Project Proposal

//Proposal Summary

Pokémon is one of the most recognized media/entertainment franchises in the world, and by some estimates it is the most valuable franchise in the world

(more valuable than even the Star Wars franchise). Pokémon 's success is due to its ability to appeal to fans across multiple mediums, whether the TV show, the

trading card game, or clothing and accessories. But the entry point to the franchise for many people, myself included, is the Pokémon video game. The Pokémon video

game is designed for younger children to be able to play, and therefore is not especially difficult to beat in single player mode. However, with the introduction of

online battles during the Pokémon video game's 4th Generation an almost entirely separate style/subculture of play has developed around competitive Pokémon battling.

The rules for competitive battles, and the fact that players are competing against other humans and not the in-game non-playable characters (NPCs), make competitive

battling far more challenging than the standard Pokémon experience. For this reason, competitive Pokémon battling is one of the least well-known parts of the Pokémon

franchise. The fundamental problem presented to all competitive battlers is how to make time-constrained decisions that require complex calculations (either

heuristically or explicitly) under conditions of uncertainty. Therefore, I believe that there is ample opportunity to use the techniques I am learning as a Cloud

Application Developer to develop a program that will assist competitive battlers in developing their Pokémon team strategies and guiding them through the various

stages of a competitive battle.

//Broad Description of Competitive Battle Rules

The basic premise of a standard Pokémon video game is that of a young player travelling throughout a fictional region with the goal of eventually becoming the

champion of that region. This is accomplished by battling against other players (called trainers) by using the Pokémon as proxies. After defeating another trainer,

the player's Pokémon gain experience. With enough experience, Pokémon can increase in level, which increases their stats, available move pool, and sometimes causes

them to transform into stronger versions of their species (called "evolution"). As the player progresses through the main story, they typically (in all versions of

the game but one) defeat eight boss trainers (called Gym Leaders) and earn the right to challenge the four strongest trainers in the region (the Elite Four") and

finally defeat the region's champion to become champion in their own right.

Throughout the game, the only restrictions placed on the player is that they can only have up to six Pokémon travelling in their party (and therefore available

for use in battle) and the maximum level of any one Pokémon is 100. Battles in the standard story mode are primarily 1 vs 1: one of the player's Pokémon fighting one

of the opponent's Pokémon at a time. The battle continues until all of one player's Pokémon are defeated. There are usually a small number of "double battles", where

both the player and opponent battle using two Pokémon at the same time, but these are usually rare and inconsequential occurrences.

Competitive Pokémon battle rules are far more restrictive. They change slightly from year to year, tournament to tournament, but the basics are as follows:

Each player enters a team of six Pokémon. There can only be one of each species of Pokémon, and no two Pokémon can hold the same item. All Pokémon are scaled to be

level 50, regardless of their actual level. Battles are double battles. Finally, and most importantly for this project, a player can only bring four of their six

Pokémon into the battle.

Before a competitive Pokémon battle begins, each player sees the full list of 6 Pokémon that their opponent could theoretically bring into battle. But each

player has to decide which four Pokémon they should bring into the battle based on the set of 6 possible Pokémon that their opponent has available. Players typically

have only 90 seconds to decide which four Pokémon to bring into battle. At the start of a battle, each player will see two of the four Pokémon that their opponent

chose to bring, but they will still have uncertainty about the composition of the final two. Since each Pokémon can either attack or switch positions with another

Pokémon on the team during each turn, the players must account for not only the Pokémon they know the opponent brought to the battle but also for the Pokémon their

opponent might have brought. One of the best competitive Pokémon players has described the competitive version of the game as a combination of chess, poker, and random

chance.

//Building a Team

The first step in becoming a competitive Pokémon battler is deciding on which six Pokémon you want to have in your team. Players must choose the combination of

six Pokémon that provide them with the best combination of stat points, typings, held items, moves, and variations of four-Pokémon combinations to choose from. With

400 Pokémon currently available to choose from, this can be a daunting task. Therefore, the first task that my application would perform is helping analyze a Pokémon team in the abstract. Primary criteria would be each Pokémon's type and their overall stat rating: Do multiple Pokémon share the same type, thereby making the

player's team exceptionally vulnerable to a specific type of Pokémon? My application should be able to evaluate a given set of 6 Pokémon's most common weaknesses and

strengths base on each Pokémon's typing. Then it should also be able to calculate an average stat level given the individual stat levels of all six Pokémon.

The second consideration in building a team is how adaptable it is. In the context of competitive Pokémon battle, this means the ability to select multiple

viable four-Pokémon teams from the initial set of six. A team of six might look strong overall, but if the majority of the four-Pokémon teams that it can generate share

the same weakness, then it is not a good competitive team.

Finally, a competitive Pokémon player must consider whether their team is not just strong in a vacuum, but if it is strong when compared to the popular teams

used by other players. Competitive battle rules prevent a portion of the Pokémon from participating, and they can safely be ignored by a player developing a Pokémon

team. From the remaining set of available Pokémon, there will be a subgroup of Pokémon that are better than others and therefore more popular. This subgroup of Pokémon

that are more popular than others for a given ruleset of competitive battling are referred to colloquially as the "metagame." When building a team, player must consider

if their team is strong against the current metagame - they can choose to imitate the majority of other players or to develop a team based on defeating the most popular

Pokémon of the current metagame. Players who choose idiosyncratic teams designed to defeat the more popular, "standard" teams run the risk of struggling against other

less common teams, however.

//Battling

Once players have built their six-Pokémon teams and then selected the four that they want to use in a particular battle, they still face considerable uncertainty

about the outcome. The first decision players face is to decide which two of their Pokémon to send into battle first. These two Pokémon will thus be revealed to their

opponent, thereby reducing the opponent's uncertainty of which four Pokémon the player brought by 50%. However, the opponent faces the same decision/dilemma. Therefore

at the start of every competitive battle each player knows with certainty 50% of the other player's team. But they don't know which attacks each Pokémon will execute, or

if the opponent's Pokémon will even attack. If a player finds him/herself in a disadvantage matchup against the opponent's current two Pokémon they can chose to swap one

or both of their current Pokémon with one or both of the remaining two Pokémon that comprise the four-Pokémon team.

Adding to the uncertainty is the fact that both players chose their actions simultaneously. They must try to select the action (attack or switch Pokémon)

based on their probabilistic assessment of what their opponent is likely to do. This would be hard enough in general, but there is also a time limit on how long players

can deliberate their move for each turn (usually 90 seconds, similar to the time allotted for team selection).

//Project Concept

The concept of this project is to develop a web application that can assist competitive Pokémon players in all phases of the battling process, starting with

team building. The first step is to help player analyze their six-Pokémon teams in a vacuum. Given a player's input of their desired six Pokémon, the program will help

determine if there are there multiple shared weaknesses and/or compensating strengths. The program will output the results of the analysis by displaying the Pokémon

type(s) that the team is most weak to, as well as the overall or average stat rating of the team. This is the first step in helping the player identify which Pokémon

he/she should change or keep in order to increase the stat level and decrease the number of weakness types of the overall team.

The next step is most likely to be the most complicated but also the most important function of the application. It should receive information on which Pokémon

are the most popular for the current competitive format (the metagame) and develop a list of the six most likely Pokémon that a player will encounter. From that set

of six Pokémon, the program will generate four-Pokémon teams and compare them against all possible four-Pokémon teams from the player's initial team of six. The

program would then report the strength of the player's team vis-a-vis the hypothetical team by reporting how many four-Pokémon pairs from the opponent's team that the

player's team would have a favorable matchup against. It would also output the opponent's most likely four-Pokémon team combination, given the player's own six-Pokémon

team.

The final function that the application would perform would be to give updated probabilities on which four Pokémon the opponent brought to the battle, given

the first two Pokémon that the opponent reveals at the start of the battle. This will allow the player to make more informed decisions on which of the opponent's

Pokémon to attack, or if the player should switch to a different Pokémon.

//Data and Theory

Much of the data that I would use for this project is available, but the ease of acquiring it is uncertain at this time. There are many Pokémon sites/apps that

store all od the data on Pokémon (types, stats, moves, items, abilities, etc). My first choice would be the website Serebii.net to see if it has an API I could

interface with. However, if Serebii.net doesn't allow me to pull the necessary statistics I could build a database manually using Pokémon game books that list all of

the relevant information.

Data for which Pokémon are currently most popular (the "metagame") is far less common. Players typically have to intuit which Pokémon are likely to be possible

through abstract analysis of the current competitive battling ruleset and trial and error. However, there is a new website run by a fan that tracks all of the Pokémon

that have participated on teams that have won competitive tournaments. It also lists the percentage of teams that featured each Pokémon. This site, VGCStats, could

therefore provide the basis for generating hypothetical (yet likely) teams against which a player can compare his/her selected team.

Once the application has data on each Pokémon's stats and its likelihood of appearing in a competitive battle, it will utilize a function that I specify to

determine which team(s) are stronger than another. There is a site called Smogon that allows players to perform calculations to determine which stats to focus on,

as well as to simulate Pokémon battles in order to help them prepare for competitive battles. The source code for Smogon, and the battle simulator called Showdown,

is available on GitHub. I will use this code primarily to aid in the first level calculation of team strengths/weaknesses since the SMogon/Showdown code is not

designed for a human player to fight against a hypothetical team; it is designed for players to conduct Pokémon battles over the internet without using the actual

Pokémon game. There are also many applications that may assist me in developing the first order team analyzer, such as BattleDex and Teambuilder. However, as far as

I know right now these applications do not go farther than the first-order analysis of a team's abstract strengths/weaknesses.

From a theoretical standpoint I will rely heavily on probability and game theory. Game theory can help players weigh the expected outcomes of different

decisions under varying conditions of uncertainty. Competitive Pokémon battles are simultaneous-move games with perfect information, which means that although

opponents know exactly what actions the other took in the past, they cannot know/observe what the other will do until the action has been taken. Game theory

can help provide players with strategies to employ that will help them manage the information they reveal to their opponent through their moves, while keeping

their own motives as opaque as possible. After each turn in a battle, players (and the application) must update the probabilities of what the opponent is likely

to do next and which Pokémon the opponent likely has remaining.

//Conclusion and Disclaimer

In conclusion, my application will assist Pokémon players in selecting a team of six Pokémon for their competitive team, determining which four-Pokémon

subset of that team is most likely to be victorious against an opponent's team, and finally help calculate conditional probabilities during a battle. Although I

believe this application will be useful for competitive battles, I do not expect it would be authorized during official tournaments run directly by the Pokémon

Company International - players are only allowed to use a physical notebook to track team composition and battle progress. However, my application could still

provide value to players battling each other online during either friendly battles or during online competitions. Through repeated use of my application players

could develop better instincts for team selection and conditional probability even in competitions where they cannot use it.