

# Final Termination Project Report

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My project is called Dota2 predictor, whose inspiration comes from my enthusiasm in the famous game – DotA2, to elaborate my project, I will give an introduction of DotA2.



**Dota 2** is a [multiplayer online battle arena](#) (MOBA) video game developed and published by [Valve](#). The game is a sequel to [Defense of the Ancients](#) (*DotA*), which was a community-created [mod](#) for [Blizzard Entertainment's Warcraft III: Reign of Chaos](#). *Dota 2* is played in matches between two teams of five players, with each team occupying and defending their own separate base on the map. Each of the ten players independently controls a powerful character, known as a "hero", who all have unique [abilities](#) and differing styles of play. During a match players collect [experience points](#) and [items](#) for their heroes to successfully defeat the opposing team's heroes in [player versus player](#) combat. A team wins by being the first to destroy the other team's "Ancient", a large structure located within their base.

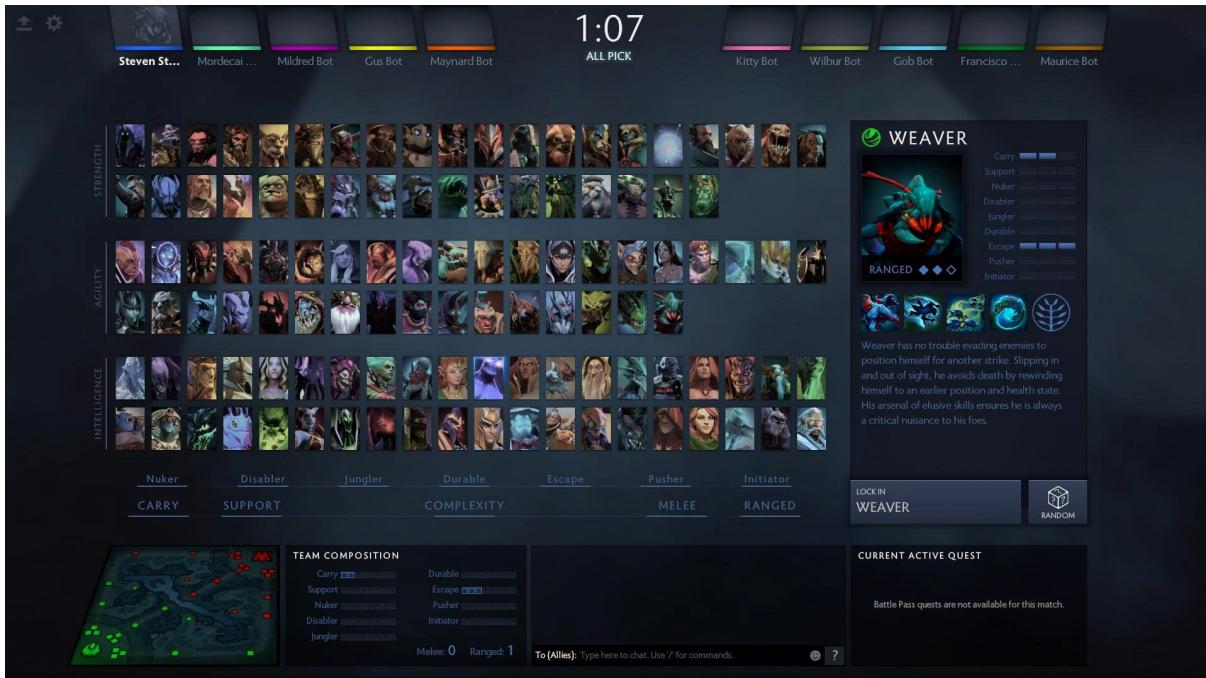


Figure 1 draft phase

*Dota 2* is a [multiplayer online battle arena](#) (MOBA) video game in which [two teams of five players](#) compete to collectively destroy a large structure defended by the opposing team known as the "Ancient", whilst defending their own. As in [Defense of the Ancients](#), the game is controlled using standard [real-time strategy controls](#), and is presented on a single [map](#) in a [three-dimensional isometric perspective](#).<sup>[1][2]</sup> Ten players each control one of the game's [121 playable characters](#), known as "heroes", with each having their own design, strengths, and weaknesses. Heroes are divided into two primary [roles](#), known as the core and support.



Figure 2 in-game start



Figure 3 map topology

The two teams—known as the Radiant and Dire—occupy fortified bases in opposite corners of the map, which is divided in half by a crossable river and connected by three paths, which are referred to as "lanes". The lanes are guarded by defensive towers that attack any opposing unit who gets within its [line of sight](#). A small group of weak [computer-controlled](#) creatures called "[creeps](#)" travel predefined paths along the lanes and attempt to attack any opposing heroes, creeps, and buildings in their way. Creeps periodically spawn throughout the game in groups from two buildings, called the "barracks", that exist in each lane and are located within the team's bases. The map is also permanently covered for both teams in [fog of war](#), which prevents a team from seeing the opposing team's heroes and creeps if they are not directly in sight of themselves or an allied unit. The map also features a day-night cycle, with some hero abilities and other game mechanics being altered depending on the time of the cycle.<sup>[5]</sup> Also present on the map are "neutral creeps" that are hostile to both teams, and reside in marked locations on the map known as "camps". Camps are located in the area between the lanes known as the "jungle", which both sides of the map have.



Figure 4 in-game victory scene

*Dota 2* has a large esports scene, with teams from around the world playing in various professional leagues and tournaments. Valve manages an event format known as the Dota Pro Circuit, which are a series of tournaments that award qualification points for earning direct invitations to The International, the game's premier annual tournament. Internationals feature a crowdfunded prize money system that has seen amounts in upwards of US\$30 million, making *Dota 2* the most lucrative esports game. Media coverage of most tournaments is done by a selection of on-site staff who provide commentary and analysis for the ongoing matches, similar to traditional sporting events. In addition to playing live to audiences in arenas and stadiums, broadcasts of them are also streamed over the internet, and sometimes simulcast on television networks, with peak viewership numbers in the millions.

Due to the diversity of hero pools and the counter mechanism between heroes' abilities, hero draft is one of the most important factors that impact the outcome of the game. Usually, for Dota2 professional scene, a coach of team is responsible for drafting.



Figure 5 pro scene draft phase

Back to my project, Dota2 Predictor is a program based on machine learning to predict results of Dota2 matches. It can automatically obtain the game data of designated players and predict the results of their future games according to the heroes selected in these games.

To run this program, following requirements are needed:

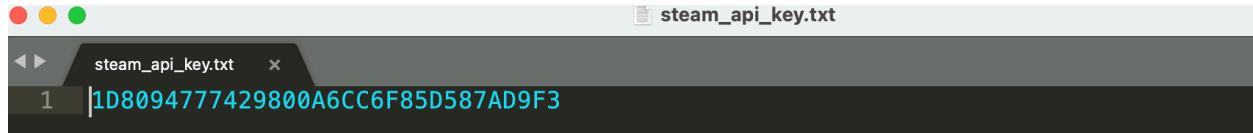
Python 2.7

Python packages:

- a. dota2api
- b. sklearn
- c. pandas
- d. numpy
- e. requests

To get data and set up:

API key is required. Dota2 Predictor get data via dota2api, so a steam API key is needed. If you haven't got one, get it from <https://steamcommunity.com/dev/apikey>. Then paste your API key in steam\_api\_key.txt.



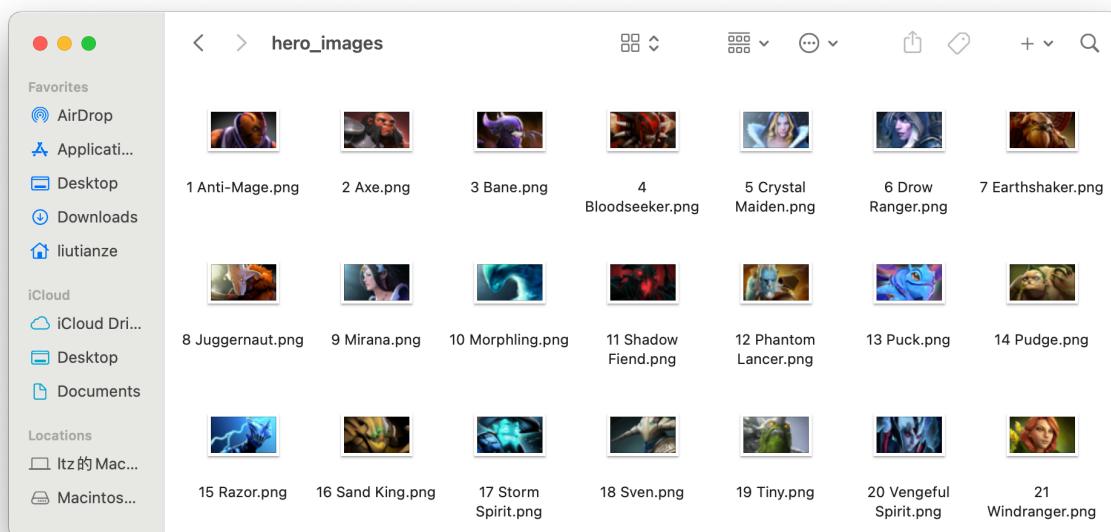
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steam_api_key.txt
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To get your Steam ID ready, Save your friends' and your steam ids in our\_ids.txt like:

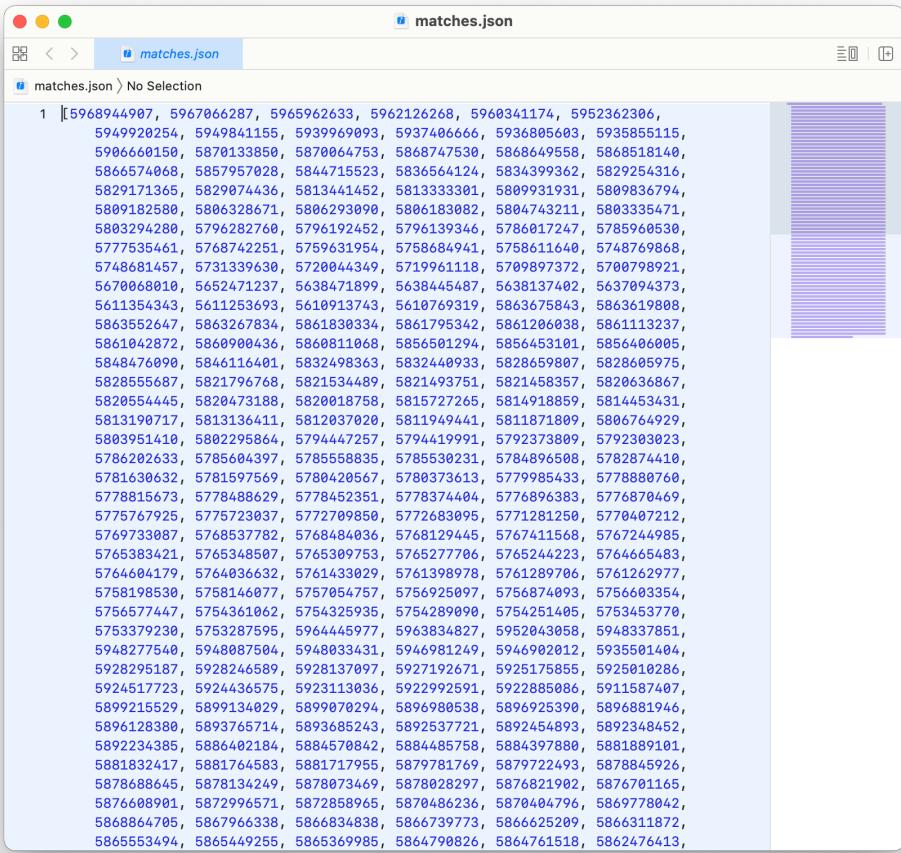


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our_ids.txt
1 |1001697509
2 |473582311
3 |152869961
4 |194879831
5 |371370703
6 |398757219
```

Run get\_images.py to download hero profile pictures.



Run get\_matches.py to get data of matches of you and your friends. The more data you get, the more accurate the prediction will be.



The screenshot shows a Mac OS X application window titled "matches.json". The window contains a single text-based list of approximately 1000 IDs, each preceded by a small blue square icon. The IDs are listed in a single column, separated by commas. The window has the standard OS X title bar with red, green, and yellow buttons, and a scroll bar on the right side.

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View	Zoom	Add Category
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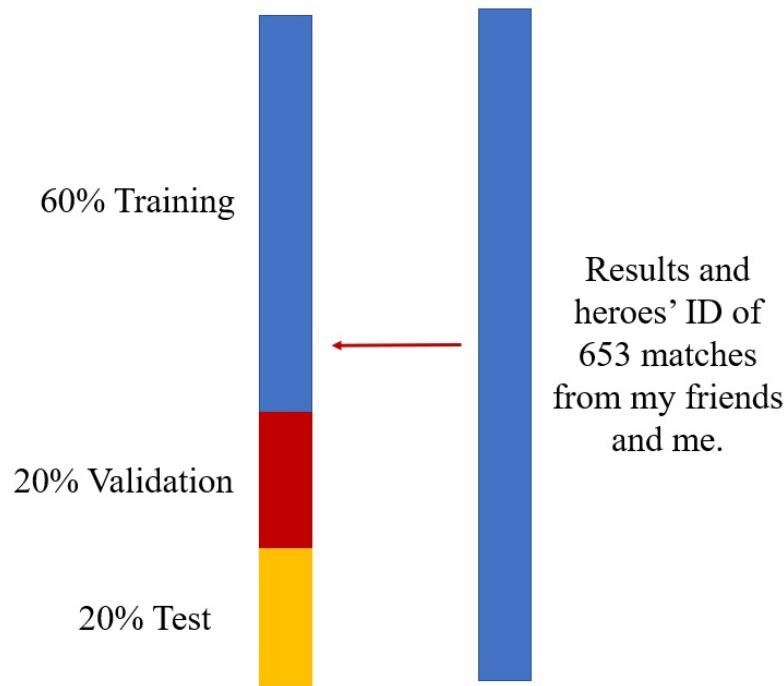
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38	81	119	32	121	39	22	84	23	120	1	
9	42	51	2	35	47	5	99	26	114	1	
67	121	96	83	35	11	7	101	41	40	0	
42	31	29	84	39	2	43	123	86	56	1	
15	42	100	25	121	44	94	2	87	30	1	

After the running, a json file called matches.json and a csv file called X.csv are simultaneously created and the data in them are totally synchronized.

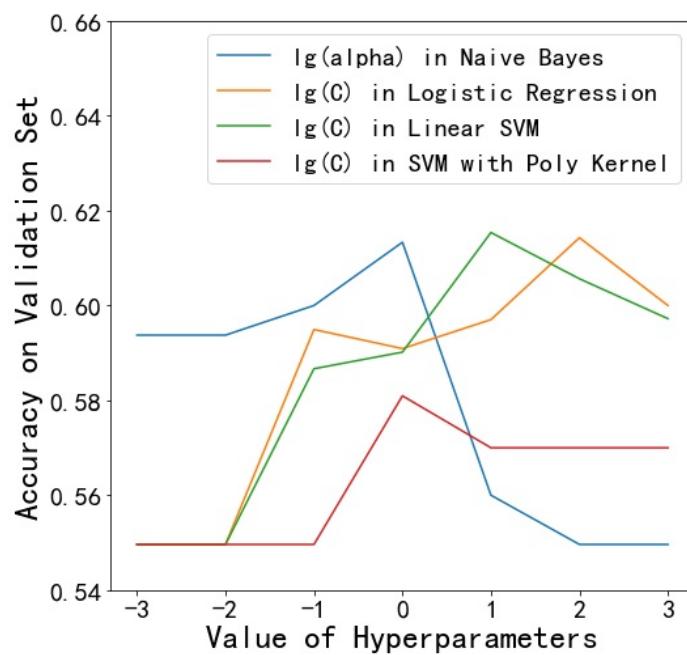
Run gui.py after completing the previous steps. To update your data, you can just run get\_matches.py again. If dota2 has an update involving new heroes, run get\_id\_name.py and get\_images.py again.

In the development of this program, 653 matches of my friends and me were used. The model selection and final evaluation are as follows.

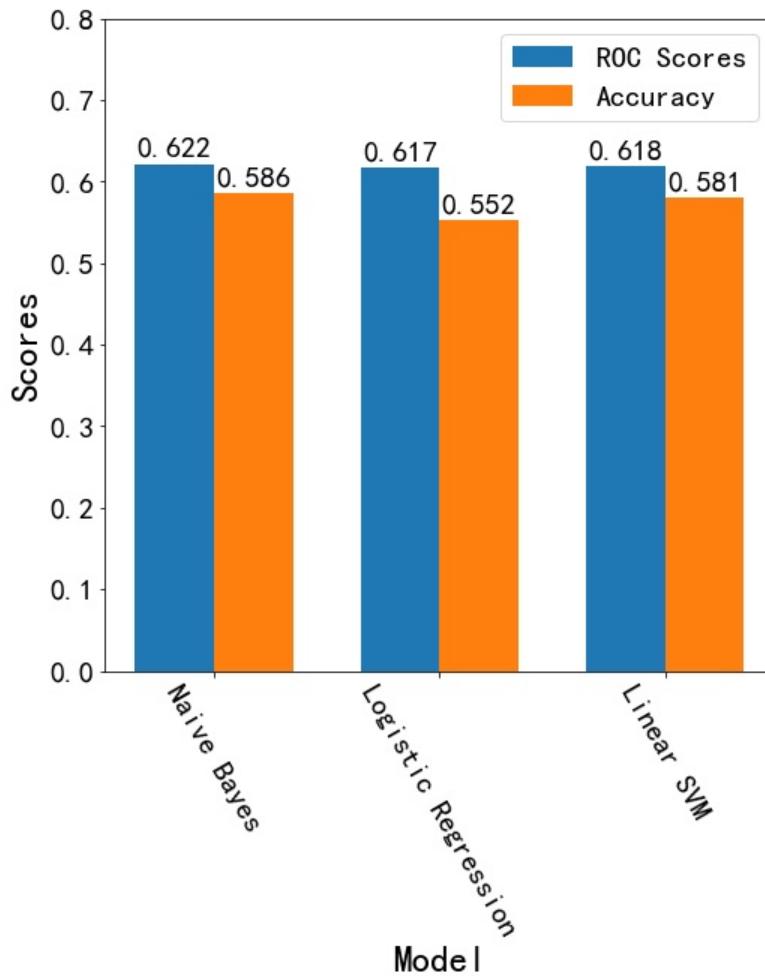
To do data set partition, First, the dataset is divided into training set, validation set, and test set according to the scale shown in the figure below. The training set is used to train models, the validation set is used to determined hyperparameters and the test set is used for final evaluation.



To select the best model suitable for our data samples, various algorithms are tried and their hyperparameters are determined by maximizing the accuracy on validation set, which is shown as the figure below.

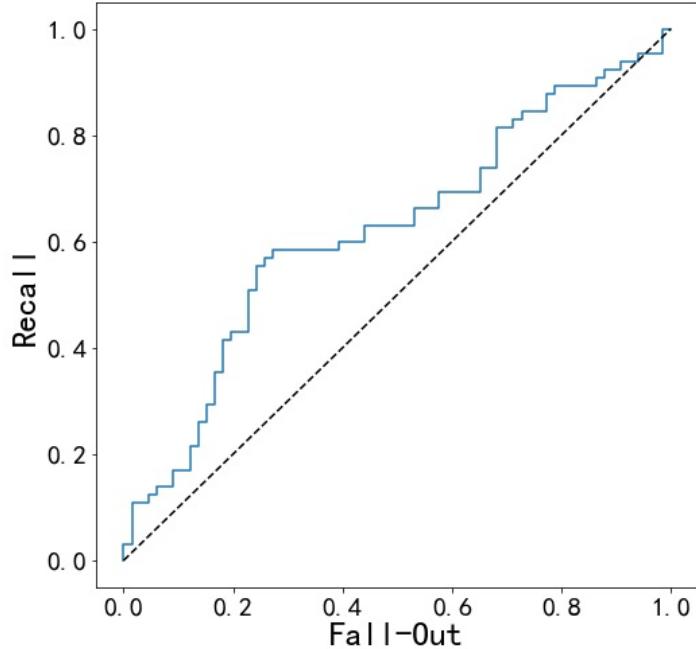


After determining hyperparameters, the accuracy and the area of the ROC curve (noted as ROC scores) on the test set of the three algorithms which perform well on the validation set are calculated, which is shown as the figure below.



After considering the accuracy and the ROC scores, Naive Bayes model is selected.

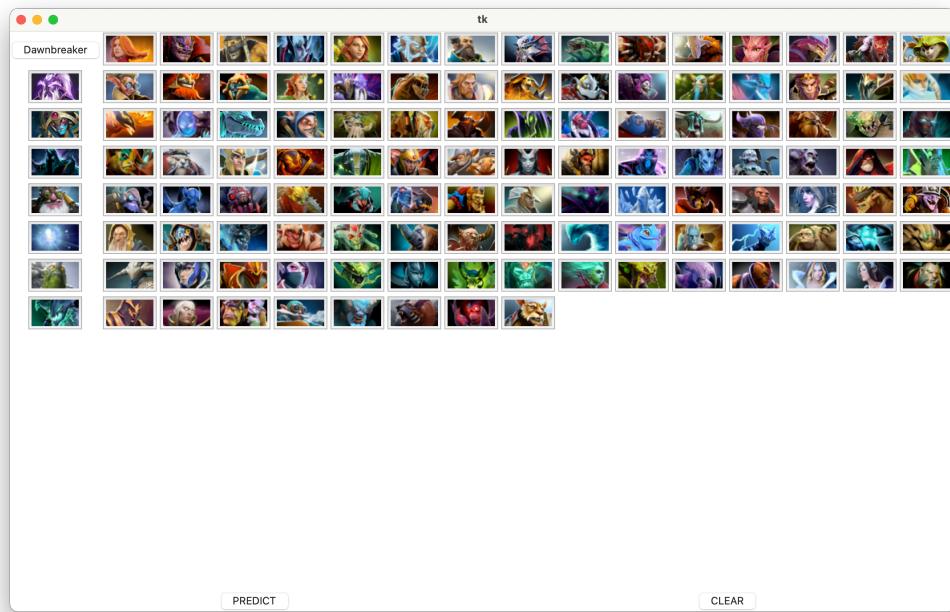
The accuracy on test set of the model is 0.586 and the ROC score is 0.622. The ROC curve is shown in the figure below.



In summary, Dota2 Predictor is not robust enough to predict every matches accurately because of the randomness of Dota2. But it can reflect the likelihood of winning or losing a game for designated players to some extent.

let's demo the final program.

In the following pictures, the UI of dota2 predictor is showed. you could press the hero profile picture button to select the line-up of your side and your opponent.



*Figure 6 before selection*

after yours and your opponents' draft are selected, press the predict button, the win probability and the prediction are shown.

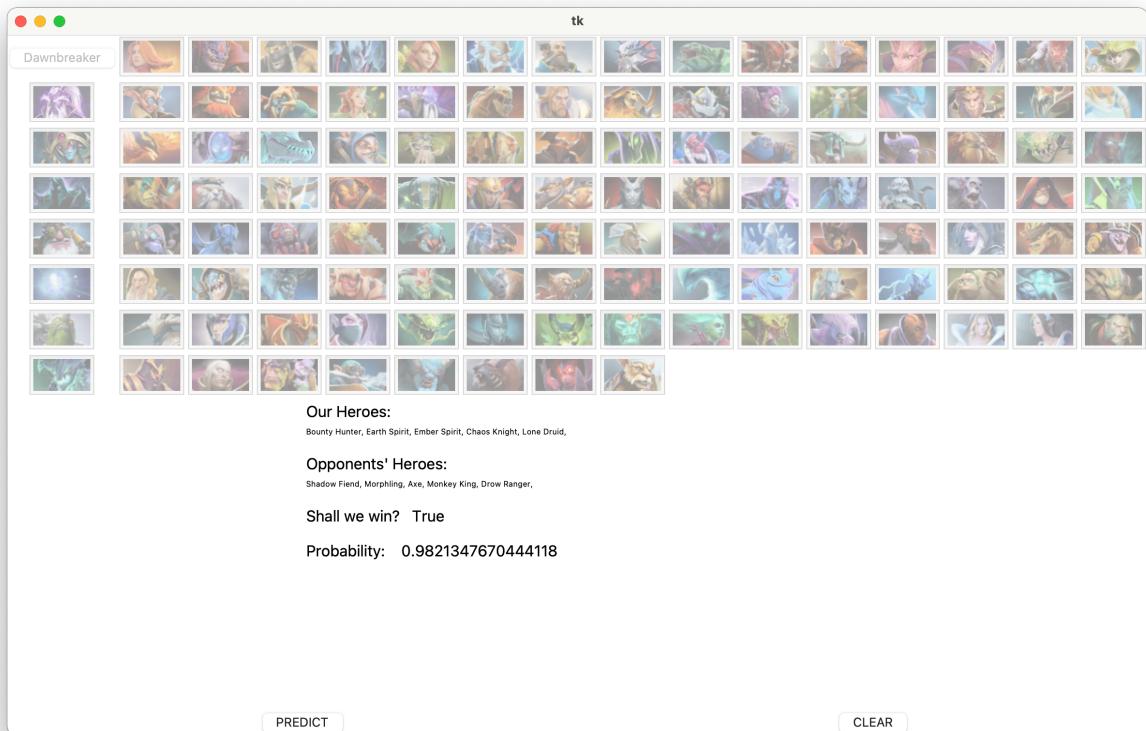


Figure 7 after selection

And pressing clear button will back to the initial stage without any hero being selected.