

project

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A through analysis on Dota 2 hero Magnus

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Dota 2 (Defense of the Ancients 2) was designed by IceFrog and published by Valve in 2013. It was originally a game mode for Blizzard Entertainment's Warcraft III: Reign of Chaos. It was one of the greatest video games in all times, and it was rated high by IGN: 9.4/10, GameSpot: 9/10, etc. As I was writing this document in May 2 2022 7:00 pm, there were still around 361,449 players playing this game.

Dota 2 is a type of MOBA (multiplayer online battle arena) game. There are two sides in Dota 2, one is called Dire, which always appeared at upper right corner of the map. The other is called Radiant, which always appeared at lower left corner of the map. There are 10 player in total, and they will be randomly assigned as 5 players in Dire and 5 players in Radiant. Before the match started, players need to pick a hero to control. Generally, heroes are classified by role of carry, mid, tank, support. In order to win the game, players should have all these roles in their teams and cooperate with each other. Although sometimes players can win with only one or two roles in their teams, the best practices of winning the game is to have all of these roles. Heroes can have the same roles, but each heroes are unique. For example, they have unique skills, damage, health, strong periods, etc. After picking a hero, the players will see a map like this:

As the map shows, there are three roads leading to opposite team's base. Every 30 seconds, creeps spawn in both team's base, and follow the three routes to attack. Players can choose one route, and follow creeps to attack the other team. However, the enemy heroes controlled by enemy team, creeps and defense towers will slow down the pace of attacking. To destroy enemy team's base, you have to use the strength of your hero, and try to kill enemy players and creeps to accumulate experience and gold. More experience and gold will solidify your skills, and allow you to purchase more powerful items at your base. In the end, one team will destroy the other team's base, and the game is over.

As a pro Dota player with 1500h+ play time and 5 years game experience, I am deeply interested in heroes' gameplay strategy, lineup matching, and winning percentage against different heroes. Recently, I paid special attention to Magnus, which is a hero characterized by high strength, able to hardly lock down enemy heroes, and an great initiator. Why do I analyze this hero? It's because in TI 10 (The International is the biggest annual event hosted by Valve. It gathers top ranking Dota teams around the world to compete in this championship, and it has total prize pool of 40 million dollars funded by Dota 2 community) final match PSG.LGD vs Team Spirit, Magnus was picked 4 times, and there were only 5 matches in total. So many great and decisive moments were created as Magnus played by Team Spirit. It's the Magnus' long lasting ultimate and blink dagger pushing enemies back made Team Spirit champion of the Ti10.

Dota 2 official site: <https://www.dota2.com/home> Dota 2 Steam store site: https://store.steampowered.com/app/570/Dota_2/ Dota 2 Wikipedia: https://en.wikipedia.org/wiki/Dota_2 Dota 2 Reddit: <https://www.reddit.com/r/DotA2/> Introduction of Magnus: <https://dota2.fandom.com/wiki/Magnus>

Now, let's begin analysing. We want to know in recent matches what's the general win rate of Magnus in different ranks? Comparing to other heroes, how good was Magnus?

```
[ ]: # To gather related data, we use opendota api (a api famous for statistical
      ↪analysis in Dota 2)
      # and python requests to get the data back.
      # opendota link: https://www.opendota.com/
      # api docs: https://docs.opendota.com/
import requests
import json
link = 'https://api.opendota.com/api/heroStats'
r = requests.get(link)
data = json.loads(r.text)

# We use json library to parse returned json objects, and recompile the
      ↪information into pandas dataframe.
import pandas as pd
df = pd.DataFrame(data)

# Clean and reformat the dataframe, so we only see data related to our task.
df = df[["localized_name", "1_pick", "1_win", "2_pick", "2_win", "3_pick",
      ↪"3_win", "4_pick", "4_win",
      "5_pick", "5_win", "6_pick", "6_win", "7_pick", "7_win", "8_pick", "8_win"]]

# Rename ranking
df = df.rename(columns={"localized_name": "Heroes", "1_pick": "Herald picks",
      ↪"1_win": "Herald wins",
                        "2_pick": "Guardian picks", "2_win": "Guardian wins",
      ↪"3_pick": "Crusader picks",
                        "3_win": "Crusader wins", "4_pick": "Archon picks",
      ↪"4_win": "Archon wins",
                        "5_pick": "Legend picks", "5_win": "Legend wins",
      ↪"6_pick": "Ancient picks",
                        "6_win": "Ancient wins", "7_pick": "Divine picks",
      ↪"7_win": "Divine wins",
                        "8_pick": "Immortal picks", "8_win": "Immortal wins"})
all_hero_wp_df = df.copy()
magnus_df = all_hero_wp_df[all_hero_wp_df["Heroes"] == "Magnus"]
magnus_df.reset_index(inplace=True, drop=True)
magnus_df.head()
```

```
[ ]: Heroes Herald picks Herald wins Guardian picks Guardian wins \
0 Magnus 8244 3790 19299 8813

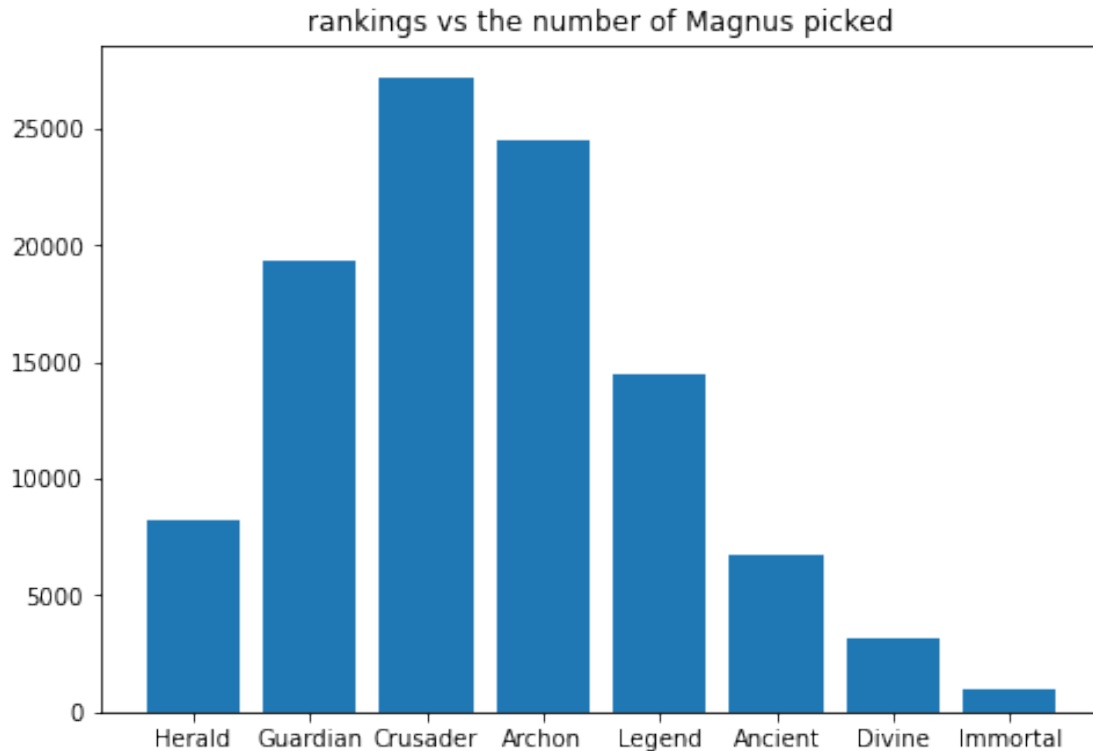
Crusader picks Crusader wins Archon picks Archon wins Legend picks \
0 27218 12949 24502 11569 14460

Legend wins Ancient picks Ancient wins Divine picks Divine wins \
0 7045 6766 3356 3138 1505

Immortal picks Immortal wins
0 1000 476
```

Generally speaking, players with Herald, Guardian, or Crusader titles are newbies. Players with Archon, Legend, or Ancient titles are medium players. Players with Divine or Immortal titles are pro players. Next, we will calculate the win rate of Magnus in different player rankings, and plot a few graphs to visualize the results.

```
[ ]: import matplotlib.pyplot as plt
fig = plt.figure()
ax = fig.add_axes([0,0,1,1])
ranks = ['Herald', 'Guardian', 'Crusader', 'Archon', 'Legend', 'Ancient',
        ↪ 'Divine', 'Immortal']
v = [magnus_df.at[0, "Herald picks"], magnus_df.at[0, "Guardian picks"],
    ↪ magnus_df.at[0, "Crusader picks"],
        magnus_df.at[0, "Archon picks"], magnus_df.at[0, "Legend picks"],
    ↪ magnus_df.at[0, "Ancient picks"],
        magnus_df.at[0, "Divine picks"], magnus_df.at[0, "Immortal picks"]]
ax.bar(ranks,v)
ax.set_title("rankings vs the number of Magnus picked")
plt.show()
```



Wait! Do people in Crusader pick Magnus the most simply because most of the Dota 2 players are concentrated in Crusader? To find out, I have to use opendota api to get the players' distribution in realtimes. However, I didn't find a api call for this, so for the sake of simplicity, I screen shoted Dota 2 players' distribution. Although I didn't do this in script, for most of the time, I think this does reflect the players' distribution in all time.

As you see, most of the players are concentrated in Archon, but players in Crusader has most of the Magnus picked. So the first conclusion we have is people love to play Magnus in Crusader. Now, let's explore the win rate of picking Magnus in different ranks.

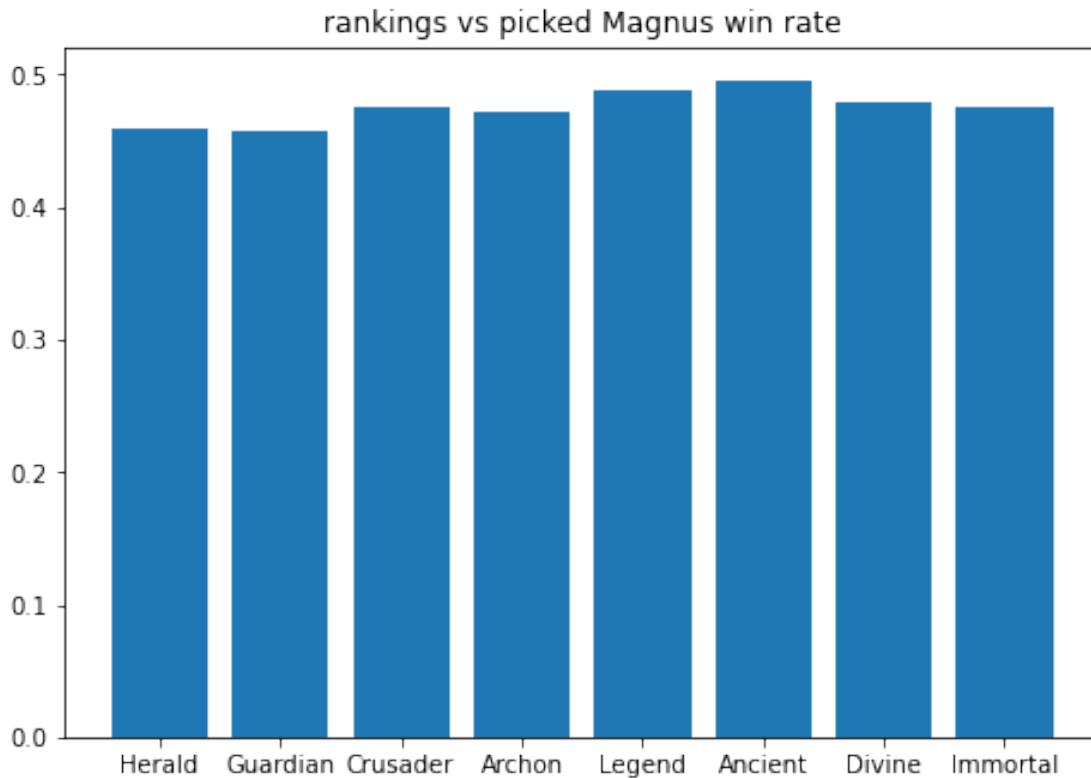
```
[ ]: fig = plt.figure()
ax = fig.add_axes([0,0,1,1])
ranks = ['Herald', 'Guardian', 'Crusader', 'Archon', 'Legend', 'Ancient', 'Divine', 'Immortal']
v = [magnus_df.at[0, "Herald wins"]/magnus_df.at[0, "Herald picks"],
     magnus_df.at[0, "Guardian wins"]/magnus_df.at[0, "Guardian picks"],
     magnus_df.at[0, "Crusader wins"]/magnus_df.at[0, "Crusader picks"],
     magnus_df.at[0, "Archon wins"]/magnus_df.at[0, "Archon picks"],
     magnus_df.at[0, "Legend wins"]/magnus_df.at[0, "Legend picks"],
     magnus_df.at[0, "Ancient wins"]/magnus_df.at[0, "Ancient picks"],
     magnus_df.at[0, "Divine wins"]/magnus_df.at[0, "Divine picks"],
     magnus_df.at[0, "Immortal wins"]/magnus_df.at[0, "Immortal picks"]]
ax.bar(ranks,v)
```

```

ax.set_title("rankings vs picked Magnus win rate")
plt.show()

jugg_df = all_hero_wp_df[all_hero_wp_df["Heroes"] == "Juggernaut"]
jugg_df.reset_index(inplace=True, drop=True)
v = ['Herald: ' + str(jugg_df.at[0, "Herald wins"]/jugg_df.at[0, "Herald_
↳picks")),
      'Guardian: ' + str(jugg_df.at[0, "Guardian wins"]/jugg_df.at[0, "Guardian_
↳picks")),
      'Crusader: ' + str(jugg_df.at[0, "Crusader wins"]/jugg_df.at[0, "Crusader_
↳picks")),
      'Archon: ' + str(jugg_df.at[0, "Archon wins"]/jugg_df.at[0, "Archon_
↳picks")),
      'Legend: ' + str(jugg_df.at[0, "Legend wins"]/jugg_df.at[0, "Legend_
↳picks")),
      'Ancient: ' + str(jugg_df.at[0, "Ancient wins"]/jugg_df.at[0, "Ancient_
↳picks")),
      'Divine: ' + str(jugg_df.at[0, "Divine wins"]/jugg_df.at[0, "Divine_
↳picks")),
      'Immortal: ' + str(jugg_df.at[0, "Immortal wins"]/jugg_df.at[0, "Immortal_
↳picks"))]
print("Juggernaut win rate in all ranks:")
for d in v:
    print(d)

```



Juggernaut win rate in all ranks:

Herald: 0.521753216699065
Guardian: 0.5369396008174979
Crusader: 0.5448573052570356
Archon: 0.5488982421391434
Legend: 0.5462330748755931
Ancient: 0.537320202151095
Divine: 0.5198280643372157
Immortal: 0.4905847373637265

As illustrated in the graph, people picked Magnus have relatively high win rate in Legend. However, the win rate of magnus across all ranks is low, since none of them pass 0.5. On the other hand, Juggernaut is a powerful hero, but nearly never shows up in TI. The win rate of Juggernaut is significantly higher than Magnus across all ranks. So, Magnus is more useful in a big championship like TI. Other than that, be careful to pick Magnus in this patch, as you might want to punch the monitor and throw away the keyboard after you lose the game.

Now let's examine some meta information about Magnus. In addition, we will try to discover which heroes Magnus is good to cooperate or against.

```
[ ]: link = 'https://api.opendota.com/api/heroes'
r = requests.get(link)
data = json.loads(r.text)
```

```
df = pd.DataFrame(data)
heros_df = df.copy()
df = df[df["localized_name"] == "Magnus"]
df.head()
```

```
[ ]:      id      name localized_name primary_attr attack_type \
95  97  npc_dota_hero_magnataur      Magnus      str      Melee

      roles  legs
95  [Initiator, Disabler, Nuker, Escape]      4
```

```
[ ]: link = 'https://api.opendota.com/api/heroes/97/matchups'
r = requests.get(link)
data = json.loads(r.text)
df = pd.DataFrame(data)

print(df.head())

# At this point, we use hero names instead of hero ID, and we will calculate
↳ win rate of Magnus against other
# heros, and list the top 5 of them.
df["win rate"] = df["wins"]/df["games_played"]
df = df.sort_values(by='win rate', ascending=False).head()

print(df)
```

	hero_id	games_played	wins
0	129	290	146
1	86	197	89
2	26	189	98
3	121	168	87
4	128	167	99

	hero_id	games_played	wins	win rate
118	80	6	5	0.833333
112	5	10	8	0.800000
111	50	11	8	0.727273
89	14	31	21	0.677419
114	30	9	6	0.666667

```
[ ]: for i, r in df.iterrows():
      print(heros_df[heros_df["id"] == r["hero_id"]].get(["localized_name"]))
```

```
localized_name
78  Lone Druid
localized_name
4  Crystal Maiden
localized_name
48  Dazzle
```

```

    localized_name
13      Pudge
    localized_name
28  Witch Doctor

```

It's clear that in current patch, Magnus is best to counter the heroes listed above.

Apart from heroes that Magnus counters, we can also see who plays Magnus the most in recent times.

```
[ ]: # Players info
link = 'https://api.opendota.com/api/heroes/97/players'
r = requests.get(link)
data = json.loads(r.text)
df = pd.DataFrame(data)
print(df.head())
```

```

    account_id  games_played  wins
0    228392819           162    105
1     96169991           122     64
2     41231571           118     82
3     70388657           114     68
4     88271237            60     39

```

Well, the api document of opendota says there will be responses such as steamid, avatar, personaname, last_login, full_history_time, country_code, fantasy_role, is_pro, etc return. Nevertheless, we can only see account_id right now. I guess they didn't make all functionalities as the document described. Therefore, we cannot see magnus players' info by scripts. If you are interested in pro Magnus players, you can always head to the link: <https://master.opendota-staging.netlify.app/heroes/97/players>, and see the results in realtime.

In conclusion, as I research statistics about Magnus, I found out lots of good resources such as Dota buff, opendota, datdota, Dota 2 official website, etc. However, only opendota has clear and well documented api to use, rather than just telling you the results on the web, or vague description about the api usage. Therefore, if you want to do Dota 2 analysis, opendota can be your best choice. You can find information about players, matches, heroes, etc in Dota 2. Although opendota did a great job on providing information, it doesn't has more detailed information such as how many times Roshan (a powerful neutral creep in the game) get killed in a game? Or, where did experiences or gold of a hero get? If you want detailed information like this, you will have to collect by yourself, and make it into csv or json to analyse later.

Apart from the data sources, we can clearly understand the Magnus as a notorious initiator, gankers, and had shocked the Dota 2 fans in TI 10 is not strong. It is only powerful when you have good team mates, and they are willing to assist you. Other than that don't pick him, don't even practice him. Pick heroes such as Juggernaut, Tiny, Chaos Knnight who has high win rate in current patch and can carry the game without the team mates.