CS579 Project Milestone Report

DOTA SCIENCE

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Abstract:

In this project, various factors which affect a Dota 2 game such as kills, deaths, assists, gold per minute, experience per minute and combination of characters picked are analysed and presented in the manner of graphs. These graphs can be used to see which factors play a major role and what a player must focus on to win a game.

Problem Statement:

Dota 2 is a popular MOBA (Multiplayer Online Battle Arena) game which has a 5 VS 5 Tower defence game style. There are various factors that affect the outcome of the game. These factors can be analysed and players can look at the graphs and see which areas to focus on to achieve a win.

Data:

All the data is gathered from the Dota 2 Web Api. Real time data can be collected using the getmatches.py, getplayermatch.py. Otherwise the data gathered by me can be used to test the programs. The output is then stored as JSON files for access at a later stage.

Method:

The first method used to calculate the win rates, kills, deaths, assists, gpm, xpm percentages involve

Win Perc = total wins/ (total wins + total losses)

Kill perc = Kills when win/(Kills when win + kills when lose)

Similarly calculate percentages for the deaths, assists

Gold_per_min[i] = (total gold at the end of game/total game time)

for i in Gold_per_min[i]:

      sum = sum + gold_per_min[i]

      total_matches = total_matches + 1

Gold perc = sum/total_matches

The second method used is to determine communities of hero combinations that lead to a win in a Dota 2 game.

1. We first create a co-occurrence network:

Nodes are created for each hero. These nodes are represented by their hero id in the graph.

The graph is converted to a fully connected graph.

The edge weights for each edge gets incremented if the same end-points (heroes) co-occur in the in the same game and the game resulted in a win.
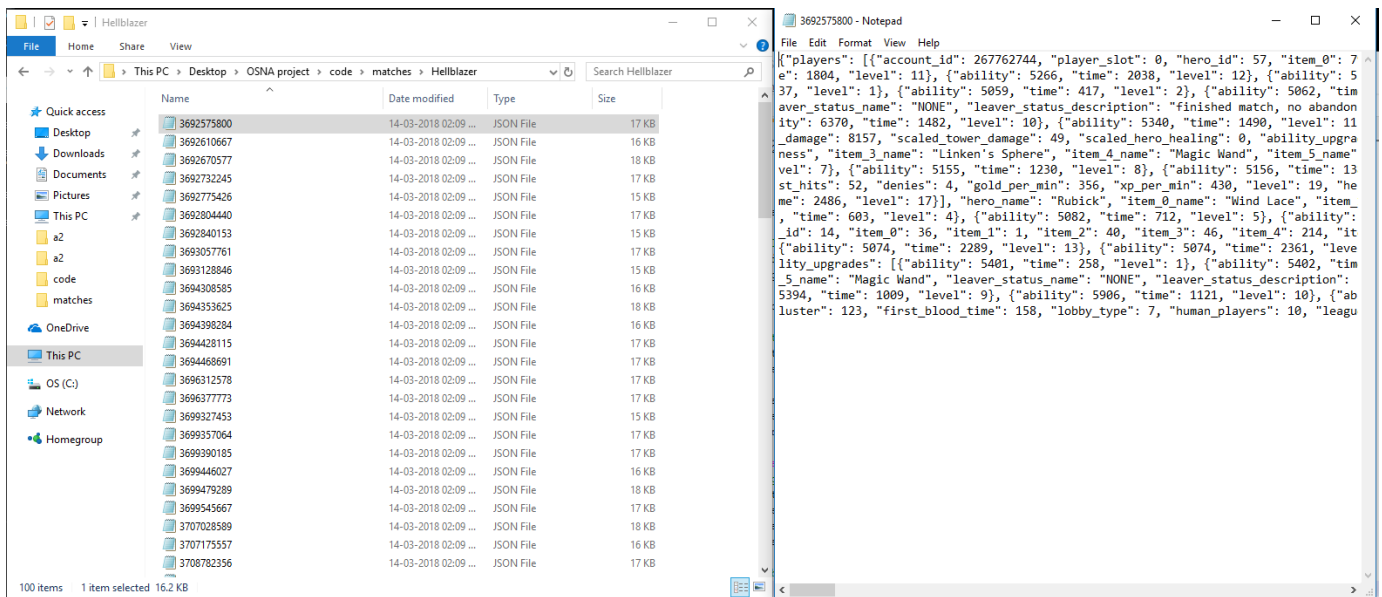
2. Community Detection

The graph is then split into communities based on Girvan Newman or Louvain community detection algorithms.

Intermediate Results:

Gathering data of recent matches and storing them in JSON files. (These files do not contain in depth data but just the general details)
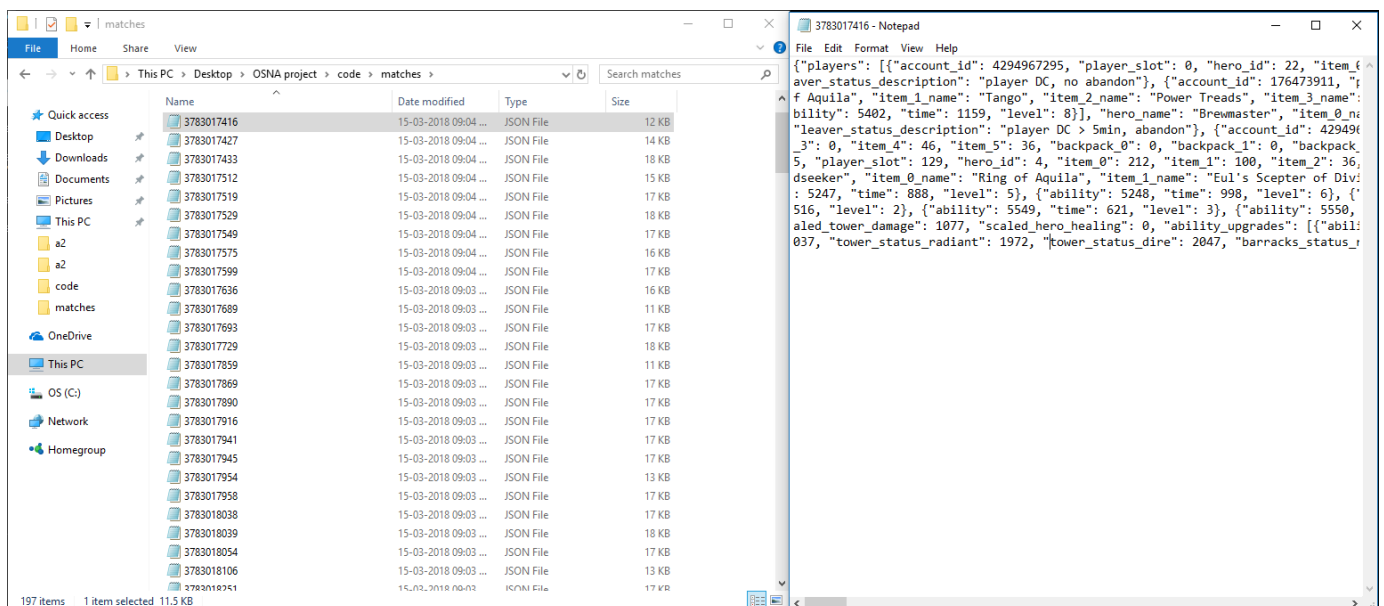
Gathering match details for one single player. (100 games)

Calculation of the win/loss counts, win percentage, kills, death, assists, average gold per minute and average experience per minute of a single player.

Gathered the hero details of all 120 heroes present in the game. Each hero is represented with a unique id to provide better representation in graphs.

HERO LIST
{1: 'Anti-Mage', 2: 'Axe', 3: 'Bane', 4: 'Bloodseeker', 5: 'Crystal Maiden', 6: 'Drow Ranger', 7: 'Earthshaker', 8: 'Juggernaut', 9: 'Mirana', 11: 'Shadow Fiend', 10: 'Morphling', 12: 'Phantom Lancer', 13: 'Puck', 14: 'Pudge', 15: 'Razor', 16: 'Sand King', 17: 'Storm Spirit', 18: 'Sven', 19: 'Tiny', 20: 'Vengeful Spirit', 21: 'Windranger', 22: 'Zeus', 23: 'Kunkka', 25: 'Lina', 31: 'Lich', 26: 'Lion', 27: 'Shadow Shaman', 28: 'Slardar', 29: 'Tidehunter', 30: 'Witch Doctor', 32: 'Riki', 33: 'Enigma', 34: 'Tinker', 35: 'Sniper', 36: 'Necrophos', 37: 'Warlock', 38: 'Beastmaster', 39: 'Queen of Pain', 40: 'Venomancer', 41: 'Faceless Void', 42: 'Wraith King', 43: 'Death Prophet', 44: 'Phantom Assassin', 45: 'Pugna', 46: 'Templar Assassin', 47: 'Viper', 48: 'Luna', 49: 'Dragon Knight', 50: 'Dazzle', 51: 'Clockwerk', 52: 'Leshrac', 53: "Nature's Prophet", 54: 'Lifestealer', 55: 'Dark Seer', 56: 'Clinkz', 57: 'Omniknight', 58: 'Enchantress', 59: 'Huskar', 60: 'Night Stalker', 61: 'Broodmother', 62: 'Bounty Hunter', 63: 'Weaver', 64: 'Jakiro', 65: 'Batrider', 66: 'Chen', 67: 'Spectre', 69: 'Doom', 68: 'Ancient Apparition', 70: 'Ursa', 71: 'Spirit Breaker', 72: 'Gyrocopter', 73: 'Alchemist', 74: 'Invoker', 75: 'Silencer', 76: 'Outworld Devourer', 77: 'Lycan', 78: 'Brewmaster', 79: 'Shadow Demon', 80: 'Lone Druid', 81: 'Chaos Knight', 82: 'Meepo', 83: 'Treant Protector', 84: 'Ogre Magi', 85: 'Undying', 86: 'Rubick', 87: 'Disruptor', 88: 'Nyx Assassin', 89: 'Naga Siren', 90: 'Keeper of the Light', 91: 'Io', 92: 'Visage', 93: 'Slark', 94: 'Medusa', 95: 'Troll Warlord', 96: 'Centaur Warrunner', 97: 'Magnus', 98: 'Timbersaw', 99: 'Bristleback', 100: 'Tusk', 101: 'Skywrath Mage', 102: 'Abaddon', 103: 'Elder Titan', 104: 'Legion Commander', 106: 'Ember Spirit', 107: 'Earth Spirit', 109: 'Terrorblade', 110: 'Phoenix', 111: 'Oracle', 105: 'Techies', 112: 'Winter Wyvern', 113: 'Arc Warden', 108: 'Underlord', 114: 'Monkey King', 120: 'Pangolier', 119: 'Dark Willow'}

For an individual player the number of times each hero was picked in the 100 games is calculated and displayed below.

```
HERO COUNTS
Anti-Mage 15
Axe 8
Bane 4
Bloodseeker 10
Crystal Maiden 7
Drow Ranger 5
Earthshaker 13
Juggernaut 26
Mirana 12
Shadow Fiend 39
Morphling 8
Phantom Lancer 9
Puck 6
Pudge 45
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Razor 4
Sand King 15
Storm Spirit 13
Sven 9
Tiny 7
Vengeful Spirit 5
Windranger 5
Zeus 9
Kunkka 18
Lina 7
Lich 3
Lion 8
Shadow Shaman 15
Slardar 7
Tidehunter 4
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Witch Doctor 4
Riki 5
Enigma 6
Tinker 25
Sniper 15
Necrophos 11
Warlock 0
Beastmaster 2
Queen of Pain 10
Venomancer 5
Faceless Void 23
Wraith King 6
Death Prophet 3
Phantom Assassin 11
Pugna 7
```

A graph consisting of heroes as nodes represented by their hero id.

Edges between each node contain weights based on hero combinations picked in games with a winning result.
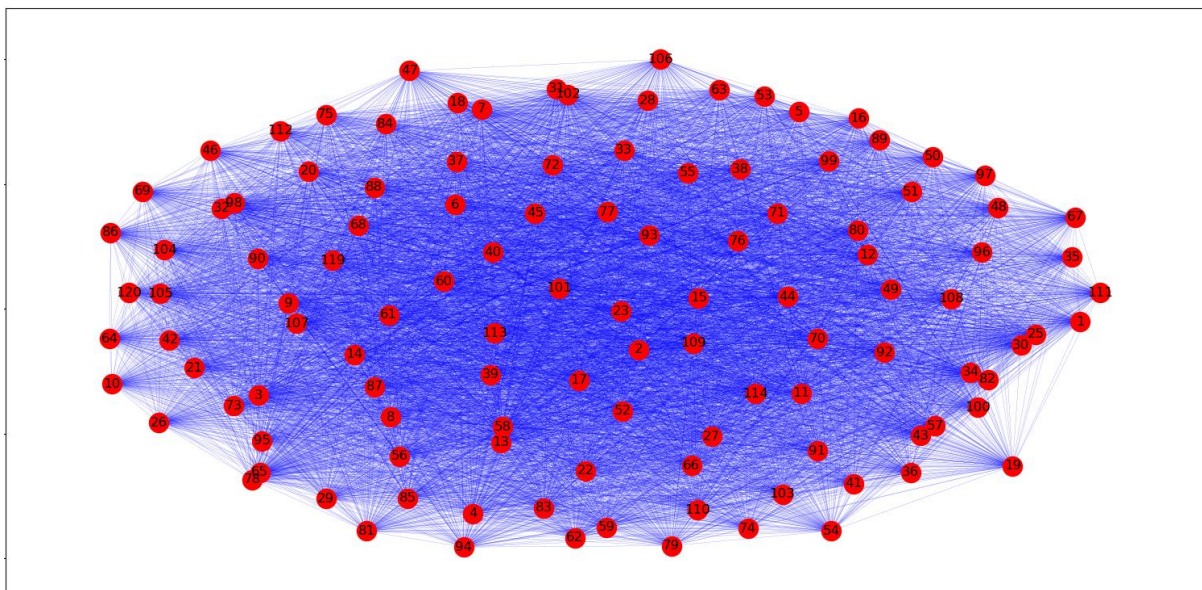
Related Work:

https://cseweb.ucsd.edu/~jmcauley/cse255/reports/wi15/Kaushik_Kalyanaraman.pdf -This paper is used as a base paper for the project. Analysis is done by understanding and applying the ideas provided by the paper.

http://www.sloansportsconference.com/wp-content/uploads/2016/02/1458.pdf - This paper provides an in-depth method of analysing Dota 2 and other MOBA games based on encounters from replay files.

https://arxiv.org/ftp/arxiv/papers/1603/1603.07738.pdf - In this paper different metrics are used to evaluate the games based on spatio-temporal team behaviour.

https://people.engr.ncsu.edu/dlrober4/papers/fdg14-combat.pdf - This paper has a different methodology to analyse the game metrics but does not focus on metrics required to win a dota 2 game. Here the data is gathered via online communities.

http://ieeexplore.ieee.org.ezproxy.gl.iit.edu/xpls/icp.jsp?arnumber=6642858 – This paper using similar analyses techniques but measures different metrics to analyse the game generally but not what metrics are required to win.

Work distribution:

Individual contribution.

Timeline:

Deadline

20/03/18 – Completed community detection

31/04/18 – Finished gathering data of 5 other players and calculated win/loss metrics for all

07/04/18 – Completed analysis and plotting of all the graphs.

14/04/18 – Presentation, Draft Report, Testing and improving programs.

References:

1. https://cseweb.ucsd.edu/~jmcauley/cse255/reports/wi15/Kaushik_Kalyanaraman.pdf

2. http://www.sloansportsconference.com/wp-content/uploads/2016/02/1458.pdf