# Ranking Factors of Team Success

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# Agenda

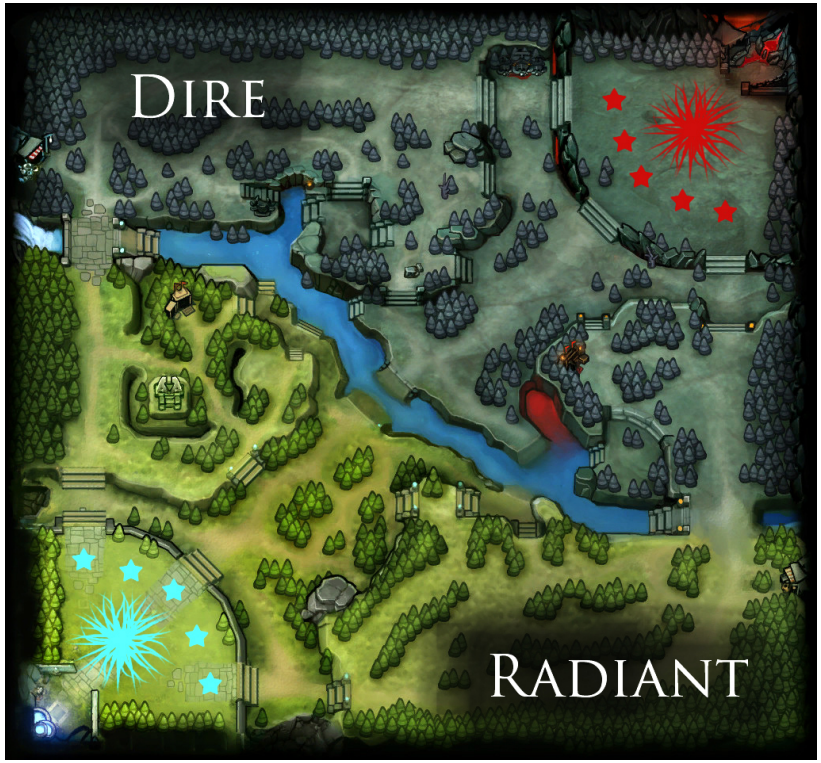
- Background and Motivation
- The Game and Its Community
- The Dataset
- Factors of Team Success
- Ranking Factors of Team Success
- Conclusion and Future Work

# Background and Motivation

- Vast amount of data on the Web allow for observing social interactions on a large scale
- We want to study cooperation within teams and factors of team success
- For this we use the multiplayer online game Dota 2
- Here players are always assigned to a team with common goals and interest

# The Game and Its Community

- Multiplayer Online Battle Arena game by Valve
- Two teams of five players
- Each player controls a "hero" that evolves through destruction of enemy forces
- One match: on average 45 minutes
- Steam platform: social network around Dota 2




http://www.dota2wiki.com/wiki/Dota_2_Wiki, 01/13

# The Game and Its Community (2)

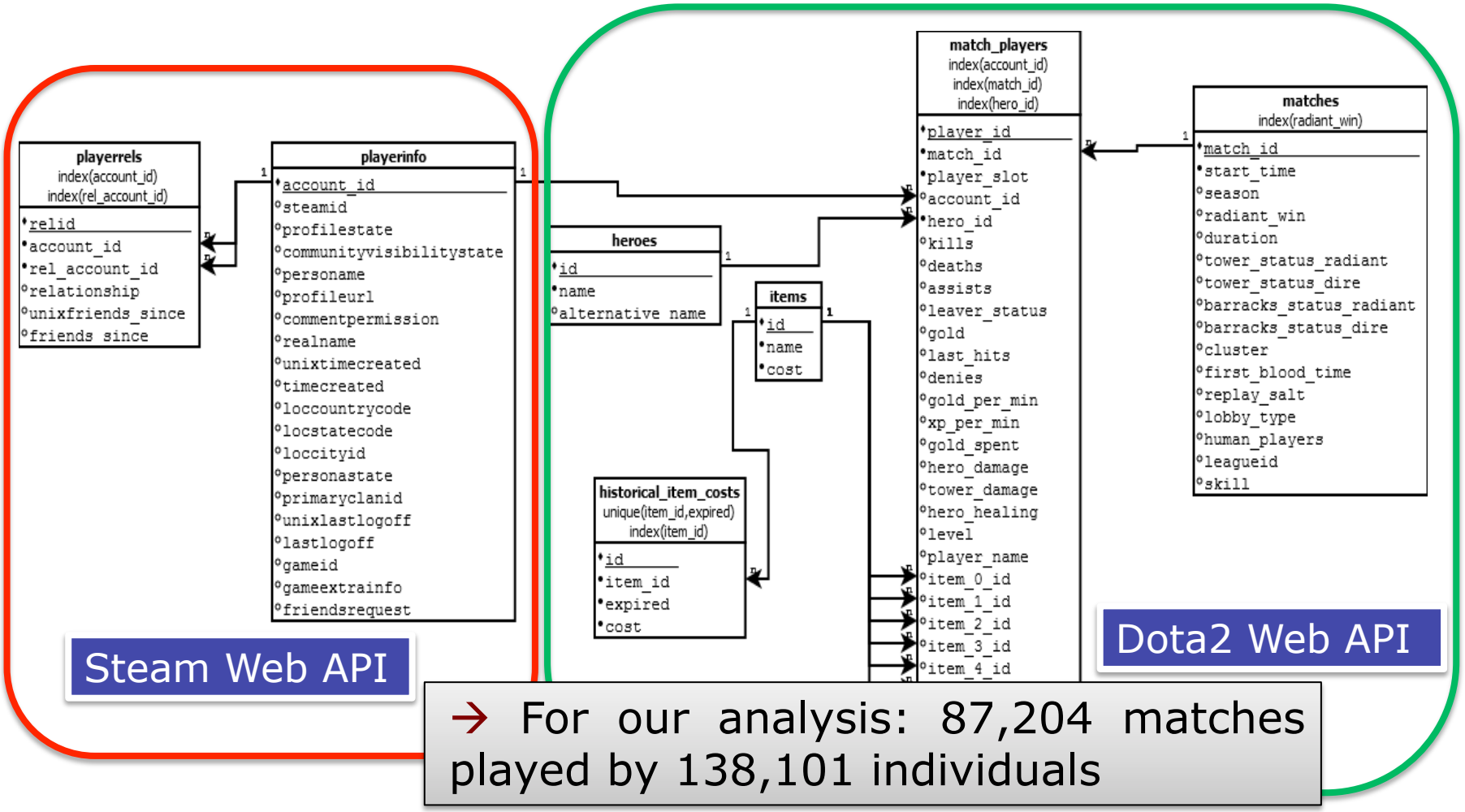
Lina

Class: *Intelligence*
Strength: 18
Agility: 16
Intelligence: 27
Role: *Nuker*
*Disabler*
*Support*

- Heroes are unique characters:
  - 66 distinct heroes
  - Through combination of initial attributes heroes are suited for different strategies ("roles")
- **Crucial**: Strategies should be chosen based on all heroes in the team

http://www.dota2wiki.com/wiki/Dota_2_Wiki, 01/13

# The Dataset




→ For our analysis: 87,204 matches played by 138,101 individuals

# Factor 1: Players' Experience

| Win? | #Previous Played Matches | #Previous Won Matches | Time Played (min) | … | #Deaths |
|---|---|---|---|---|---|
| 0 | 10 | 7 | 320 | | 25 |

Logistic regression

**Experience score for each player in a team**

Average of experience scores of team members

**Team's experience score**

→ **Result:** Team's experience score has a high impact on team success (*p<0.007*)

# Factor 2: Selected Heroes

| Win? | Strength | Agility | Intelligence | … | Attack Range |
|---|---|---|---|---|---|
| 1 | 18 | 16 | 27 | | 625 |

Logistic regression

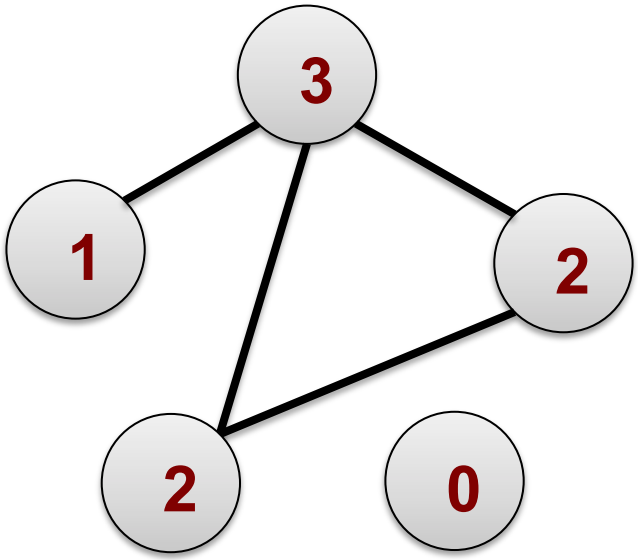
**Score for each hero**

Average of scores of heroes in a team

**Team's hero score**

→ **Result:** Team hero score has a high impact on team success ($p < 1.8 \times 10^{-6}$)

# Factor 3: Friendship Ties



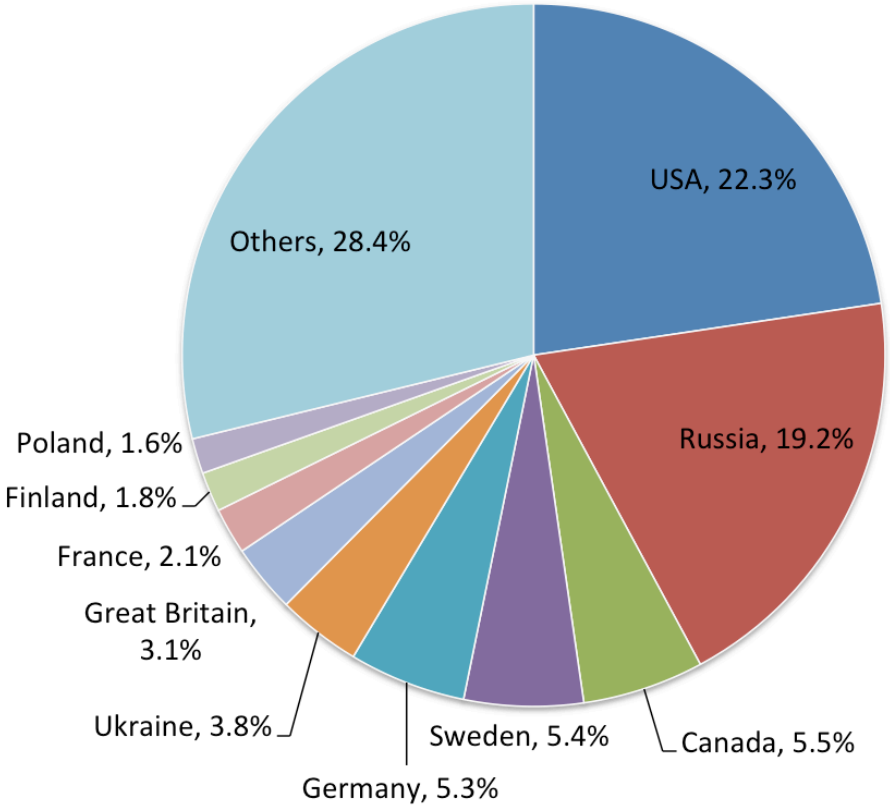

**Team's score: 3** (maximum of team members' friends)

For each player: number of friends (on Steam platform) within the team

→ **Result:** Number of friends within the team has a high impact on team success ($p < 2.2 \times 10^{-16}$)

# Factor 4: National Diversity

- Number of distinct countries in a team
- Not all countries know → filter dataset
- **Result**: Teams with *one or two* countries are more likely to win than teams with *three or more* countries ($p<0.04$)



# Factor 4: National Diversity (2)

- Next step: subdivision of matches according to their *difficulty*, i.e., low, normal, high.

**Results**:

| **Difficulty** | **Low** | Medium | High |
|---|---|---|---|
| ***p-value*** | ***<0.004*** | *0.184* | *0.421* |

→ Teams perform better if members are only from one or two countries; in particular if players are not so advanced

# Ranking Factors

- Quantification of influence of different factors
  - We exclude Factor 4 (smaller dataset, low significance level)

| Win? | Factor 1 | Factor 2 | Factor 3 |
|---|---|---|---|
| 1/0 | Team Experience Score | Team Hero Score | Maximum # of Friends |

Logistic regression

**Fitted Model**

Goodness-of-Fit Tests

**Ranking of Factors**

# Ranking Factors (2)

| Ranking | | $\chi^2$ | *Df* | *p-value* |
|---|---|---|---|---|
| **Factor 3** | *Maximum number of friends*: measures the social ties inside the team | 210.6 | 4 | $<2.0 \times 10^{-44}$ |
| **Factor 2** | *Team hero score*: is related to the chosen characters | 89.8 | 1 | $<2.7 \times 10^{-21}$ |
| **Factor 1** | *Team experience score*: aggregates the experience of the team members | 72.7 | 1 | $<1.5 \times 10^{-17}$ |

(Analysis of variance, Type III test with likelihood-ratio $\chi^2$ statistics)

# Ranking Factors (3)

- Model Summary:

***p<0.01

| win | Coefficient | Std. Error |
|---|---|---|
| **constant** | -0.067*** | 0.01 |
| **max # friends = 4** | 0.283*** | 0.026 |
| **max # friends = 3** | 0.191*** | 0.019 |
| **max # friends = 2** | 0.108*** | 0.014 |
| **max # friends = 1** | 0.038*** | 0.012 |
| **team hero score** | 0.16*** | 0.017 |
| **team experiences score** | -0.144*** | 0.017 |

Number of Observations: 174,404

# Conclusion and Future Work

- Data from online games can be used to infer social behavior pattern
- Results imply that friendship ties and strategy of the entire team are more crucial than experience of players
- Future work:
  - Extent the model to account also for other factors
  - Introduce more sophisticated measures of team experience and role distribution
  - Apply network analysis to study friendship ties
  - Take into account cultural distance