

Network Analysis of Players Transfers in eSports: The Case of Dota 2

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Abstract. In this work, we analyse the structure of local and regional market of player transfers in popular eSports discipline Dota 2. Together with team performance metrics, these data provide us with an opportunity to model network of transfers between teams. In turn, the transfers show the actual structure of mobility in the industry. We collected the data on players' transfers for the top professional teams and their transfer partners, based on transactions between two world tournaments: The International 16 to The International 17. We built a directed network of transfers and analysed centralities, assortative mixing, and link formation.

The global transfer market structure is organised around continental regions. At the same time, teams with the same level of performance rarely have transfers. This can be a reliable indicator of the presence of mobility lifts, in this case, mastodons of the tournament accept in their ranks natives of the less rated teams. On the other hand, some successful players may leave the best teams to establish their own, in the same way as top managers leave the large corporations to launch startups.

Keywords: eSports, Transfer Networks, Social Network Analysis

1 Introduction

Transfers widespread in diverse spheres, such as the labour market, in which employers are interested in foremost staff, or education, where universities want to enrol surpassing students, or sports/eSports, within which team performance depends on combinations of the most talented players. In all these domains, the ability to expose the superlative set of teammates cannot be overestimated.

Only the investment of money and time can make the existence of organisational mobility possible. However, it is not just about them because this concept is quite specific and does depend on factors specific to the certain area. For example, the Japanese model of the labour market presupposes lifelong contracts. Even so, such career longevity is not accustomed to eSports where one player can change several teams within the season.

Nevertheless, sports teams are perfectly suitable for the social network analysis as far as they consist of bounded, well-dened groups of individuals, or,

according to the social network terms, they do represent a full network. Furthermore, in our case, we can analyse it by taking into account geographical segments. They not only show homophily but possess unique structure. One outstanding example is the Chinese eSports ecosystem where the unique structure of organisations exists with several teams under the auspices of one brand, and recruitment to high-profile teams goes through these channels. There is no such structure in any other region.

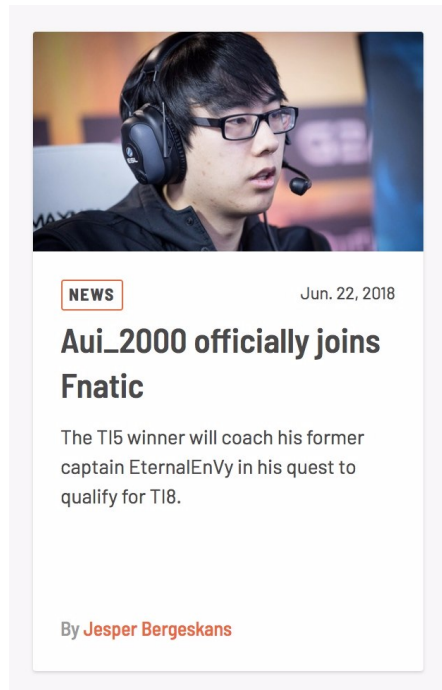


Fig. 1. Example of transfer news. [https : //cybersport.com/post/au_i2000 –officially –joins –fnatic](https://cybersport.com/post/au_i2000-officially-joins-fnatic)

The transfer is an important event which is covered not only by media but also by official sources (Figure 1) where organisations introduce new players to their audience.

Transfers can be used to explore intertwined connections between the personal and teams brands. The audience can find information about a player they are interested in official sources (e.g. website), and on personal players accounts (e.g. Twitter and Twitch.tv).

Team brand is supported by publishing interviews and stories about teams life and allows to establish closer relationships between players and audience.

2 Literature

Game industry raised a few years ago and from the year 2015 total industry revenue estimated two times more than film production. And this led to the emergence of special competitive games, also known as esports. Some types of eSport games are sport-related, for example, FIFA takes the name of a consonant, and it is a football simulator. On the other hand, some games create they own world, for example, DOTA 2 [7].

One of the areas of traditional sports management is the creation of a global transfer network, both within a single league and in the discipline in general. The transfer fees are the most precise assessment of the player's performance and their importance for the team, in comparison with the salary [3]. Thus, at the level of players, an important factor is the centrality of the position and activity in the game that influences managerial recruitment [4]. Considering the importance of individual players for the success of the team, it is necessary to assess the stability of the composition, the medium or small level of national diversity [3]. At the macro level, the study of transfers networks is used to assess the strength of the team to detect the most talented players [6].

For example, Liu et al. [6] analysed transfer network between 400 football clubs in 24 leagues in the period between 2011 and 2015. The main aim was to find a relation between a clubs success and their actions on the transfer market. For that purpose, they created a network where elite clubs were considered as nodes and player transfers and loans as directed graphs. For the network, the authors identify two main node properties: coreness and brokerage of the nodes. For the former, they used eigenvector centrality and PageRank centrality, and for the latter – effective size, closeness centrality and betweenness centrality. The authors consider that clubs with large brokerage can control part of the transfer resources. Therefore, they become mediators of the market and, as a consequence, have the most beneficial position. There is a positive correlation between match performance and brokerage metrics, especially for international transfers.

Finally, several sports clubs with high rich-club coefficient were found in the network. This metric shows how well nodes with high degree are connected with other similar nodes. In this papers, authors show an interaction between such clubs which create a coalition. They do control resources spread within the network. Also, transfers between clubs are less frequent to lean toward an exchange of players if these players have a large number of peer clubs[6].

3 Data and methods

For our study, we gathered data about Dota 2 players transfers conducted between The International 2016 and The International 2017. We have records about transfers between team-participants of TI, transfers from non-participants to participants, and vice versa. As a source of data which consists of 1007 transfers, we have chosen Liquipedia – the most significant community about eSport

disciplines including Dota 2, its mechanics and the whole industry which content is produced by the players.

For each transfer observation, we have the following variables: date, players name, titles of former and current teams, and countries, in which those teams are located. We build a unimodal directed network, where nodes were teams and edges were transfer. Weight represents a number of transfers between two teams.

4 Analysis and results

Transfers between teams in Dota 2 are visualised by employing a directed network. Network nodes are teams, and directed edges between them are players' transfers; the colour of the node stands for the affiliation region.

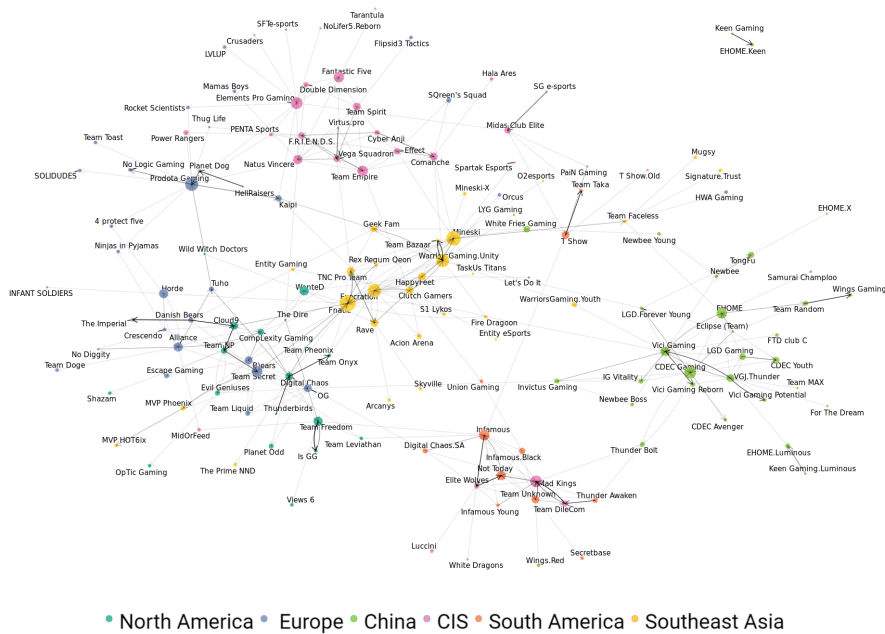


Fig. 2. Transfers of players between teams clustered by region

Figure 2 clearly shows that the number of transfers between teams is small, so the network is not saturated, and the teams that belong to the same region are grouped, furthermore in the centre, there is the core of the European teams.

For our research we propose the following hypotheses which will help to reveal the structure of the transfer network in eSport:

- Transfers between teams which are located in the same region are more frequent.

- Participation in TI is positively correlated with the probability of transfer.
- Belonging to the one organisation is significant for the probability of transfer.
- Difference in Elo rating decreases the probability of transfer.

As a measure of the homogeneity of the transfers, we found the assortativeness. Assortativity exists in the range of -1 – disassortativity, up to 1 – maximal assortativeness and was calculated with the help of `igraph` package. It is an external module for the R programming language[1]. By using random permutation test with 3500 random reshuffles, we collect coefficient to compare with the distribution of null hypothesis, in this way p-value was calculated.

Elo rating [2] measures the performance of a team and based on wins, draws, and loses. The rating shows the relative superiority of the player over others and the difference in ratings is responsible for the result of the match, namely for scores. By dint of `EloRating` package in R[5] and data from `dotabuff`, by Elo Entertainment LLC, contains data about the professional and the amateurs as well, the rating for teams was calculated based on data for three months before the transfer period. For teams that did not play at that time, the value 1000 was set as the default.

These hypotheses were tested with the help of assortativity (Figure 3) which shows the number of transfers between residents of one region, relative to all. For our first hypothesis, we get the value of 0.669 $p < .001$ which demonstrates the high probability of transfers within the region. Thus, despite the declared internationality of sports discipline, the mobility of players is more interregional. In the second case, the assortativity coefficient is not significant – 0.052. Therefore, we can say there is no relation between players choice of the team they go, and the teams of the TI remain open to players from weaker teams. Also, the role of the organisation is insignificant with coefficient 0.046. We can not consider that as a special channel of recruiting. For an assortativity by Elo rating of teams p-value, more than 0.517 was got, which is a strong indicator of the lack of connection between the rating and the transfer.

5 Conclusion

With the help of the Dota 2 data, one of the most popular cybersport disciplines, we show some unique features of transfers in eSports such as the importance of the country, and its absence if we speak about participation in the primary Dota 2 championship.

Teams in Dota 2, unlike the traditional sport, show more consistency, because when transferring only two players it almost breaks the team down, and three players are more than half, after all, there are only five members.

Our plans for developing this research project are following on conducting the QAP regression analysis to estimate the significance of attributes. We are going to use methods of relational event models to estimate the importance of the dynamics of the professional scene and to consider the factors specific to particular regions. Second, we will make an ERGM-model for adding new variables such as year of team formation and structural factors (e.g. `istar` or

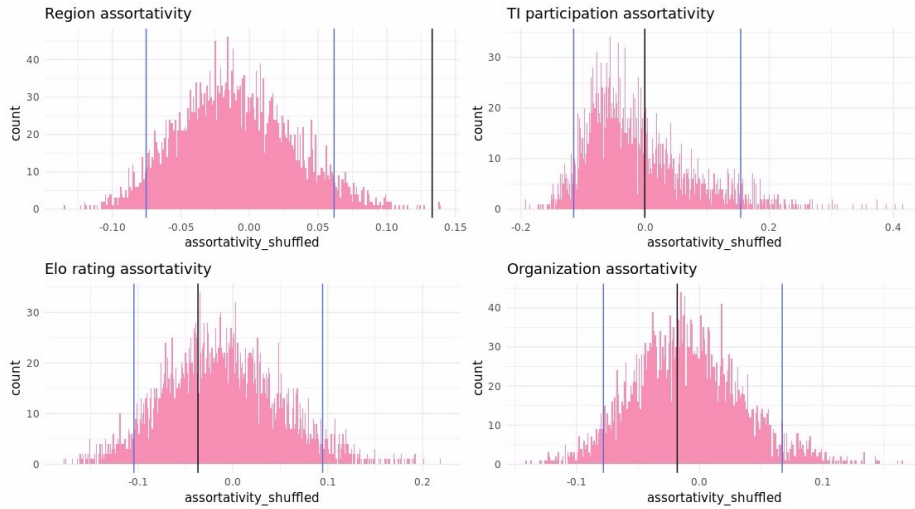


Fig. 3. Assortativity. Permutation tests.

outgoing shared partner) to estimate the importance of unique patterns like a structure of organisations in China.

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