

## **APPLYING CENTRALITY METRICS TO IDENTIFY THE PROMINENT FOOTBALL PLAYERS**

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### INTRODUCTION

In attacking moments, the passing sequence reveals the way in which teammates cooperate and also how players determine the style of play of a team (Malta & Travassos, 2014). A possible approach to identify the specific interactions that emerges during the match is the network that is based on graph theory. The use of graph theory on football match analysis is quite recent, mainly using such approach to classify the individual contribution of players. In a study carried out by Duch, Waitzman and Amaral (2010) it was found during the Euro Cup 2008 that the best player was the Xavi (Spain midfielder). This study used a network approach to compute the performance indicators and rank the players by their individual contribute during the matches. In another study it was used some centrality network metrics to classify the individual contribution of players during the FIFA World Cup 2010 final (Peña & Touchette, 2012). The page rank measure revealed that Xavi (once again) had the highest score. Thus, the tendency of Spain team was to centralize the passing sequence on the central midfielder. Nevertheless, there are another interesting metrics such as degree centrality, degree prestige or closeness centrality that can help to better understand the prominence of players during the passing sequence. Moreover, the studies only focused on individual players (independently of their positional role during the match) and did not considered the tactical roles. Therefore, the aim of this study was to analyse the centrality levels of Spain positional roles during the FIFA World Cup 2014 and to identify the prominent tactical positions that determined the moments with ball.

### METHOD

#### *Sample*

Three official matches from Spain in FIFA World Cup 2014 tournament were analysed in this study. A total of 290 adjacency matrices were generated based on the teammates' interactions and then converted in 3 network graphs. A total of 1154 passes were analysed.

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### *Observation and Coding*

To perform the network analysis it is necessary generate an adjacency matrix. Such matrix represents the connections between players with an adjacency teammate. The criteria to define the connection were the pass between players. An adjacency matrix per unit of attack was generated, that corresponds to the first pass after recover the ball until the last before to lose her. After each match, an overall adjacency matrix was build corresponding to the sum of all adjacency matrices per unit of attack. Per each pass between nodes it was give a code of 1 (one) and for no passes between teammates it was give a code of 0 (zero). Based on tactical line-up, the tactical position of each player was codified. It was adopted a techno-tactical assignment to positional roles (Di Salvo et al., 2007).

### *Network Analysis*

Once the 3 overall adjacency matrices were generated based on passes between teammates, they were imported into Social Networks Visualizer (SocNetV) to be analysed. Three network metrics were used to analyse the centrality levels of tactical roles: i) degree centrality; ii) degree prestige; and iii) closeness centrality. In the context of our data the players having larger degree centrality scores are those that contributed more in the their teams offensive attempts by their passes to other players of their team. In analyzing our data, the players with higher degree prestige are obviously those that their teammates preferred to pass the ball more often. Finally, the Closeness Centrality index of each player denotes how close, in terms of passes, that player has been to all other teammates during the development of the team's attack.

## RESULTS

The three matches of Spanish team were analysed and the centrality values per tactical role were computed. The results are shown in the following table 1.

TABLE 1  
Centrality index of positional roles in Spanish Team

Tactical Role	%IDC			%ODC			%CC		
	Match 1	Match 2	Match 3	Match 1	Match 2	Match 3	Match 1	Match 2	Match 3
Goalkeeper	1,40	3,94	1,89	2,80	4,23	5,14	6,93	7,19	8,50
Lateral Defender	6,99	8,45	10,00	8,16	11,55	8,92	8,66	10,79	10,20
Lateral Defender	9,79	9,30	10,00	10,72	12,68	12,16	9,45	8,30	8,50
Central Defender	8,62	9,30	5,14	10,72	10,99	5,41	10,40	9,81	9,27
Central Defender	9,09	10,14	10,81	12,59	10,99	10,81	10,40	10,79	10,20
Defensive Midfielder	12,82	9,86	10,27	13,75	9,86	13,24	10,40	9,81	8,50
Midfielder	13,75	11,55	9,73	13,29	11,27	10,27	9,45	8,99	9,27
Midfielder	9,56	12,11	14,05	7,23	9,86	12,16	9,45	9,81	9,27
Wing Midfielder	11,89	11,55	14,32	9,32	9,30	10,00	9,45	8,99	10,20
Wing Midfielder	10,02	8,17	8,65	7,46	5,35	8,65	8,00	8,30	9,27
Striker	6,06	5,63	5,14	3,96	3,94	3,24	7,43	7,19	6,80

(%IDC - Degree Prestige; %ODC - Degree Centrality; %CC - Closeness Centrality)

The results showed that midfielders were the players that most received the balls from their teammates in the degree prestige. Such players are the targets of the team to pass the ball. In other hand, the degree centrality reveals that lateral defenders and midfielders tends to be the players that more contribute to perform the passes, thus can be considered the players that starts the passing sequence. Finally, the greatest values of closeness centrality were found in central and lateral defenders and also in defensive midfielder.

#### DISCUSSION

In this study it was found that the players that most received passes from their teammates were the midfielders. This can be justified by the Spanish style of play. In fact, the called "tiki-taka" bases their passing sequence in the midfield players, thus it is normal that such players are the targets of the team. In some teams that adopt more direct style of play, the greatest values are generally found in forward players (Malta & Travassos, 2014). It was also found in this study that the highest values of degree centrality were found in lateral defenders and defensive midfielder. These values suggest that the first step of passing sequence building starts from the lateral defenders and the defensive midfielder, trying to support the attacking transition from the most backward spaces. Finally, the greatest closeness centrality was found in defenders thus

revealing that passing sequence was based on the rearmost players and not in the forward players.

This study showed how network centrality metrics can be a very interesting solution to provide useful information for coaches and also to study the individual contribution of players for the attacking process. In the Spanish team the most prominent players were the midfielders and also the lateral defenders, thus suggesting a style of play based on possession and not in counter-attack.

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