

Team H	15	Center Midfielder	0.24	0.00	1
Team E	16	Left Winger	0.24	0.67	6
Team H	17	Center Forward	0.24	0.14	7
Team D	18	Center Forward	0.23	1.00	4
Team M	19	Attacking Midfielder	0.23	0.00	6
Team A	20	Right Back	0.23	0.29	7

Table 3. This table provides information on the top 20 players ranked by their average off-ball scoring opportunity per match. Additionally, we show the position they play, which team they play for, the mean goals scored per match and the number of matches which they participated in (in our test set of 53 games).

Another interesting player is the midfielder on Team M (19th ranked). Despite playing for a weaker side and having no goals, it appears the midfielder is able to create substantial space in dangerous areas judging from their mean *OBSO*/match. It is possible that this player could become a scoring threat in the right situation.

Certain players have distinctive danger zones where most of their shots and goals come from. An example of this is the 20th ranked player in Table 3, the right back from Team A. Whether it results in a score or not, this player tends to create *opportunities* from distance on the right side of the pitch. Notice how the *opportunity* maps maintain a similar profile over the four games shown in Figure 9 even though the scoring and shooting output varies from match to match.

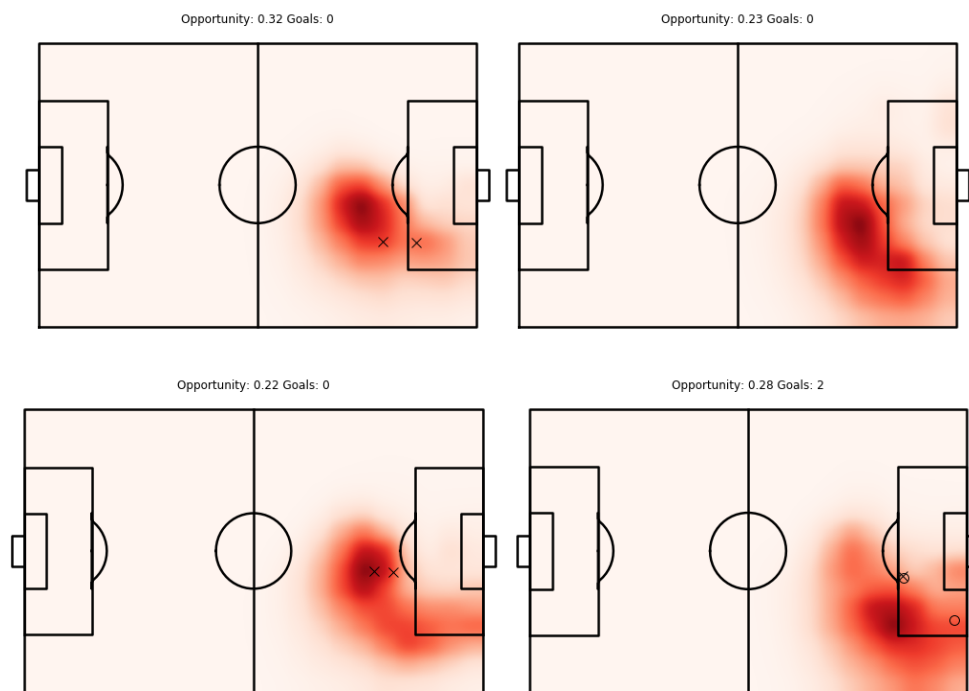


Figure 9. Four off-ball scoring opportunity maps for the right back from Team A (ranked #20 in Table 3). Each map represents a game. Integrated opportunity is shown above each plot. Shots are shown by an "x" and goals are shown by an "o".

Compare these to the scoring maps for a center forward found in Figure 10. This particular center forward appears to play a bit left of center creating space within the penalty area and inside the 6-yard line.

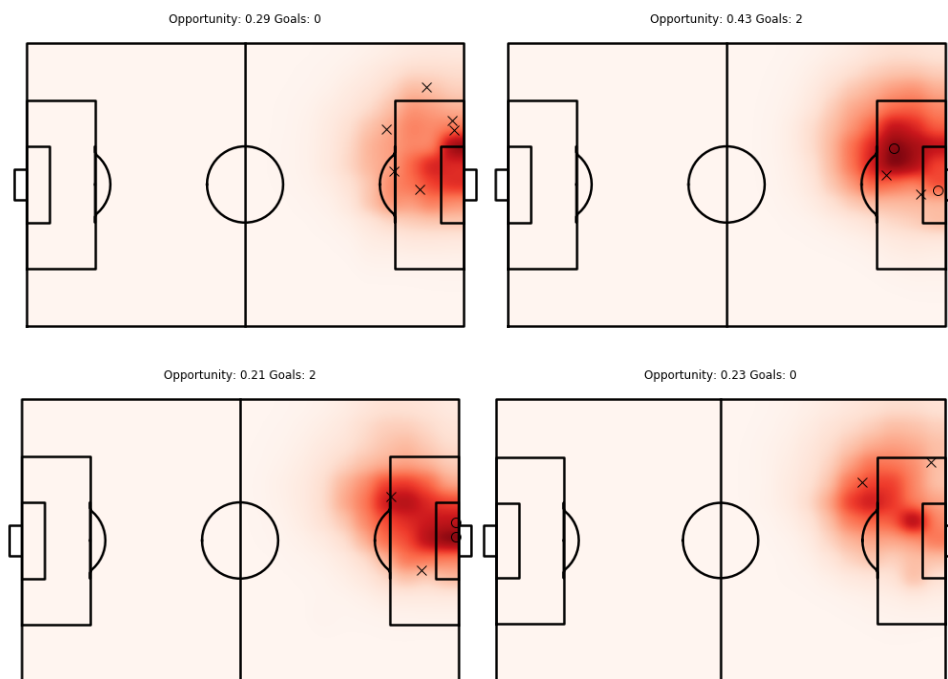


Figure 10. Four off-ball scoring opportunity maps for a center forward from Team C (ranked #6 in Table 3). Each map represents a game. Integrated opportunity is shown above each plot. Shots are shown by an "x" and goals are shown by an "o".

6. Conclusions and Discussion

The increasing prevalence of spatiotemporal tracking information in soccer has dramatically broadened the number of questions the analyst can ask the data. We have presented a new approach to using this tracking data to quantify *off-ball scoring opportunity (OBSO)*. This metric can be used as a leading indicator of future player scoring and there are many possible applications for the *opportunity* model. The *OBSO* can be used by club analysts to expedite the process of discovering key moments during post-match analysis. Player-specific opportunity maps can be used by opposition analysts to identify dangerous regions that may need extra defensive attention to mitigate the attacking threat posed by a specific opposing player in an upcoming match. For scouting, the *OBSO* can be used to identify talented players with good spatial awareness who could thrive if given the opportunity.

The model presented in this paper is not without its limitations and future work will be needed to refine the scoring model (Section 3.3) and the effect that defensive pressure and player speed has on the ability of a player to successfully deliver the ball to a teammate. Despite these limitations, we are excited by the use of spatial probability densities to predict future game state over short time scales and we believe that this approach and the constituent models that describe control (Section 3.1) and transition (Section 3.2) can serve as the basis for further soccer research.

Acknowledgements

I would like to give a special thanks to the Hudl Analysts and the Hudl Research & Development team who worked so tirelessly to produce the spatiotemporal tracking data and event data that made this research possible.

References

- [1] S. Green, "Assessing The Performance of Premier League Goalscorers," 12 Apr 2012. [Online]. Available: <http://www.optasportspro.com/about/optapro-blog/posts/2012/blog-assessing-the-performance-of-premier-league-goalscorers/>. [Accessed 4 Dec 2017].
- [2] W. Gurpinar-Morgan, "Valuing Possession," 25 Aug 2015. [Online]. Available: <https://2plus2equals11.com/2015/08/25/valuing-possession/>. [Accessed 4 Dec 2017].
- [3] D. Altman, "OptaPro Forum: Beyond Shots," 9 Mar 2015. [Online]. Available: <http://www.optasportspro.com/about/optapro-blog/posts/2015/film-optapro-forum-beyond-shots/>. [Accessed 4 Dec 2017].
- [4] J. Boice, "How Our Soccer Club Projections Work," 19 Jan 2017. [Online]. Available: <https://fivethirtyeight.com/features/how-our-club-soccer-projections-work/>. [Accessed 4 Dec 2017].
- [5] P. Lucey, A. Bialkowski, M. Monfort, P. Carr and I. Matthews, "'Quality vs Quantity': Improved Shot Prediction in Soccer using Strategic Features from Spatiotemporal Data," in *MIT Sloan Sports Analytics Conference*, Boston, 2015.
- [6] D. Link, S. Lang and P. Seidenschwarz, "Real Time Quantification of Dangerousity in Football Using Spatiotemporal Tracking Data," *PLoS ONE*, vol. 11, no. 12, p. e0168768, 2016.
- [7] W. Spearman, P. Pop, A. Basye, R. Hotovy and G. Dick, "Physics-Based Modeling of Pass Probabilities in Soccer," in *MIT Sloan Sports Analytics Conference*, Boston, 2017.
- [8] A. Savitzky and M. Golay, "Smoothing and Differentiation of Data by Simplified Least Squares Procedures," *Analytical Chemistry*, vol. 36, no. 8, pp. 1627-1639, 1964.
- [9] T. Asai and K. Seo, "Aerodynamic drag of modern soccer balls," *SpringerPlus*, vol. 2, no. 1, p. 171, 2013.



