Quantifying Pressing Effectiveness and Its Impact on Formations in Football

Candidate no. SSKKEN001

Thesis word count: 15000

Submitted in partial fulfillment of the requirements for the degree of Master in Philosophy in Data Science

Master in Philosophy in Data Science

2025

Abstract

Master in Philosophy in Data Science

Quantifying Pressing Effectiveness and Its Impact on Formations in Football

by

Kenneth Ssekimpi

2025

Declaration

This project report is submitted in partial fulfilment of the requirements for the degree of Master of Philosophy in Data Science. I declare that this Minor Dissertation was composed by me, that the work contained therein is my own, except where explicitly stated otherwise in the text, and that it has not been submitted, in whole or in part, for any other degree or professional qualification.

Kenneth Ssekimpi

Word Count: 15000

This thesis was conducted under the supervision of Mr Neil Watson
Lecturer, Department of Statistical Sciences, University of Cape Town
Email: `nm.watson@uct.ac.za`.

Abstract

Acknowledgements

I am incredibly thankful for

Table of contents

List of Figures

List of Tables

Preface

1

Introduction

1.1 Background

Association football, also known as soccer, is a game played by two teams of 11 players each. Teams compete by advancing a ball into their opponent's goal, adhering to established rules that govern gameplay, player conduct, and scoring, with the aim to score more goals than their rivals (Sumpter, 2016; Memmert & Raabe, 2018). Although the fundamental simplicity of football contributes significantly to its global popularity and appeal, the game simultaneously possesses incredible complexity characterised by movement patterns, match plans, playing philosophies, and creativity (Bornn, Cervone & Fernandez, 2018; Vicente et al., 2024). These qualities are collectively referred to as football tactics (Memmert & Raabe, 2018).

Football tactics involve strategically positioning players on the field and co-ordinating their movements to maximise the chances of winning matches. This encompasses both the formation that a team adopts (that is, the spatial arrangement of players on the pitch) and their overall style of play (Wilson, 2010). Furthermore, Rein & Memmert (2016) describe football tactics as the actions and strategies implemented by a team and its players during a match to achieve specific goals, primarily winning the game. These actions are typically adaptations to dynamically-changing situations in the match and the behaviour of the opposing team, managing space, time, and individual actions on the pitch.

Fundamental to understanding these tactical deployments are the distinct player positions and the common tactical formations they operate within. Football teams are typically

composed of players in four main categories: Goalkeepers (GK), primarily responsible for preventing goals; Defenders (DEF), who protect their goal and prevent opposing attacks (e.g., Centre-Backs, Full-Backs); Midfielders (MID), who link defence and attack and control central areas (e.g., Defensive Midfielders, Attacking Midfielders, Wingers); and Forwards/Strikers (FWD), whose main role is to score goals. These positions are strategically arranged into tactical formations, which dictate a team's general shape and approach during different phases of play. A phase of play in football refers to a segment of a match, typically defined for analysis or coaching purposes, characterised by the actions and organisation of one or both teams (Ghezzi & Sotudeh, 2024). It can be understood as a sequence of consecutive events or actions that fit together (Decroos, 2020)

References

Andrienko, G., Andrienko, N., Budziak, G., Dykes, J., Fuchs, G., Landesberger, T. von & Weber, H. 2017. Visual analysis of pressure in football. *Data Mining and Knowledge Discovery*. 31(6):1793–1839. DOI: 10.1007/s10618-017-0513-2.

Andrienko, G., Andrienko, N., Budziak, G., Landesberger, T. von & Weber, H. 2018. Exploring pressure in football. In *Proceedings of the 2018 International Conference on Advanced Visual Interfaces*. (AVI '18). New York, NY, USA: Association for Computing Machinery. 1–3. DOI: 10.1145/3206505.3206558.

Bauer, P. 2022. Automated Detection of Complex Tactical Patterns in Football—Using Machine Learning Techniques to Identify Tactical Behavior. Doctoral. Universität Tübingen. Available: https://publikationen.uni-tuebingen.de/xmlui/handle/10900/124679 [2024, March 17].

Bauer, P. & Anzer, G. 2021. Data-driven detection of counterpressing in professional football. *Data Mining and Knowledge Discovery*. 35(5):2009–2049. DOI: 10.1007/s10618-021-00763-7.

Bauer, P., Anzer, G. & Shaw, L. 2023. Putting team formations in association football into context. *Journal of Sports Analytics*. 9(1):39–59. DOI: 10.3233/JSA-220620.

Beal, R., Chalkiadakis, G., Norman, T.J. & Ramchurn, S.D. 2020. DOI: 10.48550/arXiv.2003.10294.

Beal, R., Changder, N., Norman, T. & Ramchurn, S. 2020. Learning the Value of Teamwork to Form Efficient Teams. In *Proceedings of the AAAI Conference on Artificial Intelligence*. V. 34. (5th series). 7063–7070. DOI: 10.1609/aaai.v34i05.6192.

Bialkowski, A., Patrick Lucey, Carr, P., Yue, Y., Sridharan, S. & Matthews, I. 2014. Identifying Team Style in Soccer Using Formations Learned from Spatiotemporal Tracking Data. In *2014 IEEE International Conference on Data Mining Workshop*. 9–14. DOI: 10.1109/ICDMW.2014.167.

Borbely, L., Hrebfk, J., Ganczner, P. & Singer, A. 2018. *All About Pressing in Soccer: History, Theory, Practice*. Meyer & Meyer Sport.

Bornn, L., Cervone, D. & Fernandez, J. 2018. Soccer analytics: Unravelling the Complexity of "The Beautiful Game". *Significance*. 15(3):26–29.

Bortnik, L., Burger, J. & Rhodes, D. 2022. The Mean and Peak physical Demands During Transitional Play and High Pressure Activities in Elite football. *Biology of Sport*. 39(4):1055–1064.

Bradley, P.S. & Ade, J.D. 2018. Are Current Physical Match Performance Metrics in Elite Soccer Fit for Purpose or Is the Adoption of an Integrated Approach Needed? *International Journal of Sports Physiology and Performance*. 13(5):656–664. DOI: 10.1123/ijspp.2017-0433.

Bransen, L. & Van Haaren, J. 2020. DOI: 10.48550/arXiv.2003.01712.

Brîndescu, S., Datcu, F.-R. & Buda, I.-A. 2021. Study on the efficiency of advanced pressing in the Premier League. *Baltic Journal of Health and Physical Activity*. 13(6):11.

Brooks, J., Kerr, M. & Guttag, J. 2016. Using machine learning to draw inferences from pass location data in soccer. *Statistical Analysis and Data Mining: The ASA Data Science Journal*. 9(5):338–349. DOI: 10.1002/sam.11318.

Carr, R., Mullen, R. & Williams, M. 2020. Differences in high intensity running when playing a 4-4-2 formation with a high press strategy: A case study from the English Championship. *International Sports Studies*. 42(2).

Chambers, T. 2022. Available: https://soccersourcecoaching.com/different-types-of-presses-in-football/ [2024, March 13].

Cooper, D. & Pulling, C. 2020. The Impact of Ball Recovery Type, Location of Ball Recovery and Duration of Possession on the Outcomes of Possessions in the English Premier League and the Spanish La Liga. *Science and Medicine in Football*. 4(3):196–202.

Cotton, R. & Miller, I.L. 2022. Available: https://www.datacamp.com/blog/how-data-science-is-changing-soccer.

Cox, M.W. 2017. *The Mixer: The Story of Premier League Tactics, from Route One to False Nine*. 1st ed. HarperCollins Publishers.

Cox, M.W. 2019. *Zonal Marking: The Making of Modern European Football*. 1st ed. HarperCollins Publishers.

Dayus, Jacob, Callaway, Andrew, Ellis, Shelley & Butterworth, Andrew. 2021. Analysis of playing style across different developmental stages in football: International Journal of Performance Analysis in Sport: Vol 21, No 6. *International Journal of Performance Analysis in Sport*. 21(6):934–952. DOI: https://doi.org/10.1080/24748668.2021.1963106.

De Bacco, C. 2021. Available: https://vimeo.com/534001492.

Decroos, T. 2020. Soccer Analytics Meets Artificial Intelligence: Learning Value and Style from Soccer Event Stream Data. PhD thesis. KU Leuven. Available: https://tomdecroos.github.io/reports/thesis_tomdecroos.pdf.

Decroos, T. & Davis, J. 2019. Interpretable Prediction of Goals in Soccer. In *Proceedings of the AAAI-20 Workshop on Artificial Intelligence in Team Sports*.

Decroos, T., Van Haaren, J. & Davis, J. 2018. Automatic Discovery of Tactics in Spatio-Temporal Soccer Match Data. In *Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining.* (KDD '18). New York, NY, USA: Association for Computing Machinery. 223–232. DOI: 10.1145/3219819.3219832.

Delibas, E., Uzun, A., Inan, M.F., Guzey, O. & Cakmak, A. 2019. Interactive Exploratory Soccer Data Analytics. *INFOR: Information Systems and Operational Research.* 57(2):141–164. Available: https://www.tandfonline.com/doi/abs/10.1080/03155986.2018.1533204 [2024, March 09].

Fernandes, T., Camerino, O., Garganta, J., Hileno, R. & Barreira, D. 2020. How do Elite Soccer Teams Perform to Ball Recovery? Effects of Tactical Modelling and Contextual Variables on the Defensive Patterns of Play. *Journal of Human Kinetics.* 73:165–179. DOI: 10.2478/hukin-2019-0141.

Fernandez-Navarro, J., Fradua, L., Zubillaga, A. & McRobert, A.P. 2019. Evaluating the effectiveness of styles of play in elite soccer. *International Journal of Sports Science & Coaching.* 14(4):514–527. DOI: 10.1177/1747954119855361.

Fernandez-Navarro, J., Ruiz-Ruiz, C., Zubillaga, A. & Fradua, L. 2020. Tactical Variables Related to Gaining the Ball in Advanced Zones of the Soccer Pitch: Analysis of Differences Among Elite Teams and the Effect of Contextual Variables. *Frontiers in Psychology.* 10:3040. DOI: 10.3389/fpsyg.2019.03040.

Forcher, L., Altmann, S., Forcher, L., Jekauc, D. & Kempe, M. 2022. The use of player tracking data to analyze defensive play in professional soccer-A scoping review. *International Journal of Sports Science & Coaching.* 17(6):1567–1592.

Forcher, L., Forcher, L., Altmann, S., Jekauc, D. & Kempe, M. 2022. The keys of pressing to gain the ball – Characteristics of defensive pressure in elite soccer using tracking data. *Science and Medicine in Football.* 0(0):1–9. DOI: 10.1080/24733938.2022.2158213.

Forcher, L., Forcher, L., Altmann, S., Jekauc, D. & Kempe, M. 2023. The Success Factors of Rest Defense in Soccer – A Mixed-Methods Approach of Expert Interviews, Tracking Data, and Machine Learning. *Journal of Sports Science & Medicine.* 22(4):707–725. DOI: 10.52082/jssm.2023.707.

Forcher, L., Forcher, L., Wäsche, H., Jekauc, D., Woll, A., Gross, T. & Altmann, S. 2023. Is ball-possession style more physically demanding than counter-attacking? The influence of playing style on match performance in professional soccer. *Frontiers in Psychology.* 14. Available: https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2023.1197039 [2024, March 05].

Forcher, Leander, Forcher, Leon, Altmann, Stefan, Jekauc, Darko & Kempe, Matthias. 2024. Is a Compact Organization Important for Defensive Success in Elite Soccer? – Analysis

Based on Player Tracking Data. *International Journal of Sports Science & Coaching.* 19(2):757–768. Available: https://journals.sagepub.com/doi/abs/10.1177/17479541231172695 [2024, March 13].

Forcher, Leander, Beckmann, Tobias, Wohak, Oliver, Romeike, Christian, Graf, Ferdinand & Altmann, Stefan. 2024. Prediction of Defensive Success in Elite Soccer using Machine Learning - Tactical Analysis of Defensive Play using Tracking Data and Explainable AI. *Science and Medicine in Football.* 8(4):317–332. Available: https://www.tandfonline.com/doi/abs/10.1080/24733938.2023.2239766 [2024, March 13].

Ghezzi, E. & Sotudeh, H. 2024. Hudl StatsBomb conference 2024. Old Trafford, Manchester, United Kingdom: StatsBomb. 13. Available: https://statsbomb.com/wp-content/uploads/2024/10/Match-Phases-In-Practice-Ghezzi-and-Sotudeh.pdf.

Goes, F.R., Meerhoff, L.A., Bueno, M.J.O., Rodrigues, D.M., Moura, F.A., Brink, M.S., Elferink-Gemser, M.T., Knobbe, A.J., et al. 2021. Unlocking the potential of big data to support tactical performance analysis in professional soccer: A systematic review. *European Journal of Sport Science.* 21(4):481–496. DOI: 10.1080/17461391.2020.1747552.

González-Rodenas, J., Martínez López, A. & Pérez Gay, R. 2024. Effects of contextual and tactical dimensions on the creation of goal-scoring opportunities in U12 and U13 elite Spanish soccer teams. *International Journal of Sports Science & Coaching.* 19(1):202–213. Available: https://journals.sagepub.com/doi/abs/10.1177/17479541221141816 [2024, March 13].

Herold, M., Goes, F., Nopp, S., Bauer, P., Thompson, C. & Meyer, T. 2019. Machine learning in men's professional football: Current applications and future directions for improving attacking play. *International Journal of Sports Science & Coaching.* 14(6):798–817. DOI: 10.1177/1747954119879350.

Hubáček, O., Šourek, G. & Železný, F. 2019. Deep Learning from Spatial Relations for Soccer Pass Prediction. In *Machine Learning and Data Mining for Sports Analytics.* U. Brefeld, J. Davis, J. Van Haaren, & A. Zimmermann, Eds. (Lecture Notes in Computer Science). Cham: Springer International Publishing. 159–166. DOI: 10.1007/978-3-030-17274-9_14.

Johnson, M. 2024. Available: https://goralsoccer.com/strategies/pressing-strategies-against-different-formations/.

Ju, W., Doran, D., Hawkins, R., Evans, M., Laws, A. & Bradley, P. 2023. Contextualised High-Intensity Running Profiles of Elite Football players with Reference to General and Specialised Tactical Roles. *Biology of Sport.* 40(1):291–301.

Kazi Tani, L.F., Ghomari, A. & Kazi Tani, M.Y. 2019. Events recognition for a semi-automatic annotation of soccer videos: A study based deep learning. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences.* 42:135–141. DOI: 10.5194/isprs-archives-XLII-2-W16-135-2019.

Kerr, M.G.S.(Matthew.G.S. 2015. Applying machine learning to event data in soccer. Thesis. Massachusetts Institute of Technology. Available: https://dspace.mit.edu/handle/1721.1/100607 [2024, March 04].

Kim, H., Kim, B., Chung, D., Yoon, J. & Ko, S.-K. 2022. SoccerCPD: Formation and Role Change-Point Detection in Soccer Matches Using Spatiotemporal Tracking Data. In *Proceedings of the 28th ACM SIGKDD Conference on Knowledge Discovery and Data Mining.* (KDD '22). New York, NY, USA: Association for Computing Machinery. 3146–3156. DOI: 10.1145/3534678.3539150.

Klemp, M., Wunderlich, F. & Memmert, D. 2021. In-play forecasting in football using event and positional data. *Scientific Reports.* 11(1):24139. DOI: https://doi.org/10.1038/s41598-021-03157-3.

Knuth, D.E. 1984. Literate programming. *Comput. J.* 27(2):97–111. DOI: 10.1093/comjnl/27.2.97.

Kozlova, N. 2021.

Kraft, J. 2020. Available: https://miasanrot.com/tactics-blog-003-the-basics-of-pressing/ [2024, June 21].

Lago-Ballesteros, J., Lago-Peñas, C. & Rey, E. 2012. The effect of playing tactics and situational variables on achieving score-box possessions in a professional soccer team. *Journal of Sports Sciences.* 30(14):1455–1461. DOI: 10.1080/02640414.2012.712715.

Leander, Forcher, Altmann, Stefan, Forcher, Leon, Jekauc, Darko & Kempe, Matthias. 2022. The use of player tracking data to analyze defensive play in professional soccer - A scoping review. *International Journal of Sports Science & Coaching.* 17(6):1567–1592. DOI: https://doi.org/10.1177/174795412210757.

Link, D. 2018. Data Analytics in Professional Soccer. *Springer Vieweg, Wiesbaden.* 10. DOI: 10.1007/978-3-658-21177-6.

Liu, Y. 2024. Characterization of Immediate Pressing Tactics in Soccer in the age of Artificial Intelligence. *Applied Mathematics and Nonlinear Sciences.* 9(1). DOI: 10.2478/amns.2023.2.01415.

Liu, G., Luo, Y., Schulte, O. & Kharrat, T. 2020. Deep soccer analytics: Learning an action-value function for evaluating soccer players. *Data Mining and Knowledge Discovery.* 34(5):1531–1559. DOI: 10.1007/s10618-020-00705-9.

Llana, S., Madrero, P. & Fernández, J. 2020. The right place at the right time: Advanced off-ball metrics for exploiting an opponent's spatial weaknesses in soccer. In *Proceedings of the 14th MIT Sloan Sports Analytics Conference.*

Low, B., Boas, G.V., Meyer, L., Lizaso, E., Hoitz, F., Leite, N. & Gonçalves, B. 2018. Exploring the effects of deep-defending vs high-press on footballers' tactical behaviour, physical and physiological performance: A pilot study. *Motriz: Revista de Educação Física.* 24(2):e1018171. DOI: 10.1590/S1980-6574201800020009.

Low, B., Coutinho, D., Gonçalves, B., Rein, R., Memmert, D. & Sampaio, J. 2020. A Systematic Review of Collective Tactical Behaviours in Football Using Positional Data. *Sports Medicine*. 50(2):343–385. DOI: 10.1007/s40279-019-01194-7.

Low, B., Rein, R., Raabe, D., Schwab, S. & Memmert, D. 2021. The porous high-press? An experimental approach investigating tactical behaviours from two pressing strategies in football. *Journal of Sports Sciences*. 39(19):2199–2210. DOI: 10.1080/02640414.2021.1925424.

Low, B., Rein, R., Schwab, S. & Memmert, D. 2022. Defending in 4-4-2 or 5-3-2 formation? Small differences in footballers' collective tactical behaviours. *Journal of Sports Sciences*. 40(3):351–363.

Luo, Y. 2020. Inverse reinforcement learning for team sports: Valuing actions and players. PhD thesis. Simon Fraser University. Available: https://summit.sfu.ca/item/20564 [2024, March 06].

Ma, J. 2020. An Analysis of Formation Disruption in Soccer. {PhD} {Thesis}.

Maleki, M., Dadkhah, K. & Alahvisi, F. 2016. Ball Recovery Consistency as a Performance Indicator in Elite Soccer. *Revista Brasileira de Cineantropometria & Desempenho Humano*. 18(1):72–81. DOI: 10.5007/1980-0037.2016v18n1p72.

Memmert, D. & Raabe, D. 2018. *Data Analytics in Football: Positional Data Collection, Modelling and Analysis*. 1st ed. Taylor & Francis. Available: https://books.google.co.za/books?id=O9tdDwAAQBAJ.

Memmert, D. & Raabe, D. 2023. *Data Analytics in Football: Positional Data Collection, Modelling and Analysis*. 2nd ed. Taylor & Francis. Available: https://books.google.co.za/books?id=-ILkEAAAQBAJ.

Merckx, S., Robberechts, P., Euvrard, Y. & Davis, J. 2021. Measuring the Effectiveness of Pressing in Soccer. In *Workshop on Machine Learning and Data Mining for Sports Analytics*.

Merhej, C., Beal, R.J., Matthews, T. & Ramchurn, S. 2021. What Happened Next? Using Deep Learning to Value Defensive Actions in Football Event-Data. In *Proceedings of the 27th ACM SIGKDD Conference on Knowledge Discovery & Data Mining*. (KDD '21). New York, NY, USA: Association for Computing Machinery. 3394–3403. DOI: 10.1145/3447548.3467090.

Michael, O., Obst, O., Schmidsberger, F. & Stolzenburg, F. 2018. Analysing Soccer Games with Clustering and Conceptors. In *RoboCup 2017: Robot World Cup XXI*. H. Akiyama, O. Obst, C. Sammut, & F. Tonidandel, Eds. (Lecture Notes in Computer Science). Cham: Springer International Publishing. 120–131. DOI: 10.1007/978-3-030-00308-1_10.

Min, D.K., Lee, Y.-S. & Kim, Y.-R. 2015. Performances analysis of football matches. *Journal of the Korean Data and Information Science Society*. 26(1):187–196. DOI: 10.7465/jkdi.2015.26.1.187.

Modric, T., Malone, J.J., Versic, S., Andrzejewski, M., Chmura, P., Konefał, M., Drid, P. & Sekulic, D. 2022. The influence of physical performance on technical and tactical outcomes in the UEFA Champions League. *BMC Sports Science, Medicine and Rehabilitation*. 14(1):179. DOI: 10.1186/s13102-022-00573-4.

Modric, T., Gabrilo, G. & Sekulic, D. 2023. Influence of Team Pressing on Match Performance in Highest-Level Soccer; Preliminary Report. *Kinesiologia Slovenica*. 29(1):138. DOI: 10.52165/kinsi.29.1.138-148.

Morgan, W. 2018. Available: https://statsbomb.com/articles/soccer/how-statsbomb-data-helps-measure-counter-pressing/ [2024, March 13].

Nascimento, R.F.M. do & Rios-Neto, H.M. 2023. DOI: 10.48550/arXiv.2307.04215.

Navarro, F.J.F. 2018. Analysis of styles of play in soccer and their effectiveness. http://purl.org/dc/dcmitype/{Text}. Universidad de Granada. Available: https://dialnet.unirioja.es/servlet/tesis?codigo=216465 [2024, March 05].

Pappalardo, Luca, Cintia, Paolo, Rossi, Alessio, Massucco, Emanuele, Ferragina, Paolo, Pedreschi, Dino & Giannotti, Fosca. 2019. A public data set of spatio-temporal match events in soccer competitions. *Scientific Data*. 6(1):1–15. Available: https://www.nature.com/articles/s41597-019-0247-7 [2024, March 05].

Plakias, S., Tsatalas, T., Armatas, V., Tsaopoulos, D. & Giakas, G. 2024. Tactical Situations and Playing Styles as Key Performance Indicators in SoccerTactical Situations and Playing Styles as Key Performance Indicators in Soccer. *Journal of Functional Morphology and Kinesiology*. 9(2):88. DOI: https://doi.org/10.3390/jfmk9020088.

Rein, R. & Memmert, D. 2016. Big data and tactical analysis in elite soccer: Future challenges and opportunities for sports science. *SpringerPlus*. 5(1):1410. DOI: 10.1186/s40064-016-3108-2.

Rico-González, Markel, Pino-Ortega, José, Méndez, Amaia, Clemente, Filipe Manuel & Baca, Arnold. 2023. Machine learning Application in Soccer: A Systematic Review. *Biology of Sport*. 40(1):249–263. Available: https://www.termedia.pl/Machine-learning-application-in-soccer-a-systematic-review,78,46287,0,1.html [2024, March 13].

Robberechts, P. 2019. Valuing the Art of Pressing. In *Valuing the Art of Pressing*. V. 11.

Robberechts, P., Rudolph, Y., Van Roy, M. & Zimmermann, A. 2024. Available: https://dtai.cs.kuleuven.be/tutorials/sports/ecml2024/.

Roy, M.V., Robberechts, P., Decroos, T. & Davis, J. 2020. Valuing On-the-Ball Actions in Soccer: A Critical Comparison of xT and VAEP. In *Proceedings of the AAAI-20 Workshop on Artifical Intelligence in Team Sports. AI in Team Sports Organising Committee*.

Ruan, L., Ge, H., Shen, Y., Pu, Z., Zong, S. & Cui, Y. 2022. Quantifying the effectiveness of defensive playing styles in the Chinese Football Super League. *Frontiers in Psychology*. 13:899199.

Sahasrabudhe, Amod & Bekkers, Joris. 2023. A Graph Neural Network Deep-Dive into Successful Counterattacks.

Sanford, R., Gorji, S., Hafemann, L.G., Pourbabaee, B. & Javan, M. 2020. Group Activity Detection From Trajectory and Video Data in Soccer. 898–899. Available: https://openaccess.thecvf.com/content_CVPRW_2020/html/w53/Sanford_Group_Activity_Detection_From_Trajectory_and_Video_Data_in_Soccer_CVPRW_2020_paper.html [2024, March 06].

Scotognella, F. 2021.

"StatsBomb Privacy Policy". 2022. Available: https://statsbomb.com/privacy-policy/.

Sumpter, D. 2016. *Soccermatics: Mathematical Adventures in the Beautiful Game.* 1st ed. Bloomsbury Publishing. Available: https://books.google.co.za/books?id=CoZVCwAAQBAJ.

Sun, X., Davis, J., Schulte, O. & Liu, G. 2020. Cracking the Black Box: Distilling Deep Sports Analytics. In *Proceedings of the 26th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining.* (KDD '20). New York, NY, USA: Association for Computing Machinery. 3154–3162. DOI: 10.1145/3394486.3403367.

Tewari, A., Parwani, T., Phanse, A., Sharma, A. & Shetty, A. 2019. Soccer Analytics using Machine Learning. *International Journal of Computer Applications.* 181(50):54–56. Available: https://ijcaonline.org/archives/volume181/number50/30504-2019918773/ [2024, March 05].

Toda, K., Teranishi, M., Kushiro, K. & Fujii, K. 2022. Evaluation of soccer team defense based on prediction models of ball recovery and being attacked: A pilot study. *Plos one.* 17(1):e0263051.

Tong, Q., Yao, W., Lv, W. & Zeng, D. 2022. Analysis of Formations and Game Styles in Soccer. In *2022 IEEE 24th International Workshop on Multimedia Signal Processing (MMSP).* IEEE. 1–5. DOI: 10.1109/MMSP55362.2022.9949992.

Trainor, C. 2014. Available: https://statsbomb.com/articles/soccer/defensive-metrics-measuring-the-intensity-of-a-high-press/ [2024, March 13].

Van Roy, M., Robberechts, P. & Davis, J. 2021. Optimally Disrupting Opponent Build-ups. In *Proceedings of the 2021 StatsBomb Conference.* London, United Kingdom. 1–16.

Vicente, L.N., Alleck, T., Giovannelli, T., Mitchell, R. & Remen, O. 2024. Why is soccer so popular: Understanding underdog achievement and randomness in team ball sports. *arXiv preprint arXiv:2404.06626.*

Voice, C. 2022. Available: https://learning.coachesvoice.com/cv/4-3-3-football-tactics-explained-formation-liverpool-klopp-barcelona-guardiola/#:~:text=The%204%2D3%2D3%20is%20also%20a%20good%20formation%20from.

Wilson, J. 2010. *Inverting the Pyramid: The History of Football Tactics.* 1st ed. Orion Books Ltd. Available: https://books.google.co.za/books?id=qYSAhJn-srwC.

Yu, J., Lei, A. & Hu, Y. 2019. Soccer Video Event Detection Based on Deep Learning. In *MultiMedia Modeling*. I. Kompatsiaris, B. Huet, V. Mezaris, C. Gurrin, W.-H. Cheng, & S. Vrochidis, Eds. (Lecture Notes in Computer Science). Cham: Springer International Publishing. 377–389. DOI: 10.1007/978-3-030-05716-9_31.

Zhang, W., Gong, B., Tao, R., Zhou, F., Ruano, M.Á.G. & Zhou, C. 2024. The influence of tactical formation on physical and technical performance across playing positions in the Chinese super league. *Scientific Reports*. 14(1):2538. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10828377/ [2024, June 20].

Zivkovic, J. 2025. *worldfootballR: Extract and Clean World Football (Soccer) Data*. Available: https://github.com/jaseziv/worldfootballr.