# Contextualized Generative Ghosting Model as Benchmark for Evaluating Player Movement in Football

Presenter: Chaoyi Gu (Aaron)

Authors: Chaoyi Gu, Varuna De Silva, Mike Caine, Ben Smith

Loughborough University

Institute for Digital Technologies

Machine Learning Lab

# About Me

- I am a Ph.D. student at Loughborough University. My research is mainly about how to use machine learning methods to analyze big data in soccer to gain insights that can be used to help coaching staff make better tactical decisions.


Bio: https://www.lborolondon.ac.uk/about/doctoral-researchers/chaoyi-gu/

Linkedin: https://www.linkedin.com/in/aaron-gu-226027129/

# Introduction

- Current analytical models in soccer:
  - Xg mode (Rathke, 2017)
  - Expected Possession Value model

(Fernández, Bornn, and Cervone, 2019)

  - VAEP model (Decroos et al., 2021)

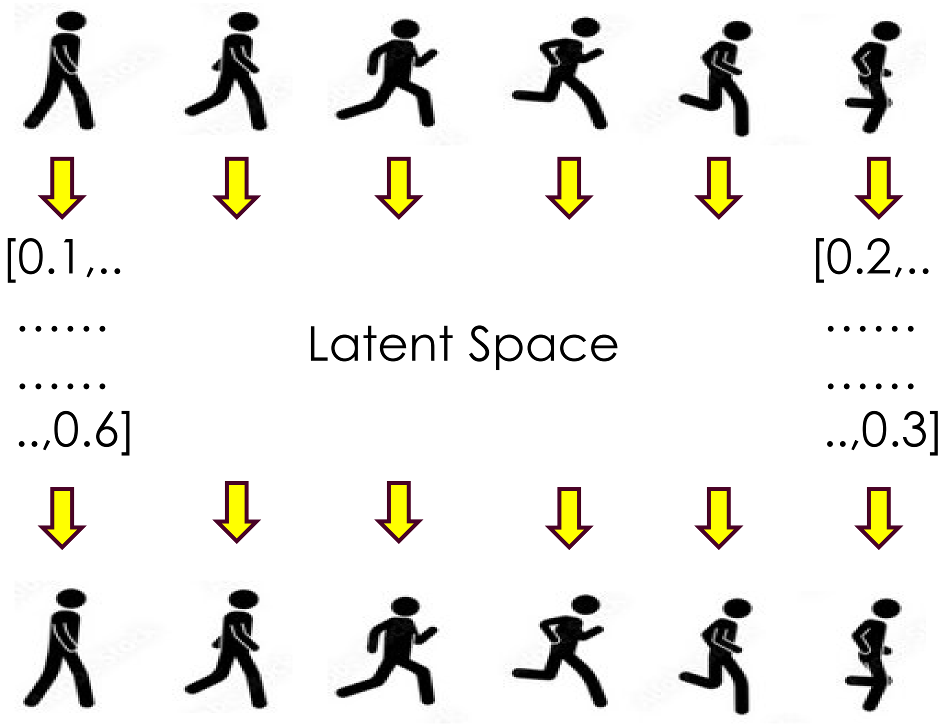
- Features:
  - Supervised learning with defined input and output
  - Model performance heavily relies on the distribution of training data
  - Cannot answer what-if questions in given context

- Generative Ghosting model:

- Features:
  - Combination of unsupervised learning and supervised learning
  - More likely to capture the generative patterns within the data
  - Can answer what-if questions in given context

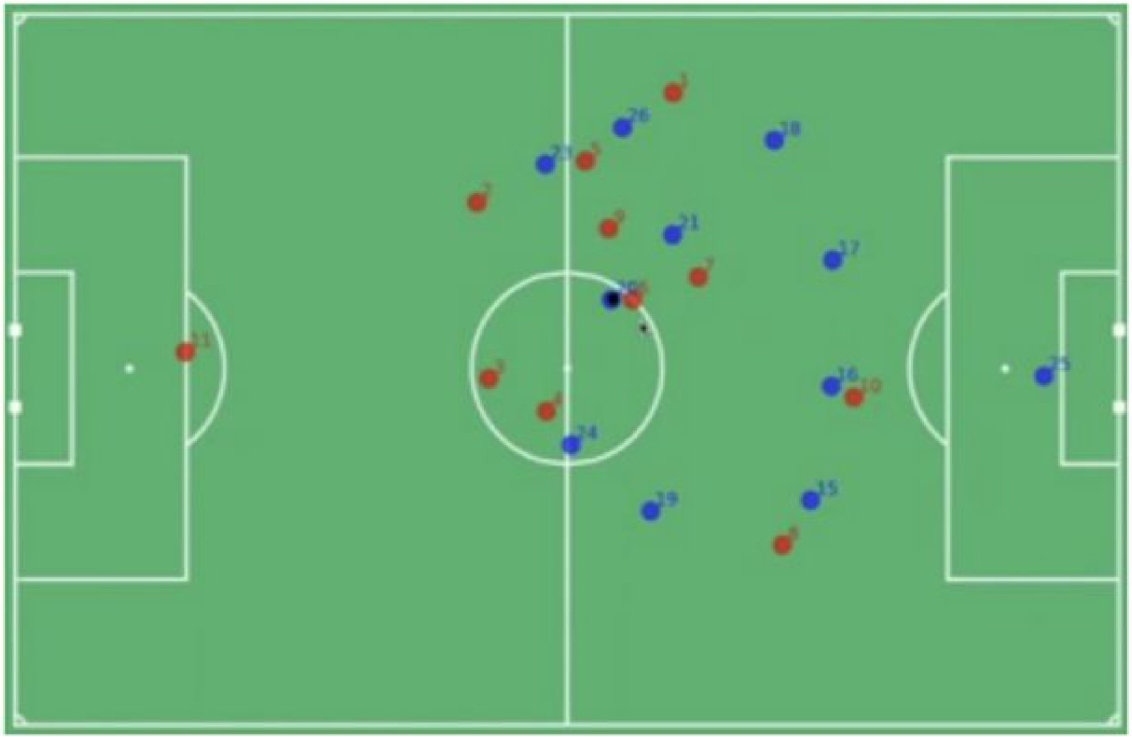
# Background

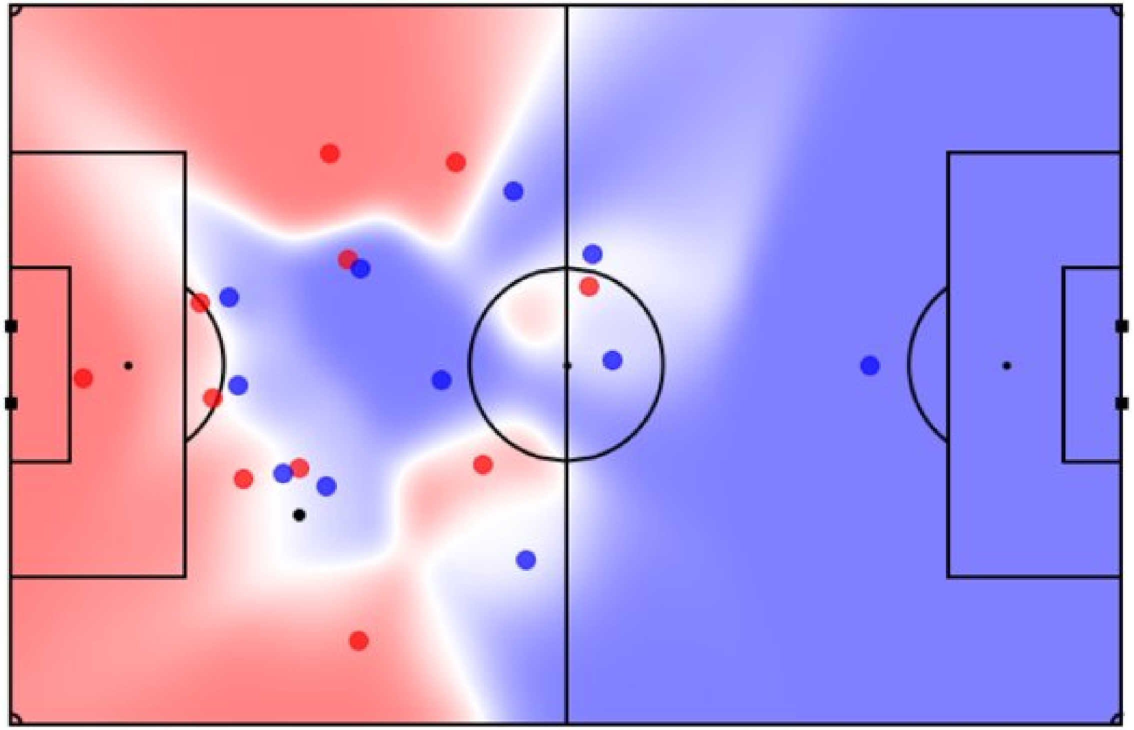
- Deep Generative Model on Time Series Data (Chung et al., 2015)




# Background

- Pitch Control (Spearman W, 2018)





# Data


Professional Soccer Matches

## Event Data

| Type | Team | From | To | Start Time [s] | End Time [s] | Ball_Start | Ball_End | Start X | Start Y | End X | End Y | Start Frame | End Frame |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pass | Away | 184667 | 95658 | 4.00 | 6.08 | [2.7, 20.25, 8.59, 0.25] | [5.37, 24.02, -10.37, 0.24] | 20.25 | 8.59 | 24.02 | -10.37 | 100 | 152 |

## Tracking Data

| Match_Phase | Time [s] | Match_Active | Last_Touch | Home_0_x | Home_0_y | | Away_0_x | Away_0_y | | ball_x | ball_y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | False | home | -17.07 | -8.40 | • • • | 21.46 | 8.98 | • • • | 0.75 | 0.40 |

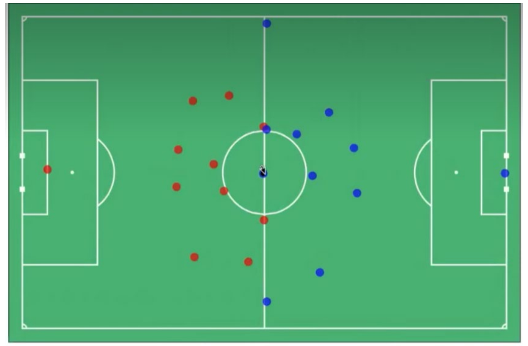
# Data Processing

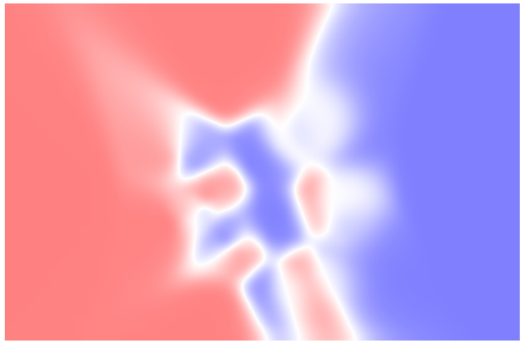
- Change data representation

Instead of directly analyzing tracking and event data,  we convert them to another form of representation – pitch control frames

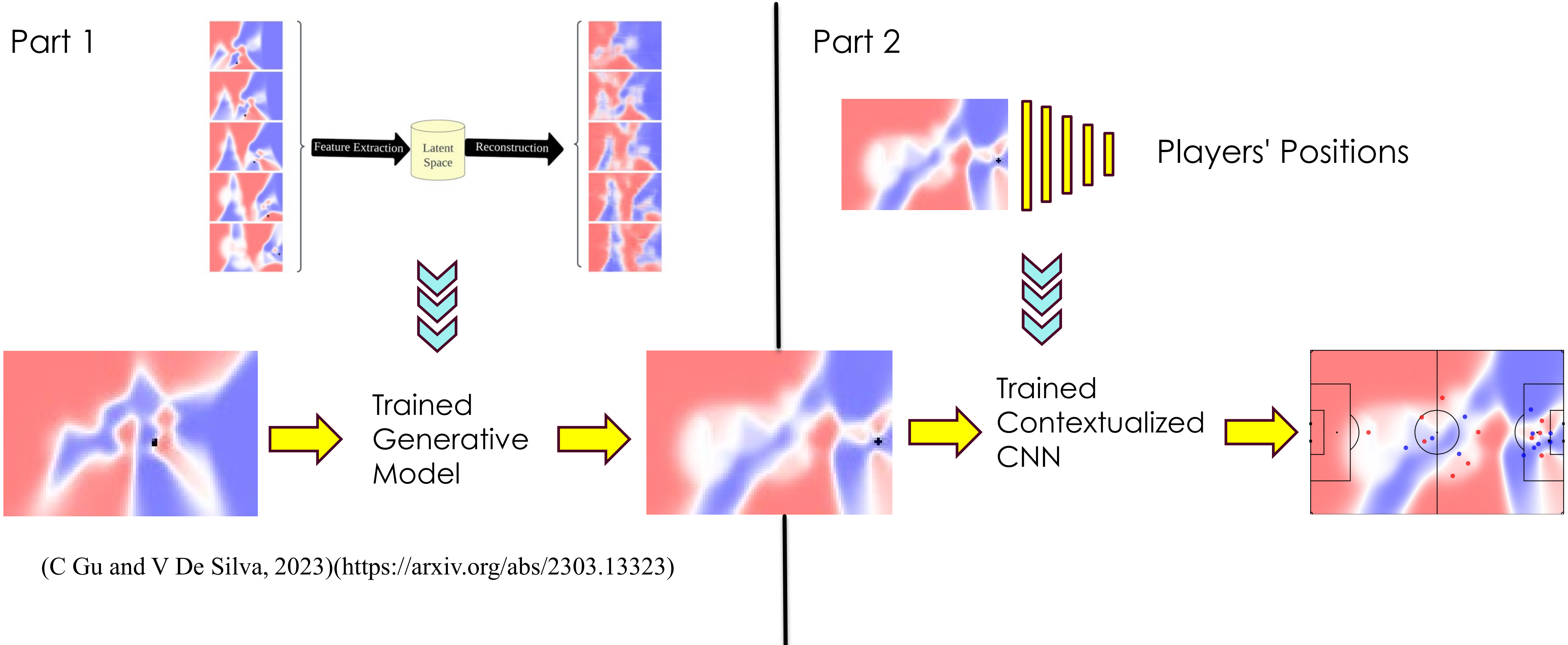
Event Data

Tracking Data



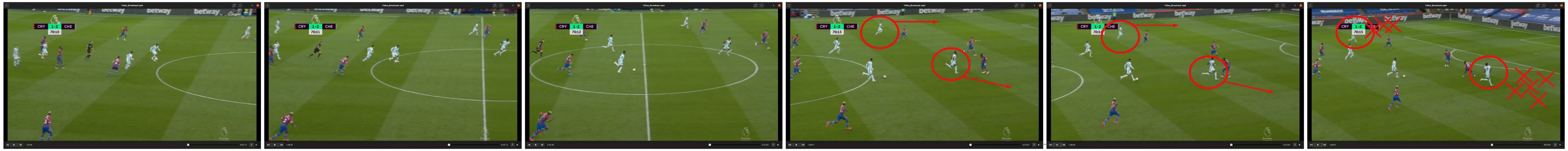


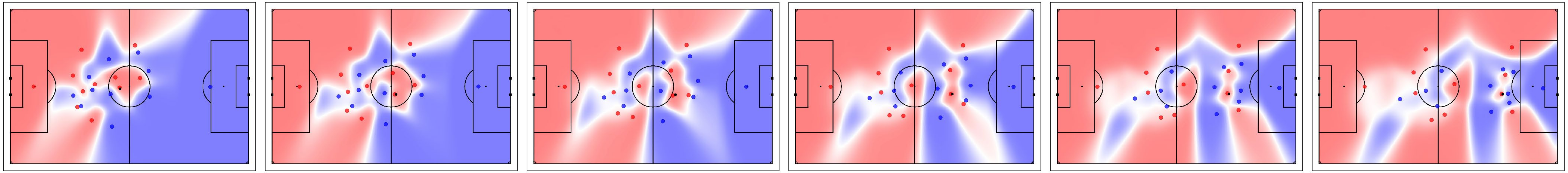
# Framework of Generative Ghosting



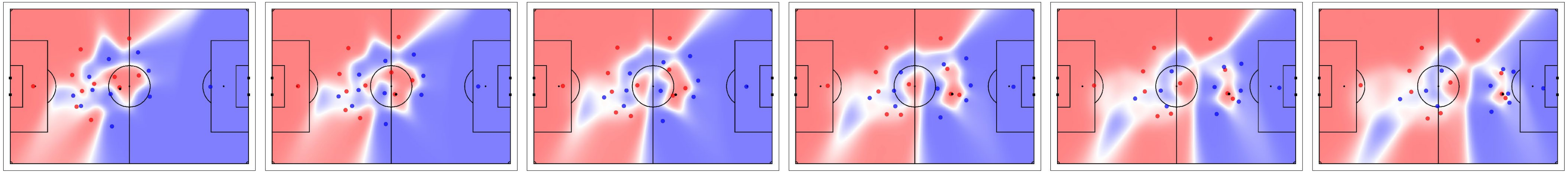

(C Gu and V De Silva, 2023)(https://arxiv.org/abs/2303.13323)

# Results





REAL POSSESSION



Ghosting POSSESSION

# Conclusion

- Contributions

Our deep generative ghosting model can be used as a benchmark for evaluating soccer players' performance on the pitch.

This model can be applied in analyzing team movement and individual player's ability of utilizing open space.

- Future Direction

The future research direction can be combining our method with expected goal model to quantify the value of each decision made within the game

# References


- Gu, C., & De Silva, V. (2023). Deep Generative Multi-Agent Imitation Model as a Computational Benchmark for Evaluating Human Performance in Complex Interactive Tasks: A Case Study in Football. arXiv preprint arXiv:2303.13323.
- Chung, J., Kastner, K., Dinh, L., Goel, K., Courville, A. C., & Bengio, Y. (2015). A recurrent latent variable model for sequential data. Advances in neural information processing systems, 28.
- Decroos, T., Bransen, L., Van Haaren, J., & Davis, J. (2021, January). VAEP: an objective approach to valuing on-the-ball actions in soccer. In Proceedings of the Twenty-Ninth International Conference on International Joint Conferences on Artificial Intelligence (pp. 4696-4700).
- Fernández, J., Bornn, L., & Cervone, D. (2019, March). Decomposing the immeasurable sport: A deep learning expected possession value framework for soccer. In 13th MIT Sloan Sports Analytics Conference.
- Rathke, A. (2017). An examination of expected goals and shot efficiency in soccer. Journal of Human Sport and Exercise, 12(2), 514-529.
- Spearman, W. (2018, February). Beyond expected goals. In Proceedings of the 12th MIT sloan sports analytics conference (pp. 1-17).

# End

## Thanks for listening !

*Any question is welcomed*

*Further discussion can be made via email*

*My email address: C.Gu@lboro.ac.uk*