

Multiscale Analysis, Modeling and Simulation

-Top Global University Project, Waseda University-

REPORT ON STUDY ABROAD

Name: Takuma Narizuka

Date: August 19, 2016

1. Overseas Dispatch: the Centre de Congrès de Lyon, France

2. Dates of Stay: July 16, 2016 - July 24, 2016 (9days)

3. Purpose:

To participate the international conference STATPHYS 26 held in Lyon, France.

4. Education and Research Activity in the Destination

I) Poster Presentations

- Takuma Narizuka and Yoshihiro Yamazaki, "Statistical properties of player interactions in football games", STATPHYS 26, the Centre de Congrès de Lyon (France) July 17-23, 2016.

II) Research Results:

The present study aims to extract statistical properties from the player interactions in football games. The dataset is collected from the matches in the Japan Professional Football League 2015. It includes positional coordinates of all players every 0.04 seconds. In order to characterize the moving directions between two interacting players, we focus on the angle θ between their velocity vectors; the circular variance V_θ and angle distribution $f(\theta)$ are investigated as functions of the order parameter ϕ and interpersonal distance r . We find that the two velocity vectors for the pair of one player and the nearest opponent player exhibits strong alignment. In particular, it is revealed that V_θ decreases rapidly within $r \simeq 5$ [m]: there is a characteristic interaction distance around each player. We also find that the angle distribution for the above nearest pair is changed from the wrapped Cauchy to the mixture of von Mises and wrapped Cauchy distributions at $\phi \simeq 0.7$. This result implies that football games can be divided into two phases, where the way of interaction is different in each phase. To understand these findings, we construct a simple model. Our model has two essential rules: chasing between two players and the reset of the chasing. We have numerically shown that it can reproduce the results obtained from the actual data. While our model is quite simplified, it incorporates the essential features of player interactions in football games.

During the conference, I listened to variety of presentations and I could know the cutting-edge research areas in statistical physics. However, there were no talks focusing on the sport activities. I expect that our research gives a new insight into the field of statistical physics.

5. Other Comments:

It was my first time to participate an international conference held overseas. Although I worried about the security in France, I enjoyed my stay in Lyon without any troubles. There were three dedicated poster sessions during the conference. Over 15 people came to my poster, and I had very fruitful discussions with them. Surprisingly, one of them, who is a Ph.D student in U.K, came to Japan and visited my lab after the conference. It was a precious experience for me. I'm very grateful to "Top Global University Project" for giving me an opportunity to study abroad.