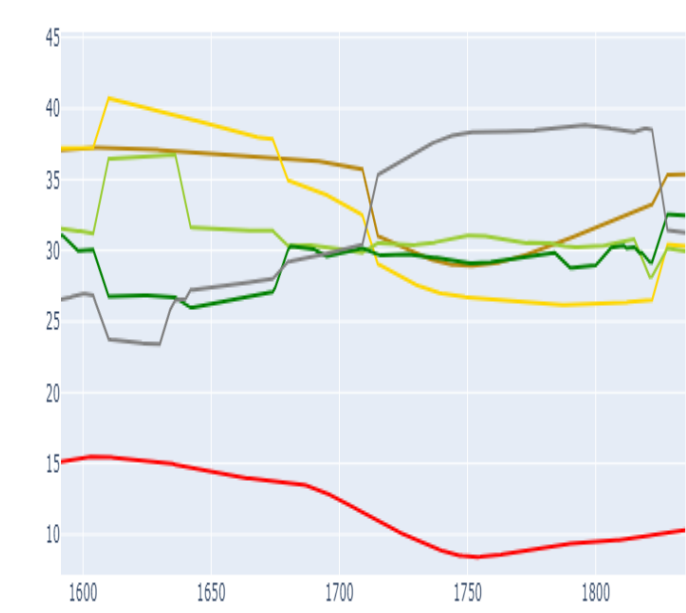


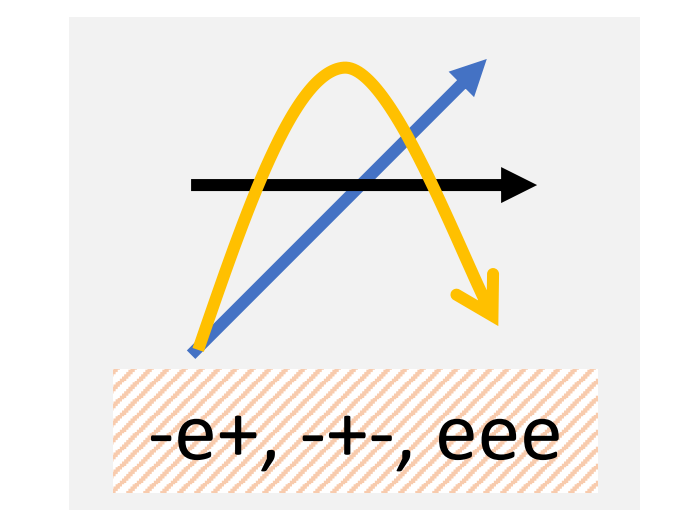
What Are The Topics In Football?

Gota Shirato^{1, 2}, Gennady Andrienko^{2, 3}, Natalia Andrienko^{2, 3}

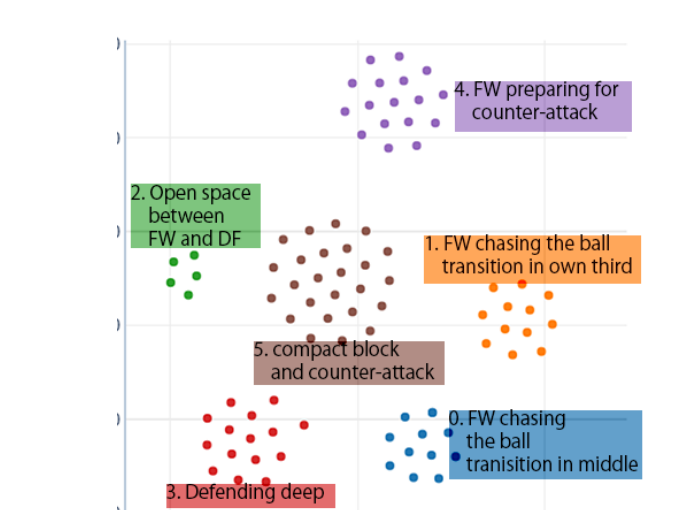
Summary / Introduction



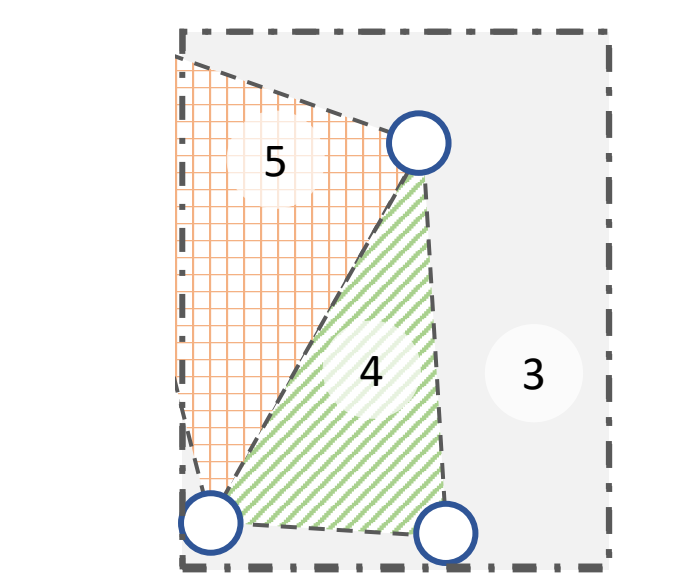
We take multiple homogeneous episodes (e.g. of a football game) and characterize them by multiple features. It is challenging to synthesize holistic understanding of the behaviours.



What can be exploited is the relationship of temporal co-occurrence of patterns from different time series. We represent variation patterns of different features by symbolic codes.

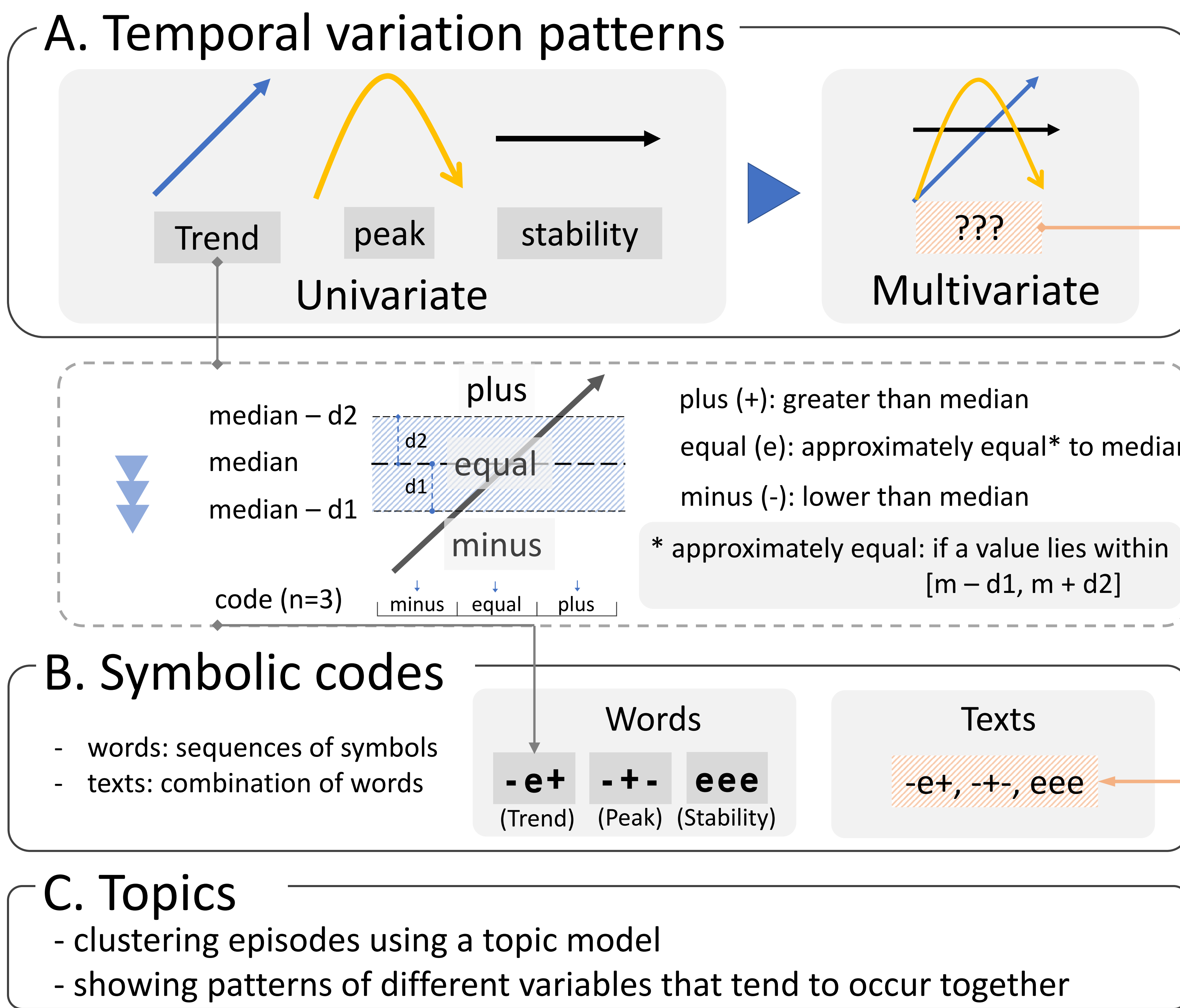


We reveal pattern co-occurrences using topic modelling. We found semantic interpretation in each cluster.



We apply the approach to episodes of a football game characterized by a novel feature **gate width** reflecting space availability to attackers and space control by defenders.

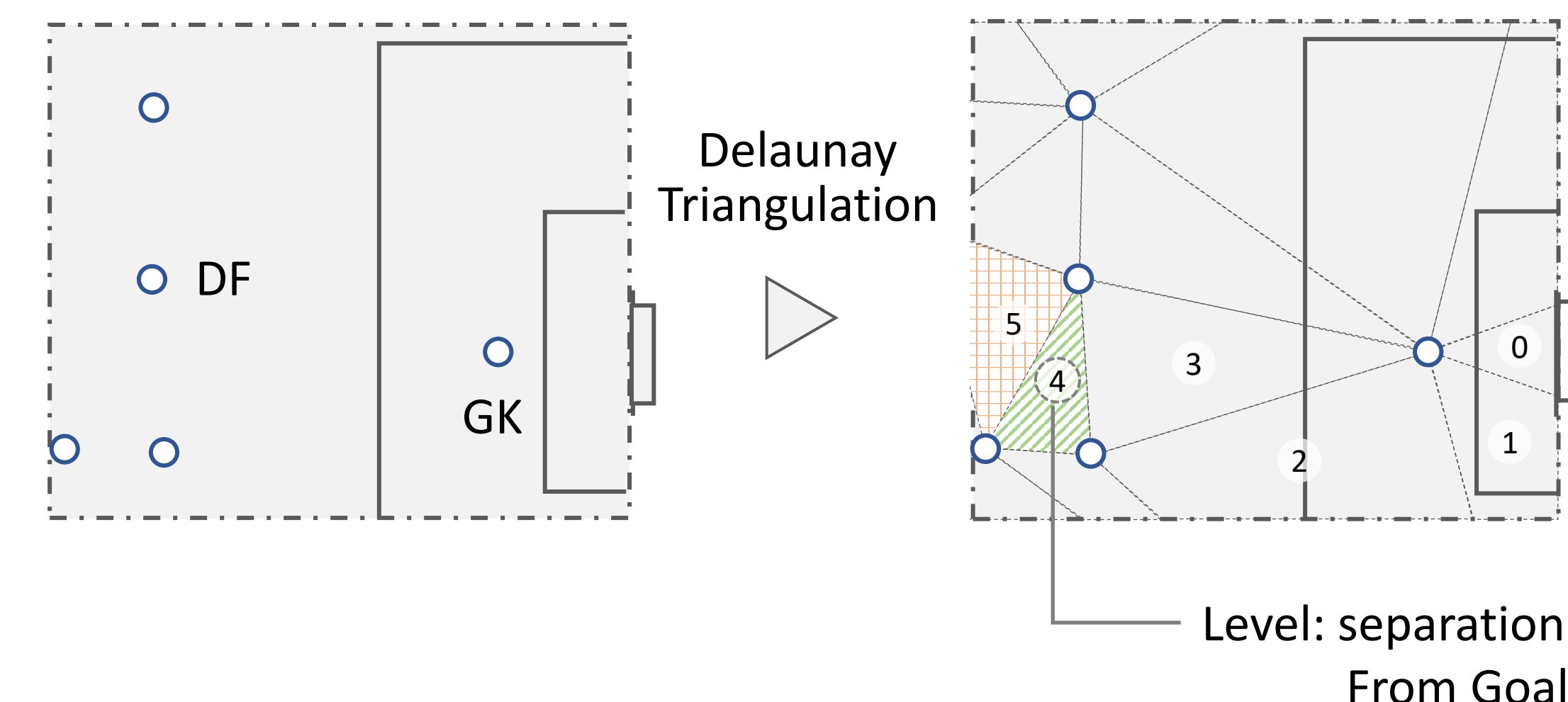
Method: Patterns In Multivariate Time Series



Application in Football

Spatial Feature – Gate Width

A novel feature that captures inter-player spaces



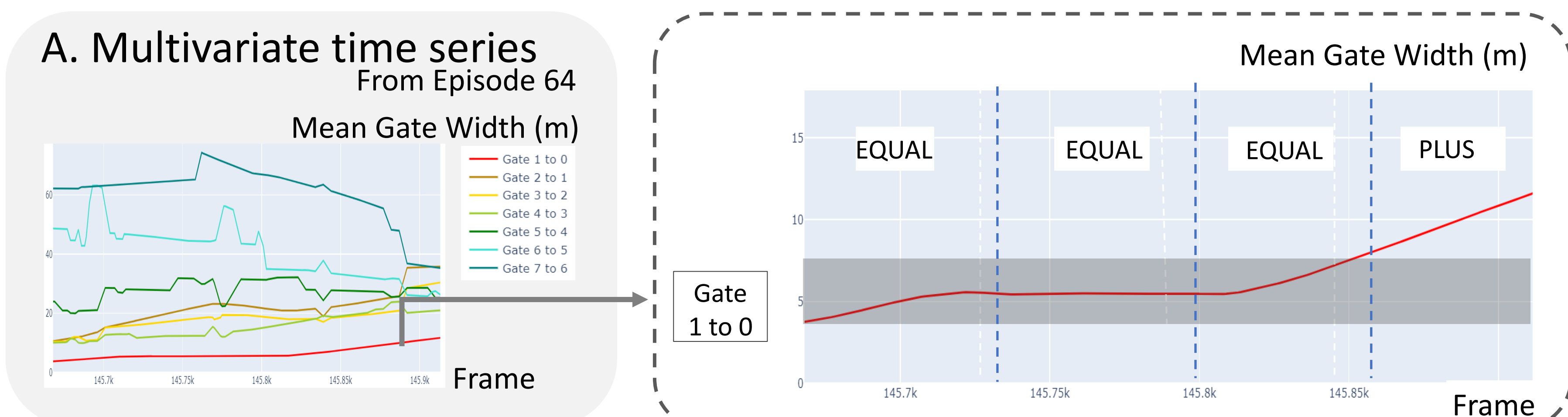
- **Level**
Discrete separation from goal
- **Gate**
An edge of triangle through which the level decreases

■ The multivariate time series consists of gate width that is aggregated for each level.

Data Examples

Results

- 85 Episodes of ball possession change
Transitions from defense to attack
- 10 seconds
5 seconds before and after transitions
- Defending players' positional data
250 timesteps with sampling rate of 25 Hz



Documents

```
['0_+--', '1_+e-e', ..., '6_+---', '7_eee'] #0
['0_++-e', '1_+e-e', ..., '6_-e++', '7_+++'] #1
...
['0_eee+', '1_-ee+', ..., '6_++e-'] #64
...
['0_+e-e', '1_+--e', ..., '6_ee++', '7_eeee'] #84
```

Topic Probabilities

