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# Tactical analysis in Olympic wrestling: a Markov chain approach

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**INTRODUCTION:**
**In sport, the concept of tactics has been defined by several authors as the actions taken by players to adapt to dynamically changing match situations. The delicate competitive balance between two athletes is broken as soon as the former scores a point. This change in the status of the fight inevitably leads to changes in the tactics, style of play and psychological state of the athletes [1]. Therefore, the objective of the study was to develop a tactical model of wrestling matches in order to determine the probability of the outcome as a function of a given score, the time remaining before the end of the match and the associated co-variables throughout a match.**
**METHODS:**
**The score, time, weight class, round of competition and wrestling style were automatically annotated from 5280 bouts from the international wrestling circuit. In order to determine the probability of evolution and outcome of the fight, a multi-state Markov model was calculated. The transition intensities were calculated from the Nelson-Aalen estimator. The evolution probabilities of the fight were calculated at each moment of the fight thanks to the Aalen-Johansen estimator.**
**RESULTS:**
**The model developed makes it possible to understand the mechanisms of score transitions during a fight. It also allow to estimate outcome of fight according to the current score. All the probabilities of score changes and combat outcomes were calculated for each possible score difference and grouped into a matrix. Taking the example of a 4-point gap, regardless of the style of wrestling, this advantage lead the fight towards victory (40%). And this tend to be accentuated if this gap occurs late in the fight (90% in the last minute).**
**CONCLUSION:**
**This work presented a Markov chain approach for better understand the tactical evolution of a wrestling match. Although the results are promising, we see opportunities for several improvements, though the majority can only be implemented with a more detailed dataset. In the near future, we will be able to add the techniques associated with each point scored as well as the area on the combat surface. The current model will be able to evolve towards a semi-Markovian model inhomogeneous in time [2], taking into account the time spent in a state, and parametric by testing several laws a priori.**

**Keywords : score; wrestling; markov chain; time; performance; tactics**

**[1] R. Rein et D. Memmert, « Big data and tactical analysis in elite soccer: future challenges and opportunities for sports science », Springerplus, vol. 5, no 1, p. 1410, août 2016, doi: 10.1186/s40064-016-3108-2.**
**[2] A. Asanjarani, B. Liquet, et Y. Nazarathy, « Estimation of semi-Markov multi-state models: a comparison of the sojourn times and transition intensities approaches », The International Journal of Biostatistics, vol. 18, no 1, p. 243 262, mai 2022, doi: 10.1515/ijb-2020-0083.**

**Topic:** **Statistics and Analyses**

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