

Combining machine learning and mathematical games for the automated analysis of the origin of movement

Abstract for the MLDM Workshop of the AI*IA Conference

Giorgio Gnecco¹, Marcello Sanguineti^{2*}, Antonio Camurri², Benoit Bardy³, Denis Mottet³

¹ IMT Lucca, Italy

² University of Genova, Italy

* corresponding author

³ University of Montpellier, France

giorgio.gnecco@imtlucca.it, {antonio.camurri, marcello.sanguineti}@unige.it
{benoit.bardy, denis.mottet}@umontpellier.fr

Abstract

Computational models combining machine learning and cooperative mathematical games on graphs are developed to detect the origin of full-body human movement as it is perceived by an observer, and tracking its propagation. A transferable-utility game is defined on a skeletal representation of the body, whose players are the joints. A characteristic function related to the change of movement features on adjacent joints is adopted. Mathematical properties of the game are interpreted in terms of movement analysis. The Shapley values of the joints are evaluated and used to extract a higher-level feature (“Origin of Movement”), which provides an estimate of the joint from which movement originates/propagates. Feature ranking is performed to find the feature with the best prediction capability about the origin of movement and its propagation. This research was funded by EU Horizon 2020 research and innovation programme under grant agreement No. 824160 EU (Project EnTimeMent) and from Università Italo-Francese (project GALILEO 2021 no. G21 89).

References

- [1] K. Kolykhalova, G. Gnecco, M. Sanguineti, A. Camurri, G. Volpe. Graph-restricted game approach for investigating human movement qualities. Proc. 4th Int. MOCO Conf, article no: 30, pp. 1-4, 2017.
- [2] K. Kolykhalova, G. Gnecco, M. Sanguineti, A. Camurri, G. Volpe. Automated analysis of the origin of movement: An approach based on cooperative games on graphs. IEEE Trans. Hum. Mach. Syst. 50, 2020.
- [3] O. Matthiopoulou, B. Bardy, G. Gnecco, D. Mottet, M. Sanguineti, A. Camurri. A computational method to automatically detect the perceived origin of full-body human movement and its propagation. Proc. 1st Int. Workshop on Multi-Scale on Movement Technologies, 2020, pp. 449-453.