Complexity of human mobility. A closer look to the Community of Madrid

Mary Luz Mouronte-López[1, *] and Javier Gómez[1, 2]

[1] *Higher Polytechnic School of Universidad Francisco de Vitoria*
Pozuelo de Alarcón, Madrid 28223, Spain
[2] *Grupo de Sistemas Complejos, Escuela Técnica Superior de Ingeniería Agronómica,*
Alimentaria y de Biosistemas, Universidad Politécnica de Madrid,
Avda. Puerta de Hierro 2-4, 28040 Madrid, Spain

Abstract Gaining a better understanding of human mobility in a city can contribute to optimizing the design of infrastructures and urban spaces as well as to achieving a better knowledge regarding the points of greatest interest. This research analyses human mobility in the Community of Madrid [1]. The analysis is based on data collected in the Mobility Survey of the Community of Madrid, conducted in 2018 by the Regional Transport Consortium of Madrid [4]. The research takes into consideration various trip typologies and administrative zones Mouronte1. The highest percentages of trip modes correspond to walking (33.60%), driver in private car (29.65%), subway (8.56%), urban bus (6.18%), and commuter trains (4.02%). The main movement flows are examined using a coarse-graining approach. Distances, travel times, and cumulative probability distributions by type of flow are studied. Additionally, with the purpose of comparing the existing mobility networks, these variables are also topologically studied Mouronte1. In particular, parameters such as giant component, average shortest path and average degree are analysed in addition to assortativity and k-core decomposition [3]. A brief analysis of the public transportation infrastructure (stops) is also carried out. Additionally, a generalised linear model describing the mobility between origin and destination zones was constructed. The model used as explanatory variables local, quasilocal, and global similarity metrics. The model used also provides optimal results in the characterization of public transport networks [2].

---

[1] M.L. Mouronte-López & J. Gómez (2023). Exploring the mobility in the Madrid Community. Sci Rep, **13**, 904. https://doi.org/10.1038/s41598-023-27979-5

[2] M. L., Mouronte-López (2021). Modeling the Public Transport Networks: A Study of Their Efficiency", Complexity, **2021**. https://doi.org/10.1155/2021/3280777

[3] K. Yi-Xiu, S. Gui-Yuan, W. Rui-Jie, Z. Yi-Cheng, k-core: Theories and applications. *Physics Reports*,**832**,1-32 (2019). https://doi.org/10.1016/j.physrep.2019.10.004.

[4] Encuesta de mobilidad de la comunidad de Madrid 2018. Documento síntesis. `https://www.crtm.es/media/712934/edm18_sintesis.pdf.Accessed17Apr2023`.

* maryluz.mouronte@ufv.es