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Modeling individual human mobility patterns by travel purpose

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Modeling individual human mobility patterns by travel purpose

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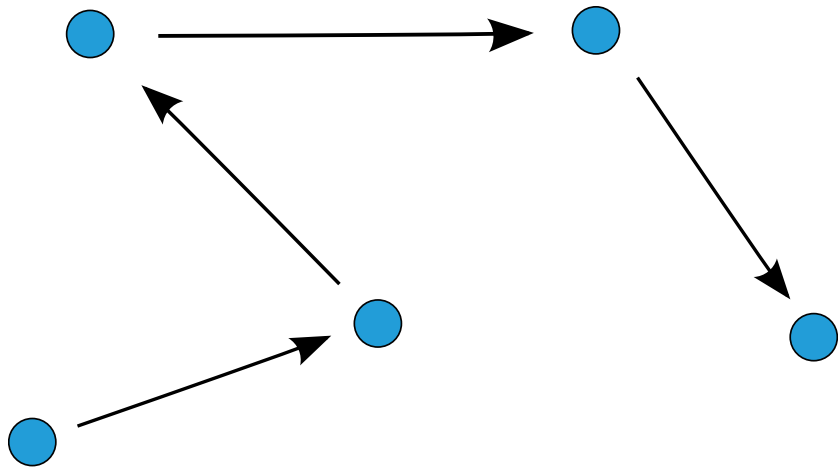
JJ Ramasco | IFISC, Spain

CCS 2016 | Amsterdam, Netherlands

19 September 2016

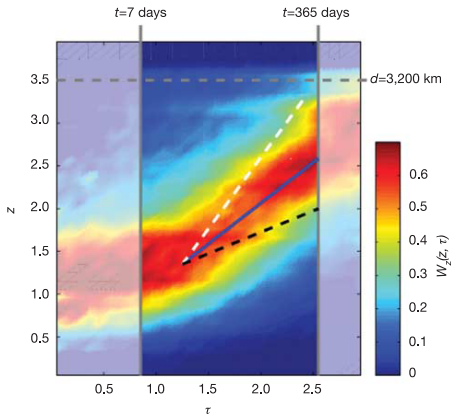


Individual human mobility patterns



Individual human mobility patterns

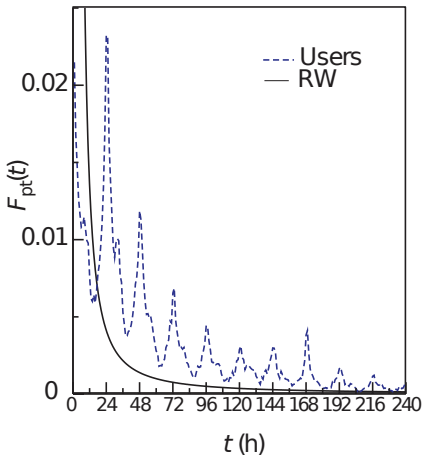
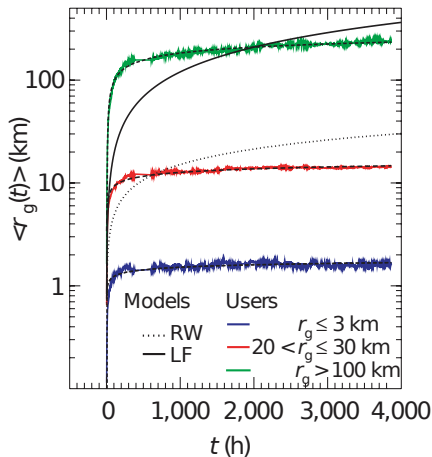
- ▶ **Brockmann *et al.*** (2006) The scaling laws of human travel.
Nature 439, 462-465.



Continuous-Time Random Walks

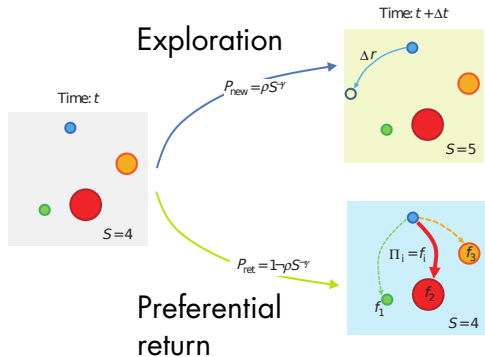
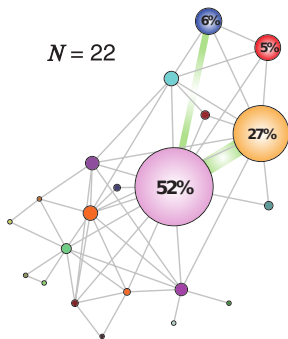
Individual human mobility patterns

- ▶ **Gonzalez et al.** (2008) Understanding individual human mobility patterns. *Nature* 453, 779-782.



Individual human mobility patterns

- ▶ **Song et al.** (2010) Limits of predictability in human mobility.
Science 327, 1018-1021.
- ▶ **Song et al.** (2010) Modelling the scaling properties of human mobility
Nature Physics 6, 818.

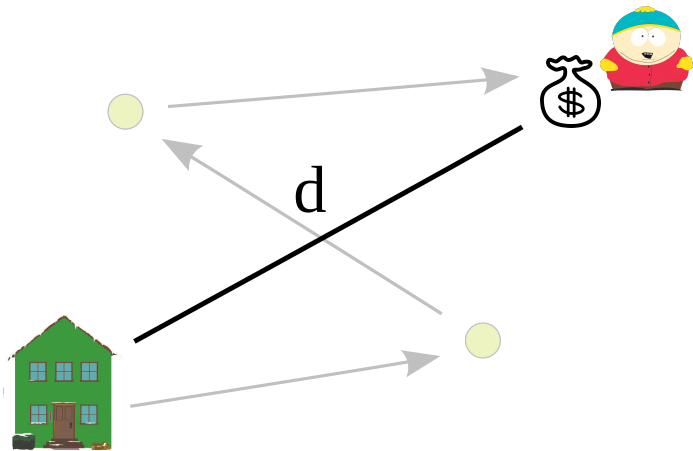


and many more papers...

- ▶ **Rhee et al.** (2008) On the Levy-walk nature of human mobility. INFOCOM 2008.
- ▶ **Lee et al.** (2009) SLAW: A mobility model for human walks. Proceedings of the 28th Annual Joint Conference of the IEEE Computer and Communications Societies (INFOCOM).
- ▶ **Kang et al.** (2012) Intra-urban human mobility patterns: An urban morphology perspective. *Physica A* 391, 1702-1717.
- ▶ **Hasan et al.** (2013) Spatiotemporal Patterns of Urban Human Mobility. *J Stat Phys* 151, 304–318.
- ▶ **Schneider et al.** (2013) Unravelling daily human mobility motifs. *J R Soc Interface* 10, 20130246.
- ▶ **Han et al.** (2015) Cascading Walks Model for Human Mobility Patterns. *Plos One* 10, e0124800.
- ▶ **Gallotti et al.** (2015) A stochastic model of randomly accelerated walkers for human mobility. *Nature Communications* 7, 12600.

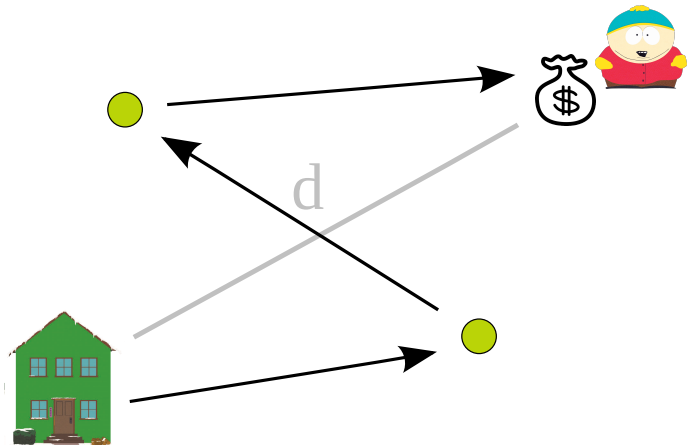
Importance of trip destination

Is there a link between the amount of "energy" invested into a travel and the value attached to the purpose/objectif of this travel?



Importance of trip destination

How to integrate the importance of trip destination into an individual human mobility model?



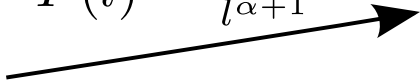
Model



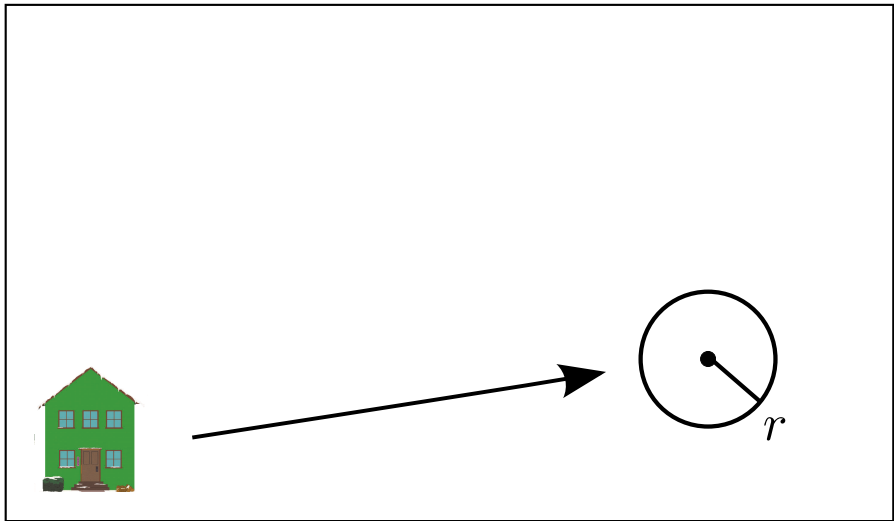
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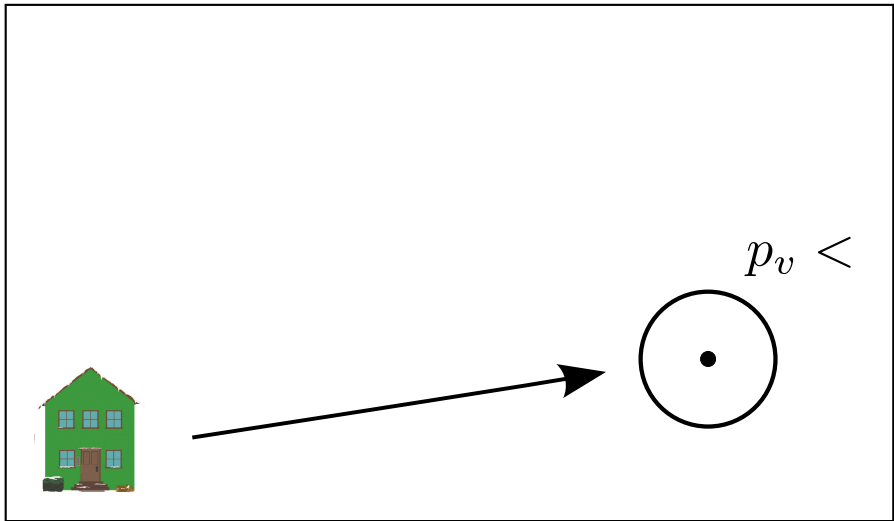
$$P(l) = \frac{\alpha l_0^\alpha}{l^{\alpha+1}}$$



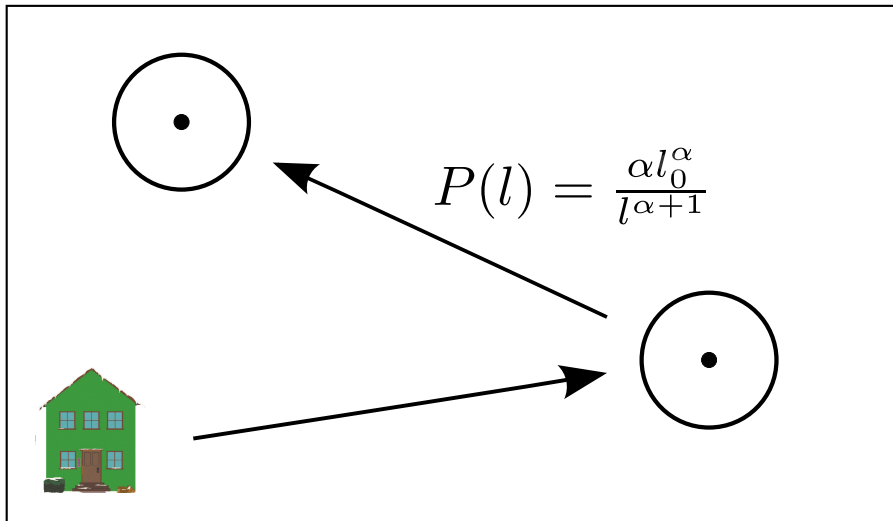
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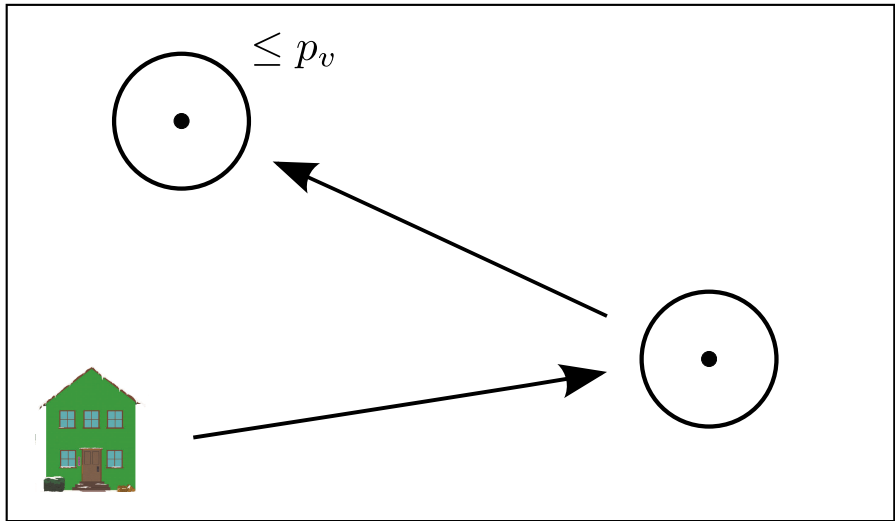
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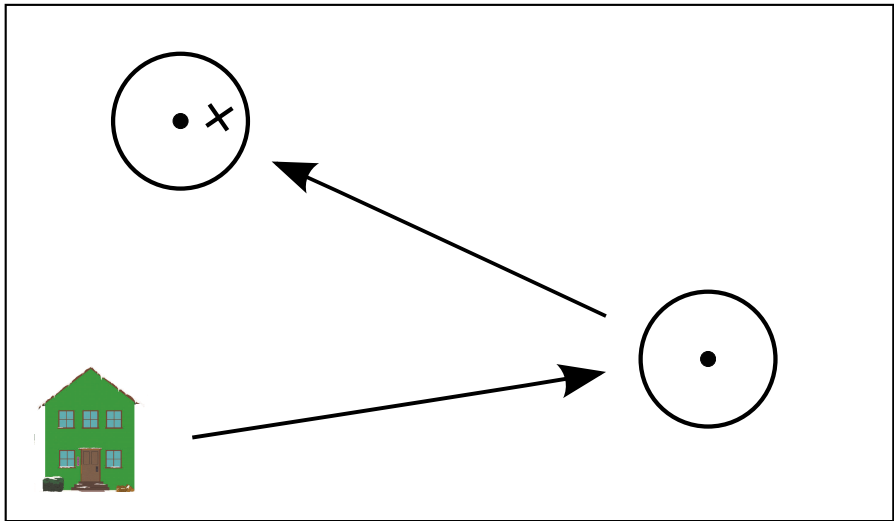
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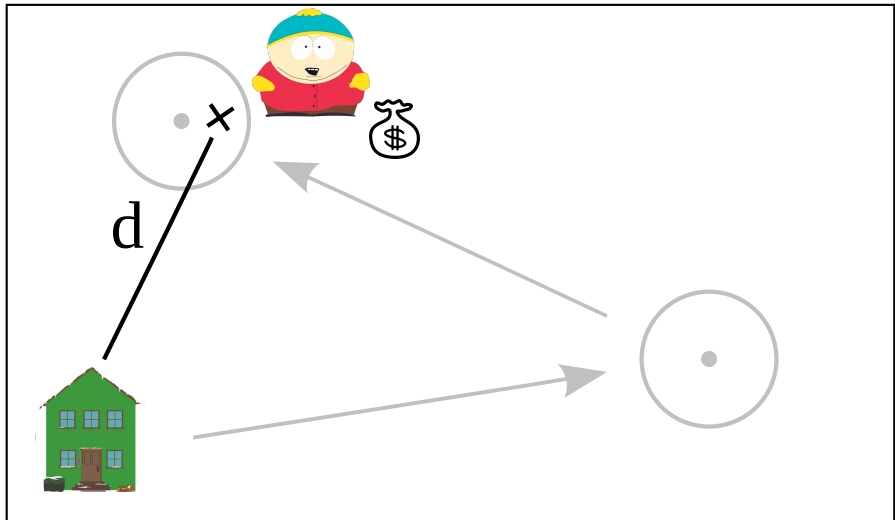
Model



Model

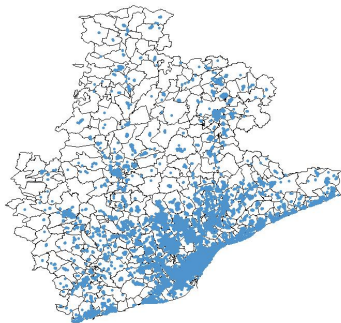
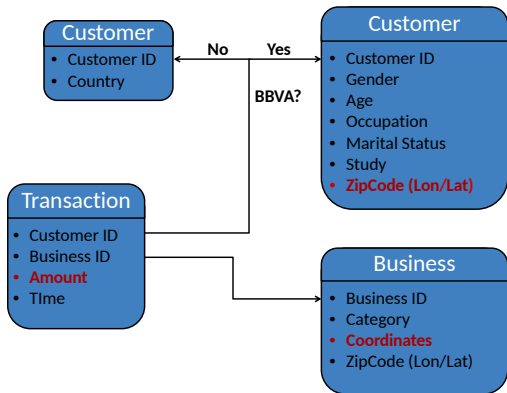


Model

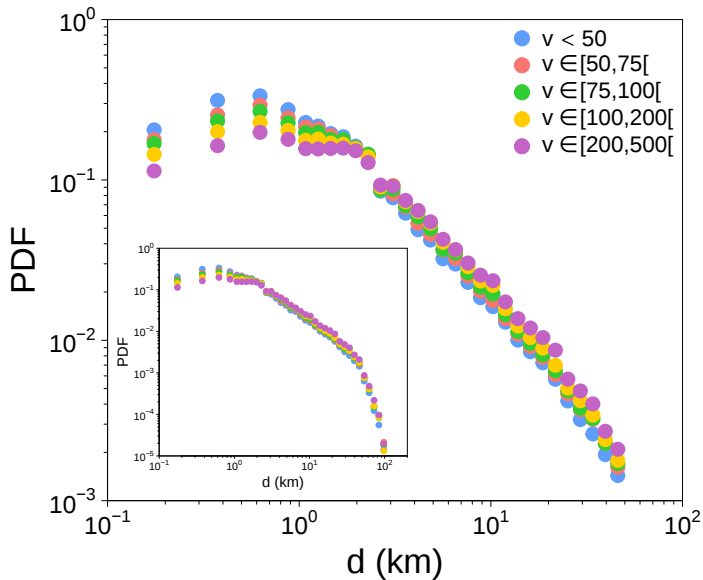


Results

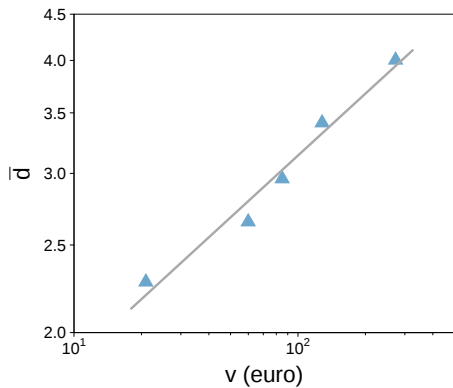
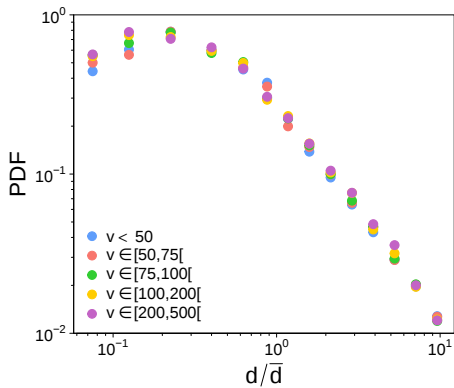
13 M of transactions made by 300,000 users in Barcelona in 2011



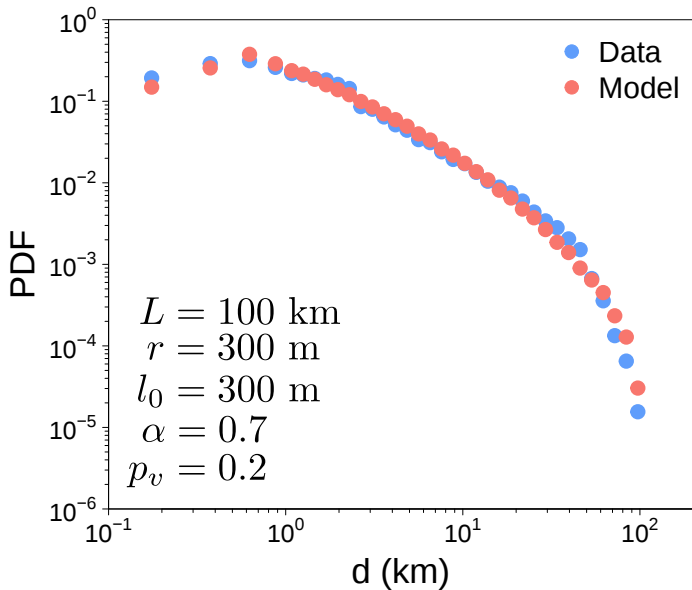
Results



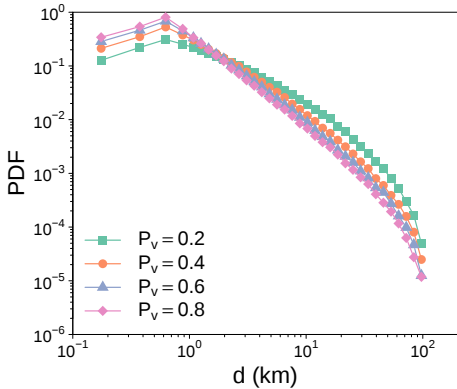
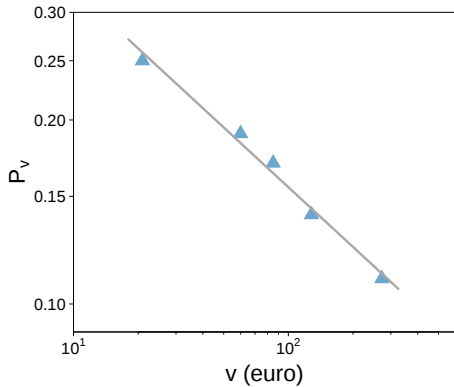
Results



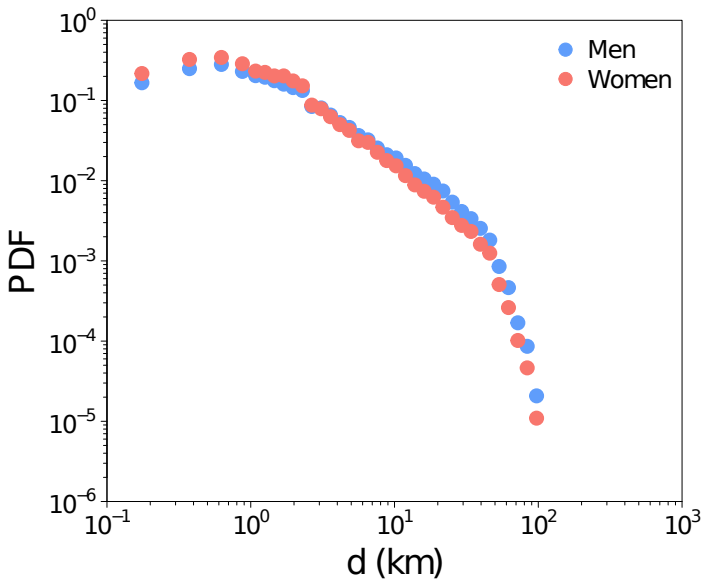
Results



Results



Results

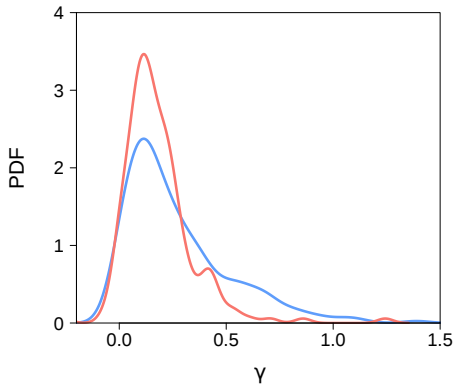


Take home messages

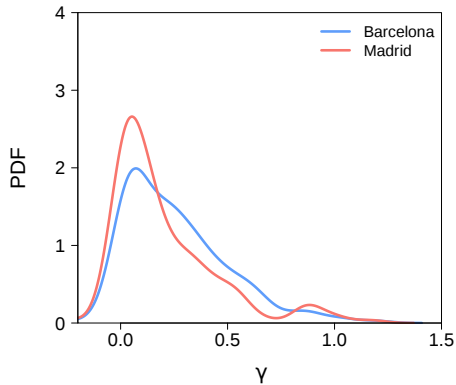
- ▶ Importance of trip destination in the modeling of individual human mobility patterns
- ▶ Test the model against empirical data
- ▶ Analytical solution
- ▶ Test the model with other type of data

Results

Home



Business



Results

