Abstract

Key words:
PACS:

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References

[1] Zheng, Y., Li, Q., Chen, Y., Xie, X., Ma, W.Y., 2008 Understanding mobility based on GPS data. Proceedings of the 10th international conference on Ubiquitous computing. ACM, pp. 312–321.

[2] Jiang, B., Yin, J., Zhao, S., 2009 Characterizing the human mobility pattern in a large street network. *Physical Review E, 80*, 021136.

[3] Belik, V., Geisel, T., Brockmann, D. Natural human mobility patterns and spatial spread of infectious diseases. *Physical Review X* **2011**, *1*, 011001.

[4] Greenwood, M.J. Human migration: Theory, models, and empirical studies. *Journal of regional Science* **1985**, *25*, 521–544.

[5] Brockmann, D., Hufnagel, L., Geisel, T. The scaling laws of human travel. *Nature* **2006**, *439*, 462–465.

[6] Gonzalez, M.C., Hidalgo, C.A., Barabasi, A.L. Understanding individual human mobility patterns. *Nature* **2008**, *453*, 779–782.

[7] Jurdak, R., Zhao, K., Liu, J., AbouJaoude, M., Cameron, M., Newth, D. Understanding Human Mobility from Twitter. *PLoS ONE* **2015**, *10*, e0131469.

[8] Rhee, I., Shin, M., Hong, S., Lee, K., Kim, S.J., Chong, S. On the levy-walk nature of human mobility. *IEEE/ACM transactions on networking (TON)* **2011**, *19*, 630–643.

[9] Sevtsuk, A., Ratti, C. Does urban mobility have a daily routine? Learning from the aggregate data of mobile networks. *Journal of Urban Technology* **2010**, *17*, 41–60.

[10] Kung, K.S., Greco, K., Sobolevsky, S., Ratti, C. Exploring universal patterns in human home-work commuting from mobile phone data. *PloS one* **2014**, *9*, e96180.

[11] Thatcher, J. Living on fumes: Digital footprints, data fumes, and the limitations of spatial big data. *International Journal of Communication* **2014**, *8*, 1765–1783.

[12] Hawelka, B., Sitko, I., Beinat, E., Sobolevsky, S., Kazakopoulos, P., Ratti, C. Geo-located Twitter as proxy for global mobility patterns. *Cartography and Geographic Information Science* **2014**, *41*, 260–271.

[13] Giannotti, F., Pedreschi, D. *Mobility, data mining and privacy: Geographic knowledge discovery*, Springer Science & Business Media, 2008.

[14] Crampton, J.W. Collect it all: national security, Big Data and governance. *GeoJournal* **2014**, pp. 1–13.

[15] Wu, L., Zhi, Y., Sui, Z., Liu, Y. Intra-urban human mobility and activity transition: Evidence from social media check-in data. *PloS one* **2014**, *9*, e97010.

[16] Hasan, S., Zhan, X., Ukkusuri, S.V. Understanding urban human activity and mobility patterns using large-scale location-based data from online social media. Proceedings of the 2nd ACM SIGKDD international workshop on urban computing. ACM, 2013, p. 6.

[17] Cho, E., Myers, S.A., Leskovec, J. Friendship and mobility: user movement in location-based social networks. Proceedings of the 17th ACM SIGKDD international conference on Knowledge discovery and data mining. ACM, 2011, pp. 1082–1090.

[18] Noulas, A., Scellato, S., Lambiotte, R., Pontil, M., Mascolo, C. A tale of many cities: universal patterns in human urban mobility. *PloS one* **2012**, *7*, e37027.

[19] Balcan, D., Colizza, V., Gonçalves, B., Hu, H., Ramasco, J.J., Vespignani, A. Multiscale mobility networks and the spatial spreading of infectious diseases. *Proceedings of the National Academy of Sciences* **2009**, *106*, 21484–21489.

[20] Tamerius, J., Nelson, M.I., Zhou, S.Z., Viboud, C., Miller, M.A., Alonso, W.J. Global influenza seasonality: reconciling patterns across temperate and tropical regions. *Environmental health perspectives* **2011**, *119*, 439.

[21] Tsou, M.H. Research challenges and opportunities in mapping social media and Big Data. *Cartography and Geographic Information Science* **2015**, *42*, 70–74.

[22] Zheng, Y., Xie, X., Ma, W.Y. GeoLife: A Collaborative Social Networking Service among User, Location and Trajectory. **2010**.

[23] Becker, R., Cáceres, R., Hanson, K., Isaacman, S., Loh, J.M., Martonosi, M., Rowland, J., Urbanek, S., Varshavsky, A., Volinsky, C. Human mobility characterization from cellular network data. *Communications of the ACM* **2013**, *56*, 74–82.

[24] Sobolevsky, S., Szell, M., Campari, R., Couronné, T., Smoreda, Z., Ratti, C. Delineating geographical regions with networks of human interactions in an extensive set of countries. *PLoS One* **2013**, *8*, e81707.

[25] Twitter. Twitter streaming API. *available from: https://dev.twitter.com/streaming/overview* **2016**.

[26] Cranshaw, J., Schwartz, R., Hong, J.I., Sadeh, N.M. The Livehoods Project: Utilizing Social Media to Understand the Dynamics of a City. ICWSM, 2012.

[27] Mitchell, L., Frank, M.R., Harris, K.D., Dodds, P.S., Danforth, C.M. The geography of happiness: Connecting twitter sentiment and expression, demographics, and objective characteristics of place **2013**.

[28] Longley, P.A., Adnan, M., Lansley, G., others. The geotemporal demographics of Twitter usage. *Environment and Planning A* **2015**, *47*, 465–484.

[29] Hägerstrand, T., others. Time-geography: focus on the corporeality of man, society, and environment. *The science and praxis of complexity* **1985**, pp. 193–216.

[30] Kwan, M.P., Lee, J. Geovisualization of human activity patterns using 3D GIS: a time-geographic approach. *Spatially integrated social science* **2004**, *27*.

[31] Andrienko, N., Andrienko, G. Designing visual analytics methods for massive collections of movement data. *Cartographica: The International Journal for Geographic Information and Geovisualization* **2007**, *42*, 117–138.

[32] MacEachren, A.M., Kraak, M.J. Research challenges in geovisualization. *Cartography and Geographic Information Science* **2001**, *28*, 3–12.

[33] MacEachren, A.M. *How maps work: representation, visualization, and design*, Guilford Press, 2004.

[34] Andrienko, G., Andrienko, N., Wrobel, S. Visual analytics tools for analysis of movement data. *ACM SIGKDD Explorations Newsletter* **2007**, *9*, 38–46.

[35] Black, A., Mascaro, C., Gallagher, M., Goggins, S.P. Twitter zombie: Architecture for capturing, socially transforming and analyzing the Twittersphere. Proceedings of the 17th ACM international conference on Supporting group work. ACM, 2012, pp. 229–238.

[36] Shvachko, K., Kuang, H., Radia, S., Chansler, R. The hadoop distributed file system. Mass Storage Systems and Technologies (MSST), 2010 IEEE 26th Symposium on. IEEE, 2010, pp. 1–10.

[37] Dean, J., Ghemawat, S. MapReduce: simplified data processing on large clusters. *Communications of the ACM* **2008**, *51*, 107–113.

[38] Gao, H., Tang, J., Liu, H. Exploring Social-Historical Ties on Location-Based Social Networks. ICWSM, 2012.

[39] Buttenfield, B.P., McMaster, R.B. *Map Generalization: Making rules for knowledge representation*, Longman Scientific & Technical New York, 1991.

[40] Samet, H. The quadtree and related hierarchical data structures. *ACM Computing Surveys (CSUR)* **1984**, *16*, 187–260.

[41] Clauset, A., Shalizi, C.R., Newman, M.E. Power-law distributions in empirical data. *SIAM review* **2009**, *51*, 661–703.

[42] Reynolds, A. Truncated Lévy walks are expected beyond the scale of data collection when correlated random walks embody observed movement patterns. *Journal of The Royal Society Interface* **2012**, *9*, 528–534.

[43] Zhao, K., Musolesi, M., Hui, P., Rao, W., Tarkoma, S. Explaining the power-law distribution of human mobility through transportation modality decomposition. *Scientific reports* **2015**, *5*.