

# Curriculum Vitae et Studiorum

## 1 Personal Information

**Luca Pappalardo**

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## 2 Work Experience

**Current position:** PostDoc research fellow at Department of Computer Science, University of Pisa.

**01/01/2014 – 31/08/2014:** researcher at Budapest University of Technology and Economics (BME), Hungary.

**01/01/2014 – 31/08/2014:** researcher at Central European University (CEU), Budapest, Hungary.

**01/01/2014 – 31/08/2014:** researcher at Institute of Information Science and Technologies (ISTI), National Research Council (CNR), Pisa, Italy.

**26/08/2013 – 30/09/2013.** visiting researcher at Departamento de Informática at Pontificia Universidade Católica do Rio de Janeiro (PUC), Brazil.

**20/10/2012 – 02/07/2013.** visiting researcher at Barabasi Lab, Center for Complex Network Research (CCNR), Northeastern University of Boston, MA, USA.

**22/10/2013 – 21/10/2014:** research associate at Institute of Information Science and Technologies (ISTI), National Research Council (CNR), Pisa, Italy.

**01/01/2011 – 12/12/2014:** PhD candidate in Computer Science, Galilei Galilei school organized by University of Pisa.

## 2.1 Participation in Research Project

- **[CIMPLEX 2015-2018]** The project **CIMPLEX: Bringing Citizens, Models and Data together in Participatory, Interactive Social Ex-ploratories**, is a European project with the purpose of developing computational models to predict the diffusion of epidemics and other types of contagion phenomena in complex systems. **My contribution:** study of information diffusion in social networks, developing of mobility models to prevent the disease spreading.
- **[SEEK 2012-2015]** The European project **SEEK - Semantic Enrichment of trajectory Knowledge discovery** is a Marie Curie project financed by the program PEOPLE as IRSES 2011. The consortium includes the following institutions: ISTI-CNR (Italy, coordinator), Università Cà Foscari di Venezia (Italy), University of Piraeus (Greece), University of New Brunswick (Canada), Federal University of Cearà (Brazil), Federal University of Santa Catarina (Brazil), Pontificia Universidade Católica de Rio de Janeiro (Brazil), Federal University of Pernambuco (Brazil). **My contribution:** Analysis of human mobility patterns of social community.
- **[DATASIM 2012-2015]** (FP7-ICT-270833). The project **DATASIM - DATA science for SIMulating the era of electric vehicles** is a European project with the purpose of defining and developing a micro-simulation model for human mobility, exploiting the access to Big Data. **My contribution:** analysis of human mobility patterns in order to deepen the understanding of the laws governing individuals' movements [3, 17, 12], to recognize individuals' activities from their movements [9], and to develop a mathematical model to capture the fundamental characteristics of individual mobility [1].

## 3 Education

**2011-2014: PhD in Computer Science**, University of Pisa. PhD thesis: *"Human Mobility, Social Networks and Economic Development: a Data Science perspective"*, december 2014.

**2007-2010: Master degree in Computer Science**, University of Salerno, 22/08/2010.

**2002-2007: Bachelor degree in Computer Science**, University of Salerno, 19/07/2007.

**1996-2007: Diploma in Piano and Music**, Conservatory of Salerno, July 2007.

**1996-2002: High school degree**, Istituto Tecnico Commerciale Giovanni Amendola, Salerno.

### 3.1 PhD courses and doctoral schools

**2014:** ECCS warm-up: II School on Complex Networks, organized by the European Conference on Complex Systems 2014 (ECCS'14), Lucca, Italy. <https://eccswarmup.wordpress.com/>.

**2014:** International School on Network Science, Balatonfüred, Hungary. <http://www.futurict.szte.hu/hu/summer-school>.

**2012:** Second MODAP-MOVE summer school on Privacy-Aware Social Mining Leysin, Switzerland. <http://mss2012.modap.org/>.

**2011:** Lipari School on Computational Social Science, Lipari, Italy. <http://lipari.cs.unict.it/LipariSchool/ComputationalSocialScience/>.

**2011:** Bertinoro Internatinoal Spring School, Bertinoro (Forlì-Cesena), Italy. <http://www.bici.eu/biss2011/>.

**2011– 2014:** PhD courses organized by the Department of Computer Science of University of Pisa.

## 4 Scientific activity and Research interests

In my research activity I investigated the following topics: i) study of human mobility patterns through the analysis of Big Data on individuals' displacements; ii) analysis of complex networks to study information diffusion and the definition of community detection algorithms; iii) using of Big Data as support to official statistics, with the aim of designing and developing an analytical framework to monitor and possibly predict the socio-economic development of territories; iv) study of the patterns of success in sports through the analysis of data on cyclists' and football players' performance.

**The patterns of Human Mobility.** The increasing availability of Big Data on human movements allows us the understanding of the laws regulating individuals' displacements [19, 20]. In this context, I analyzed a mobile phone dataset and GPS traces from private vehicles to study the patterns of human mobility in three directions: a) analysis of general patterns of car mobility and developing of a data-driven model to predict the urban traffic flow from GPS

data [3, 12, 17, 18]; b) profiling of individuals into returners or explorers according to the differences between their recurrent mobility and overall mobility, definition of a model (the  $d$ -EPR model) to capture the main characteristics of individual movements and the split of the population into returners and explorers [1]; c) developing of an accurate model to recognize the activity performed by individuals on the only basis of the observed movements [9].

**Complex Network Analysis.** In the context of complex network analysis, I investigated four main research topics: a) My research activity on multiplex networks led to the definition of a measure which uses the relevance of each network dimension and the network proximity of two individuals to define the strength of their social contacts [13]; b) Definition of an algorithm for community detection in dynamic social networks, which follows the evolution in time of the network and updates the communities every time a new edge appears in the network [4]; c) Analysis of the patterns of diffusion of musical tastes in the LastFM online social network, finding that musical tastes can diffuse in different ways according to the music genre; d) Developing of a classification model to predict the future engagement of Skype users from their network and community features [7].

**Big Data and Social Mining for Official Statistics.** Recently I studied how Big Data and Social Mining techniques can support official statistics. I designed and developed an analytical framework that, starting from nation-wide mobile phone data, extracts for each individual a set of indicators describing his mobility and sociality during a period of observation [5]. During the process, the individual indicators are aggregated at municipality level and combined with data from official statistics (poverty indices, per capita income, unemployment rate) in order to construct predictive models of socio-economic development. I performed a large-scale experiment on 20 million French users observed for one month (around 200 million calls), finding strong correlations between mobility measures and social measures proposed in the analytical framework and the external socio-economic indicators [5].

**Sports Analytics.** Sports analytics has evolved in recent years in an amazing way, thanks to the sensing technologies that provide high-fidelity data streams extracted from every game. In this context I studied the behavior of a football team as a complex system, extracting network-based performance measures from every team in several games of national and international leagues. I found that these measures strongly correlate with the success of a team, allowing the prediction of football games on the only basis of the observation of the behavior on the pitch [6, 8]. I investigated the pattern of success in sports in other contexts as well like cycling. Here, I analyzed the workouts of about 30,000 amateur cyclists [10], discovering that the best cyclists follow precise workout patterns.

## 4.1 Languages

- Italian, mother tongue
- English, fluent
- Spanish, fluent

## 5 Grants and Awards

**ISTI Young Researcher Award 2014:** award to the best young researcher at the Institute of Information Science and Technologies (ISTI) of National Research Council (CNR), 2014.

**Grant for Young Mobility 2013:** grant by the Institute of Information Science and Technologies (ISTI) of National Research Council (CNR) to foster young researchers to collaborate with other International institutions, 2013.

**Grant “Produrre statistica ufficiale con i Big Data”:** award to the most innovative ideas in using Big Data sources to study complex economic phenomena, awarded by Google and the Italian National Statistics Bureau (ISTAT), 2014.

**Student scholarship** for attending the Second MODAP-MOVE summer school on Privacy-Aware Social Mining Leysin, Switzerland, 01/07/2012 – 06/07/2012.

**PhD grant** financed by the National Research Council (CNR) for the period 01/01/2011 – 31/12/2013.

**Erasmus grant, Università di Salerno:** grant for Erasmus project at Universidad Rey Juan Carlos de Madrid, September 2008 – February 2009.

## 6 Other skills

- **Programming Languages:** Python, R, Java (Multithreading, RMI, JavaDoc), C, C++, Pascal,
- **Database:** SQL, MongoDB, Hadoop File System
- **Web:** Php, HTML, Asp, Javascript, CSS, Web Services
- **Data Mining and Network Analysis tools:** Weka, KNIME, Clementine, Orange, Gephi, Cytoscape
- **Editors and IDEs:** PyCharm, Eclipse, Jcreator, Emacs, TextMate, NetBeans, PyCharm
- **Operating Systems:** Mac OS X, Windows, Linux

## 7 Publications

### 7.1 Journals

- [1] L. Pappalardo, F. Simini, S. Rinzivillo, D. Pedreschi, F. Giannotti, A.-L. Barabási, Returners and Explorers Dichotomy in Human Mobility, *Nature Communications* 6:8166, doi:10.1038/ncomms9166, 2015
- [2] S. Marchetti, C. Giusti, M. Pratesi, N. Salvati, F. Giannotti, D. Pedreschi, S. Rinzivillo, L. Pappalardo, L. Gabrielli, Small Area Model-Based Estimators Using Big Data Sources, *Journal of Official Statistics (JOS)*, vol. 31(2), pp. 263-281, June 2015.
- [3] L. Pappalardo, S. Rinzivillo, Z. Qu, D. Pedreschi, F. Giannotti, Understanding the patterns of car travel, *The European Physical Journal (EPJ) Special Topics*, vol. 215 (1), pp. 61-73, Springer, 2013.

#### 7.1.1 Under Revision

- [4] G. Rossetti, L. Pappalardo, D. Pedreschi, F. Giannotti, Fluid community detection in social interactions networks, *sottomesso a Machine Learning Journal (MLJ)*, special issue on Dynamic Networks & Knowledge Discovery.

### 7.2 Conferences and Workshops

- [5] L. Pappalardo, Z. Smoreda, D. Pedreschi, F. Giannotti, Using Big Data to study the link between Human Mobility and Socio-Economic development, 2015 IEEE International Conference on Big Data (BigData2015), Santa Clara, CA, USA, 2015.
- [6] P. Cintia, L. Pappalardo, D. Pedreschi, F. Giannotti, M. Malvaldi, The harsh rule of the goals: Data analytics and football team success, 2015 IEEE International Conference on Data Science and Advanced Analytics (DSAA 2015), Paris.
- [7] G. Rossetti, L. Pappalardo, R. Kikas, D. Pedreschi, F. Giannotti, M. Dumas, Community-centric analysis of user engagement in Skype social network, In Proceedings of the 2015 IEEE/ACM International Conference on Advances in Social Network Analysis and Mining (ASONAM'15), Paris.
- [8] P. Cintia, S. Rinzivillo and L. Pappalardo A network-based approach to evaluate the performance of football teams, *Machine Learning and Data Mining for Sports Analytics – ECML/PKDD 2015 workshop*.

- [9] S. Rinzivillo, L. Gabrielli, M. Nanni, L. Pappalardo, D. Pedreschi, F. Giannotti, The Purpose of Motion: Learning Activities from Individual Mobility Networks, In Proceedings of the 2014 International Conference on Data Science and Advanced Analytics (DSAA'2014), Shanghai.
- [10] P. Cintia, L. Pappalardo, D. Pedreschi, "Engine matters": a first large scale data driven study on cyclists' performance. DMCS 2013 - Workshop on Data Mining Case Studies and Practice Prize (Dallas, US, 7 December 2013).
- [11] D. Pennacchioli, G. Rossetti, L. Pappalardo, D. Pedreschi, F. Giannotti, M. Coscia, The Three Dimensions of Social Prominence, 5th International Conference on Social Informatics (SocInfo), 2013.
- [12] L. Pappalardo, F. Simini, S. Rinzivillo, D. Pedreschi, F. Giannotti, Comparing general mobility and mobility by car, BRICS Countries Congress (BRICS-CCI) and 11th Brazilian Congress (CBIC) on Computational Intelligence, 2013.
- [13] L. Pappalardo, G. Rossetti, D. Pedreschi, How well do we know each other?: Detecting tie strength in multidimensional social networks, In Proceedings of the IEEE/ACM International Conference on Advance in Social Network Analysis and Mining (ASONAM'12) Workshops 2012, pp. 1040-1045, 2012.
- [14] P. Cintia, L. Pappalardo, D. Pedreschi, Mining efficient training patterns of non-professional cyclists, 22th Italian Symposium on Advanced Database Systems (SEBD), 2014.
- [15] D. Pennacchioli, G. Rossetti, L. Pappalardo, D. Pedreschi, F. Giannotti, M. Coscia, The patterns of musical influence on the Last.Fm social network, 22th Italian Symposium on Advanced Database Systems (SEBD), 2014.
- [16] L. Pappalardo, G. Rossetti, D. Pedreschi, Measuring tie strength in multidimensional social networks, 21th Italian Symposium on Advanced Database Systems (SEBD), 2013.
- [17] L. Pappalardo, S. Rinzivillo, D. Pedreschi, F. Giannotti, Validating general human mobility patterns on GPS data, 21th Italian Symposium on Advanced Database Systems (SEBD), 2013.

### 7.3 Book Chapters

- [18] C. Kopp, B. Kochan, M. May, L. Pappalardo, S. Rinzivillo, D. Schulz, F. Simini, Evaluation of Spatio-temporal Microsimulation Systems, in Data Science and Simulation in Transportation Research, Chapter

8, pp. 141-166, Davy Janssens, Ansar-Ul-Haque Yasar, Luk Knapen (eds.), Hershey, USA: IGI global, 2014.

- [19] F. Giannotti, L. Pappalardo, D. Pedreschi, D. Wang, A complexity science perspective on human mobility, in *Mobility Data – Modeling, Management, and Understanding*, Chapter 15, pp. 297-313. Chiara Renso, Stefano Spaccapietra, Esteban Zimanyi (eds.), New York, USA: Cambridge University Press, 2013.
- [20] L. Spinsanti, M. Berlingerio, L. Pappalardo, Mobility and geosocial networks, in *Mobility Data – Modeling, Management, and Understanding*, Chapter 16, pp. 315-333. Chiara Renso, Stefano Spaccapietra, Esteban Zimanyi (eds.), New York, USA: Cambridge University Press, 2013.

#### **7.4 Posters**

- [21] L. Pappalardo, F. Simini, S. Rinzivillo, D. Pedreschi, F. Giannotti, The origin of human heterogeneity: analyzing mobility behavior through GSM and GPS data, The 2013 European Conference on Complex Systems (ECCS), Barcellona, Spain. Abstract, article n.14.
- [22] L. Pappalardo, S. Rinzivillo, Z. Qu, D. Pedreschi, F. Giannotti, Understanding the patterns of car travel, In *SML 2012*, Bad Neuenhar (Poster-LP SML 2012 (69)).

#### **7.5 Technical Reports**

- [23] F. Giannotti, G. Andrienko, N. Andrienko, B. Furletti, J. Kertesz, F. Liu, M. Nanni, L. Pappalardo, N. Pelekis, C. Renso, S. Rinzivillo, *DATA SIM - Semantic-enriched data-driven theory of mobility demand and final framework for integration. DATA science for SIMulating the era of electric vehicles (DATASIM)*, Deliverable D2.2, 2011.

#### **7.6 PhD thesis**

- [24] Luca Pappalardo, *Human Mobility, Social Networks and Economic Development: a Data Science perspective*. Tesi di dottorato, Dipartimento di Informatica, Università di Pisa, 2014.

#### **7.7 Master thesis**

- [25] Luca Pappalardo, *Score Wiiiewer: un visualizzatore di partiture musicali diretto da Nintendo Wiimote*. Tesi di Laurea Specialistica in Informatica, Università di Salerno, Salerno, Luglio 2010.