Livro de Resumos da Conferência do Projeto de Investigação Científica "Fatores de Transformação Urbana (DRIVIT-UP)"

em conjunto com

I Conferência sobre Ciência de Dados para Ciências Sociais

e

VI Conferência de Planeamento Regional e Urbano

Abstract book from the Conference of the Scientific Research Project "Drivers of urban transformation (DRIVIT-UP)"

a joitly event with

I Conference on Data Science for the Social Sciences

And

VI Conference on Regional and Urban Planning

universidade de aveiro
theoria poiesis praxis

November 25th-26th

Conferência do Projeto de Investigação Científica "Fatores de Transformação Urbana (DRIVIT-UP)"

I Conferência sobre Ciência de Dados para Ciências Sociais

VI Conferência de Planeamento Regional e Urbano

November 25th-26th

Universidade de Aveiro

Conference of the Scientific Research Project "Drivers of urban transformation (DRIVIT-UP)"

I Conference on Data Science for the Social Sciences

VI Conference on Regional and Urban Planning

A organização da conferência "Planeamento no contexto das rápidas transformações" enquadra-se no âmbito do projeto DRIVIT-UP (PTDC/GES-URB/31905/2017 - POCI-01-0145-FEDER-031905). O projeto DRIVIT-UP é financiado pela Fundação para a Ciência e Tecnologia com o recurso a fundos do programa Compete2020 do programa Portugal2020, por sua vez apoiados pelo FEDER – Fundo Europeu de Desenvolvimento Regional

DRIVIT UP
(PTDC/GES-URB/31905/2017
POCI-01-0145-FEDER-031905)

FCT Fundação para a Ciência e a Tecnologia

Cofinanciado por:
COMPETE 2020
PORTUGAL 2020
UNIÃO EUROPEIA
Fundo Europeu de Desenvolvimento Regional

Apoios institucionais:

universidade de aveiro
Grupo de Estudos em Território e Investigação
Unidade de Investigação em Governança, Competitividade e Políticas Públicas
Departamento de Ciências Sociais, Políticas e Território

Título | Title

Livro de Resumos da Conferência do Projeto de Investigação Científica “Fatores de Transformação Urbana (DRIVIT-UP)” em conjunto com I Conferência sobre Ciência de Dados para Ciências Sociais e VI Conferência de Planeamento Regional e Urbano

Coordenadores | Editors

Comissão Executiva da Conferência

João Lourenço Marques
Fernando Nogueira
Mara Madaleno
Maria Cristina Gomes
Mafalda Pateo Sousa
Paulo Batista
Paulo Silva
Sara Moreno Pires

Edição | Publisher

UA Editora, Universidade de Aveiro, Serviços de Biblioteca, Informação Documental e Museologia

1ª edição/ 1st edition – janeiro 2022/ january 2022

ISBN

978-972-789-727-8

DOI

https://doi.org/10.48528/pkzd-wz70

Financiamento | Funding Information

A Conferência e este e-book são desenvolvidos no âmbito do projeto DRIVIT-UP (PTDC/GES-URB/31905/2017 – POCI-01-0145-FEDER-031905). O projeto DRIVIT-UP é financiado pela Fundação para a Ciência e Tecnologia com o recurso a fundos do programa Compete2020 do programa Portugal 2020, por sua vez apoiados pelo FEDER – Fundo Europeu de Desenvolvimento Regional.

DRIVIT UP (PTDC/GES-URB/31905/2017 POCI-01-0145-FEDER-031905)

FCT Fundação para a Ciência e a Tecnologia

Cofinanciado por: COMPETE 2020 PORTUGAL 2020 UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional

Apoios institucionais:

universidade de aveiro

Grupo de Estudos em Território e Investigação
Unidade de Investigação em Governança, Competitividade e Políticas Públicas
Departamento de Ciências Sociais, Políticas e Território

Índice/ Summary

15h10 – 15h30: Nuno Tiago Falcão Alpalhão

Prediction and Simulation of traffic accidents risk usig neural networks and gradient boosting with an hybrid classification/ regression modelling approach in urban context

Nuno Alpalhão[1], Bruno Jardim[1], Pedro Sarmento[1], Flávio Pinheiro[1], João Tremoceiro[2], Miguel de Castro Neto[1]

[1] NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, Campus de Campolide, 1070-312 Lisboa, Portugal
[2] Centro de Gestão de Inteligência Urbana de Lisboa (CGIUL), Câmara Municipal de Lisboa, Edifício Municipal do Campo Grande, nº25 - 2º E, 1749-099 Lisboa, Portugal
nalpalhao@novaims.unl.pt, bjardim@novaims.unl.pt, psarmento@novaims.unl.pt, fpinheiro@novaims.unl.pt, joao.tremoceiro@cm-lisboa.pt, mneto@novaims.unl.pt

Resumo/ Abstract:

Traffic accidents are the cause of considerable losses both in property and in human lives, as they can result in economic problems to the people involved and to society, in injury, incapacity and even death. To reduce and minimize these disastrous effects, it is important that emergency services have the ability to plan and define strategies to reduce the time taken to provide a first aid response to affected individuals. In this sense, traffic accident risk prediction can play a crucial role in the definition of these strategies, as it allows to both understand the factors that influence the occurrence of traffic accidents and, to anticipate in space and time in which location it is more likely that traffic accident occur. Several studies have been developed in regard to traffic accident prediction, such as Poisson's and binomial negative algorithms (Fancello, Soddu, & Fadda, 2018), ARIMA models (Ihueze & Onwurah, 2018), machine learning techniques like regression models (Chang & Chen, 2005), K-Nearest Neighbour (KNN), Bayesian networks (Hossain & Muromachi, 2012) and decision trees (Lin, Wang, & Sadek, 2015). Moreover, some deep learning approaches (Chen, Song, Yamada, & Shibasaki, 2016; Ren, Song, Wang, Hu, & Lei, 2018) have been developed to estimate the risk of traffic accidents, but in coarser regular spatial grids, failing to provide the necessary spatial detail needed for emergency operations. Besides this aspect, most of the studies regarding prediction of traffic accidents are made in a non-urban context and not enough attention has been provided to the prediction of traffic accident risk in urban environments (Yu et al., 2021). In this paper we have developed and tested two traffic accident probability prediction models based on neural networks architectures and a gradient boosting framework that uses tree-based learning algorithms. For this purpose, we used information regarding traffic accidents occurrences, that required firefighters' intervention, in the city of Lisbon

from 2013 to 2020. Traffic accidents occurrences were aggregated at the road level by period of day, along with road characteristics data, available on Lisbon Open Data Portal, and weather information. Naturally, there are far more periods without accidents than with, to deal with this unbalanced data, the modelling strategy was divided in two main steps, in which the first one consisted in a classification to identify periods where the probability of having traffic accidents was different than zero. From the resulting sample of the first step, a regression was used to compute the probability of traffic accidents by period of day at street level. The tested models provided good estimates for both the neural network and tree-based learning algorithms. From the results, a traffic accident risk simulator was developed, allowing the re-assessment of the risk of traffic accidents, if street characteristics and weather conditions are changed for a specific street and period of day. This simulator provides to the emergency services, an essential tool for planning and management of emergency operations.

Palavras-chave/ Keywords: Traffic accidents, Urban Planning, Neural Networks, Gradient Boosting Framework, Simulation

Agradecimentos/ Acknowledgements:

This work was supported by the Connecting Europe Facility (CEF) – Telecommunications sector in the framework of project Urban Co-Creation Data Lab [INEA/CEF/ICT/A2018/1837945].

Notas sobre o(s) autor(es)/ Author(s) notes:

Nuno Falcão Alpalhão is a Data Scientist and Researcher at NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa. He is an Invited Assistant Professor in Data Science at NOVA IMS, lecturing the Data Visualization and Big Data Management and Modelling in the MSc Program in Data Science and Advanced Analytics. Has a BSc in Mathematics and a MSc Program in Data Science and Advanced Analytics both from Nova University.

Bruno Jardim is an Assistant Professor in Business Intelligence and Text Mining at Nova Information Management School, collaborated with a start-up as an NLP research Data Scientist, he has lectured BI courses for organizations and public entities such has the Nova School of Business and Economics and the Lisbon Urban Management and Intelligence Center. Bruno holds a degree in Information Management by Nova IMS and is currently finishing his MSc Program in Information Management.

Pedro Sarmento is a researcher at NOVA Cidade – Urban Analytics Lab and he holds a PhD in Information Management – Geographic Information Systems

(GIS) by NOVA Information Management School. Currently he analyzes spatial data and manage projects, developing research and technical work that explore the potential of data science and GIS to promote social, economic, and environmental well-being at city, regional and national level.

Flávio L. Pinheiro is an Invited Lecturer in Data Science at NOVA IMS. His research interests focus in understanding how the network structure of socio-economic systems impacts the strategic decisions of agents at different scales. Flavio was a Postdoctoral Researcher at the MIT Media Lab, he holds a BSc and MSc from the University of Lisbon (Lisboa, Portugal) and a PhD from the University of Minho (Braga, Portugal).

João Tremoceiro have a graduation in Biophysics Engineering and a post-graduation in Territorial Planning and Resources Management by Técnico. He was responsible by several services in Lisbon municipality, and nowadays is Chief Data Officer and Director of the Management and Urban Intelligence Centre of Lisbon.

Miguel de Castro Neto is Associate Dean at NOVA Information Management School (NOVA IMS) where he is Associate Professor. Created and leads the NOVA Cidade – Urban Analytics Lab and directs the Master in Information Management and the Post-Graduation programs in Smart Cities and Business Analytics for Hospitality and Tourism. He was Secretary of State of Spatial Planning and Nature Conservation in the XIX and XX Portuguese Government and Smart Cities Personality of the Year (Green Business Week 2017 / Fundação AIP).

References

Chang, L. Y., & Chen, W. C. (2005). Data mining of tree-based models to analyze freeway accident frequency. *Journal of Safety Research*, *36*(4), 365–375. https://doi.org/10.1016/J.JSR.2005.06.013

Chen, Q., Song, X., Yamada, H., & Shibasaki, R. (2016). Learning deep representation from big and heterogeneous data for traffic accident inference. *30th AAAI Conference on Artificial Intelligence, AAAI 2016*, 338–344.

Fancello, G., Soddu, S., & Fadda, P. (2018). An accident prediction model for urban road networks. *Journal of Transportation Safety and Security*, *10*(4), 387–405. https://doi.org/10.1080/19439962.2016.1268659

Hossain, M., & Muromachi, Y. (2012). A Bayesian network based framework for real-time crash prediction on the basic freeway segments of urban expressways. *Accident Analysis & Prevention*, *45*, 373–381. https://doi.org/10.1016/J.AAP.2011.08.004

Ihueze, C. C., & Onwurah, U. O. (2018). Road traffic accidents prediction modelling: An analysis of Anambra State, Nigeria. *Accident Analysis and Prevention*, *112*, 21–29. https://doi.org/10.1016/j.aap.2017.12.016

Lin, L., Wang, Q., & Sadek, A. W. (2015). A novel variable selection method based on frequent pattern tree for real-time traffic accident risk prediction. *Transportation Research Part C: Emerging Technologies*, *55*, 444–459. https://doi.org/10.1016/J.TRC.2015.03.015

Ren, H., Song, Y., Wang, J., Hu, Y., & Lei, J. (2018). A Deep Learning Approach to the Citywide Traffic Accident Risk Prediction. *IEEE Conference on Intelligent Transportation Systems, Proceedings, ITSC*, *2018-Novem*(October), 3346–3351. https://doi.org/10.1109/ITSC.2018.8569437

Yu, L., Du, B., Hu, X., Sun, L., Han, L., & Lv, W. (2021). Deep spatio-temporal graph convolutional network for traffic accident prediction. *Neurocomputing*, *423*, 135–147. https://doi.org/10.1016/J.NEUCOM.2020.09.043 5