




# Miguel Nobre da Costa

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Portuguese 

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Currently a PhD candidate at Instituto Superior Técnico, Lisbon, Portugal focusing on understanding both objective and subjective urban cycling safety. By applying data science, computer vision and machine learning to such an important area, I hope to create a platform for better understanding and predicting how cyclists interact with their surroundings. With a completed MSc in Electrical and Computer Engineering at Instituto Superior Técnico, he then worked as a research fellow at the Institute for Systems and Robotics (ISR-IST) before starting his doctoral path.

Research Interests: Intelligent Transportation Systems, Urban Cycling, Cycling Safety, Perception of risk, Computer vision, Image processing, Machine learning, Smart mobility, Urban mobility, Sustainable transportation.

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## EDUCATION

### DTU Guest PhD Student

Technical University of Denmark  
Copenhagen, Denmark

May 2022 – ONGOING

Spending 6 months working in DTU with Prof. Carlos Lima Azevedo (Machine Learning for Smart Mobility) and Prof. Felix Wilhelm Siebert (Transport Psychology) to further develop my ongoing PhD research and applicability to other contexts.

### EIT Urban Mobility Doctoral Training Network

JUNE 2020 – ONGOING

The European Institute of Innovation and Technology Doctoral Training Network (EIT-DTN) seeks to connect PhD candidates with innovation and entrepreneurship in education, research and business. Using this unique opportunity as a platform for exchanging inputs and outputs of my research in urban mobility with other practitioners, senior researchers and other PhD candidates.

### MIT Portugal Transportation System Doctoral Program

Instituto Superior Técnico  
Lisbon, Portugal

OCTOBER 2018 – ONGOING

Research focusing on developing a framework capable of automatically and continuously understand objective and subjective urban cycling safety using inertial, mapping and imagery data. Work supervised by Professor Filipe Moura and Doctor Manuel Marques.

### Integrated master's in Electrical and Computer Eng.

Instituto Superior Técnico  
Lisbon, Portugal

SEPTEMBER 2011 – MAY 2017

Master's Thesis on: "Video-Based Risk Assessment for Cyclists" supervised by Doctor Manuel Marques and Professor João Paulo Costeira. From videos recorded from a developed Android App, optical flow was computed to discover the Focus of Expansion. This point was used to divide the image into risk levels. Risk situations were classified to then assess other risk events using two metrics. See more under Projects: Smartbike.

### Erasmus+ Exchange Program

Università di Bologna  
Bologna, Italy

SEPTEMBER 2015 – FEBRUARY 2016

Spent six months living and studying in Bologna, Italy. Living within a new culture and getting to know about other cultures, allowed me to grow immensely as a person. During this time, I understood better how innovation and entrepreneurship work and developed a computer vision project using augmented reality. This topic was something I pursued after returning to my home university.

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## PROFESSIONAL EXPERIENCE

### Research Assistant

Institute for Systems and Robotics  
Lisbon, Portugal

JULY 2017 – SEPTEMBER 2018

Research Assistant at Signal and Image Processing Group (SIPg) in ISR/IST. Worked on different research projects (see below Smartbike, and WalkBot), and an audit project for a Portuguese transportation national authority.

## Summer Intern

JUNE 2015 – JULY 2015

Spent 1 and a half months developing drivers that enabled communication between different devices and the do-motics company Control4 main controlling hub. Work included the integration of the set top box for MEO and Vodafone (two major Portuguese telecommunication companies) and the internet connected device bt.tn.

Life Emotions

Lisbon, Portugal

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## TEACHING EXPERIENCE

### Teaching Assistant

Instituto Superior Técnico

Lisbon, Portugal

**2021–2022 Transport Demand Modelling** - (Discrete Choice Models Module) Responsible: Prof. Filipe Moura.

**2020–2021 Transport Demand Modelling** - (Discrete Choice Models Module) Responsible: Prof. Filipe Moura.

**2019–2020 Transport Demand Modelling** - (Discrete Choice Models Module) Responsible: Prof. Filipe Moura.

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## PUBLICATIONS


1. **Costa, M.**, Marques, M., Roque, C., Moura, F. (2022). CYCLANDS: Cycling geo-located accidents, their details and severities. *Scientific Data*, 9(1), 1-9.
2. **Costa, M.**, Félix, R., Marques, M., Moura, F. (2022). Impact of COVID-19 lockdown on the behavior change of cyclists in Lisbon, using multinomial logit regression analysis. *Transportation Research Interdisciplinary Perspectives*, 100609.
3. **Costa, M.**, Marques, M., Moura, F. (2021). A Circuitry Temporal Analysis of Urban Street Networks Using Open Data: A Lisbon Case Study. *ISPRS International Journal of Geo-Information*, 10(7), 453.
4. **Costa, M.**, Cambra, P., Moura, F., Marques, M. (2019, October). WalkBot: A Portable System to Scan Sidewalks. In 2019 IEEE International Smart Cities Conference (ISC2) (pp. 167-172). IEEE.
5. Cambra, P., **Costa, M.**, Marques, M. and Moura, F., “WalkBot – Desenvolvimento de um Equipamento de Avaliação da Qualidade da Infra-estrutura Pedonal com Recurso a Processamento de Imagem Tridimensional,” in Congresso Rodoviário Português, Lisbon, Portugal, May 2019
6. **Costa, M.**, Ferreira, B. Q., Marques, M. (2017, October). A context aware and video-based risk descriptor for cyclists. In 2017 IEEE 20th International Conference on Intelligent Transportation Systems (ITSC) (pp. 1-6). IEEE.
7. **Costa, M.**, “Video-Based Risk Assessment for Cyclists,” M.S. thesis, Dept. Elect. And Comp. Eng., UTL, IST, Lisbon, 2017

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## SELECTED PROJECTS

### Smartbike

MARCH 2016 - September 2018

[users.isr.ist.utl.pt/~manuel/smartbike/](https://users.isr.ist.utl.pt/~manuel/smartbike/) 

Development of different metrics to assess the risk perception of a cyclist when riding a bike in an urban scenario. In this domain, the trajectory of the cyclist is considered, as well as other stationary or moving objects in its vicinity, its change in speed, acceleration and its geographic positioning (given by the smartphone) and the effort/stress of the rider, by analyzing their heart rate variability in an ECG.


**Android Application Development:** Development of an Android Application to record several different signals available in the smartphone: Video, Audio, GPS, Acceleration, Angular Velocity and others. The captured data can then be uploaded to a server where the data is stored by user.

**Backend Data Platform:** Creation of a backend platform that stores all the captured data from the smartphone in a user-based system. This way, some user characteristics are stored (e.g. age, gender, experience on riding a bike), as well as the uploaded timestamped data.

**Video Processing:** Using the captured and stored data, the video signal is processed to geographically and semantically classify different risk level situations for the cyclist. This processing is performed automatically when a new video is uploaded to the server.

### WalkBot

MAY 2017 - December 2018


[users.isr.ist.utl.pt/~manuel/walkbot/](https://users.isr.ist.utl.pt/~manuel/walkbot/) 

Development of a device capable of automatically digitalize and map a network of sidewalks in a city. This mapping will allow for the further development of support applications with the objective of guiding pedestrians in cities with various mobility needs. This project was funded by Thales TecInnov 1st Edition.

**Stereo Vision Processing:** Processing a 3D point cloud captured using a stereo vision camera. By recognizing objects, we aim to discover the walkable distance on the sidewalk, the slope of the sidewalk and the size of the sidewalk itself.

## BikeRider

MARCH 2018 – OCTOBER 2018

[ushift.tecnico.ulisboa.pt/bikerider/](http://ushift.tecnico.ulisboa.pt/bikerider/) 

Project to develop a sensorial map of a cyclable network supported on data captured by cyclists. To create this map we perform activity recognition. This project was funded by Thales TecInnov 2nd Edition.

**Activity Recognition:** Automatic bike maneuvers classification using Deep Learning. A Convolutional Neural Network was used to classify different cycling maneuvers (normal riding, braking, smooth/abrupt turning left/right) based on accelerometer and gyroscope signals captured by a smartphone.

## Passengers Tracking and Counting

MARCH 2017 – OCTOBER 2018

Contact Prof. João Paulo Costeira (jpc@isr.ist.utl.pt)

Development of a system capable of tracking and counting passengers entering or exiting a vehicle for an audit of a public transportation company for a Portuguese transportation national authority.

**Data Acquisition System & Backend System:** 3D video acquisition system using 3D cameras and small computer boards. Video was processed in real-time to automatically detect when the vehicle door was opened. Data from 10 RGBD cameras was stored inside the vehicle.

## StepHome

MAY 2018 - December 2018

Site to be published.

Development of a system capable of guiding people suffering from some sort of neurodegenerative disease to a place they know (a reference point which can be their home, a coffee place they know, a doctor) or to a relative. This project was funded by Thales TecInnov 4th Edition.

**Minimum Viable Product: App & Backend:** I helped design the minimum valuable product which consisted on a smartphone application and the backend to respond to the application requests.

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## SCIENTIFIC PRESENTATIONS

### Grupo de Estudos de Transportes

4 March 2022

Palácio da Bolsa, Porto, Portugal

**Presentation:** *Objective and Subjective Risk Mapping for Urban Cyclists*

### EIT Doctoral Training Network Annual Forum

27-29 September 2021

Munich Urban Colab, Munich, Germany

**Presentation:** *Objective and Subjective Risk Mapping for Urban Cyclists*

### Transportation Research Board Annual Meeting

21-29 January 2021

Online due to COVID-19 (Washington DC, USA)

**Poster:** *Impact of COVID-19 lockdown on the Behavior Change of Cyclists in Lisbon, using multinomial logit regression analysis*

### EIT DTN Annual Forum

15-17 September 2020

Online due to COVID-19 (Munich, Germany)

**Presentation:** *Objective and Subjective Risk Mapping for Urban Cyclists*

### Velo-City 2019 'Cycling for the Ages'

25-28 June 2019

Convention Centre Dublin, Dublin, Ireland

**Presentation:** *Bike Rider - Sensorial Mapping of Cyclable Paths*

### Signal and Image Processing Group

4 February 2019

ISR, Instituto Superior Técnico, Lisbon, Portugal

**Presentation:** *Transport Demand Modelling: A Summary*

### LARSyS 2018 Annual Meeting

14-15 June 2018

Pavilhão do Conhecimento, Lisbon, Portugal

**Poster:** *WalkBot: A Portable System to Scan Sidewalks*

**Poster:** *Smartbike: Cyclists' Perception of Risk*

## Ciência 2017 – Meeting with Science and Technology

3-5 July 2017

Lisbon Congress Center, Lisbon, Portugal

**Poster:** *A Context Aware and Video-Based Risk Descriptor for Cyclists*

## Ciência 2016 – Meeting with Science and Technology

4-6 July 2016

Lisbon Congress Center, Lisbon, Portugal

**Poster:** *Mobility in Cities: Assessing Experiences Using a Smartphone*

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## SERVICES

### Reviewing for scientific journals

IEEE Transactions on Intelligent Transportation Systems (2019)

### Reviewing for scientific conferences

Transportation Research Board Annual Meeting (2021, 2022)

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## TECHNICAL COMPETENCES

### Programming

Python

Developed my master thesis using Python, in conjunction of other tools, such as OpenCV, CVXOPT. Since then (2017) it has been my programming language of preference.

### Languages

Matlab

Developed several mathematics and control systems scripts using Matlab.

C++

Developed 1 project in image processing and computer vision solving a Sudoku and giving the result in augmented reality; WalkBot.

C

Developed a few projects in C language, such as client-server communication, client-client chat, Kakuro game solver.

Java

Developed 2 projects in Java about Dynamic Bayesian Networks and a secure, encrypted peer-to-peer chat.

Dart

Developing a mobile app using Flutter for usage in education via gamification of class contents.

### Web Development

HTML, JavaScript, CSS, PHP

Responsible for building a few projects websites, such as the one for Smartbike (see Projects). Also used when create the backend platform for both Smartbike.

### Statistical Software

IBM SPSS

Used SPSS to create different types of models, such as Multivariate Linear Regressions, Generalized Linear Models and Data Panel Models.

NLOGIT

Used NLOGIT to create a Multinomial Logistic Model and a Nested Multinomial Logistic Model for predicting the choice of type of car a person would buy depending on different attributes.

### General Software

LaTeX

Microsoft Word

Microsoft PowerPoint

Microsoft Excel

Microsoft Project

Microsoft Visio

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## LANGUAGE SKILLS

### Portuguese

Native

### English

Fluent

First Certificate in English (FCE), Certificate of Advanced English (CAE), International English Language Testing System (IELTS).

### Italian

Intermediate

Lived in Italy for 8 months.

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## SUMMER AND WINTER SCHOOLS ATTENDED

1. 2015 CERN Spring Campus (01/04/2015 - 04/04/2015)
2. Summer residential programme at Churchill House School of English Language (18/07/2010-01/08/2011)

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## VOLUNTEERING EXPERIENCE

TreeTree2 Academia de Verão	Article Review Monitor	I accompanied 3 students with ages 15-17 reviewing a scientific article. During the time I explained what makes a good article and how these are created, how experiments are conducted and how to communicate results.
Web Summit	Response Team	I was involved in the response team, which was responsible for a multiplicity of tasks. I was directly involved in the registration process and in providing information or help to attendees.
Banco Alimentar Contra a Fome	Food Collection Volunteer	I was in a team responsible for collecting food in a supermarket in Lisbon.