Nuno FERREIRA DUARTE

Contact Information

nferreiraduarte@isr.tecnico.ulisboa.pt
Personal Website
Google Scholar profile
GitHub account

Research Interests

Integrating in robots human action/intention capabilities: Human-inspired Systems, Physical Human-Robot Interaction; Studying human physiological signals, eye-gaze and arm-motion (non-verbal cues), and its connections to neurological and psychological processes to develop robot models that comprehend human actions.
Learning how to grasp everyday objects: Careful vs Not Careful Motions, Reinforcement Learning, Shape Completion Models; Studying robotic grasping strategies to tackle different challenges: how to transport or detect fragile/careful objects, how to handle artifacts or fragments, or the correct shape of objects given only the partial visual from the robot's perspective.

Current Academic Appointments

Doctoral Researcher, IST-ID

Research and Development **September 2023 to present**
Instituto de Sistemas e Robótica

- Portuguese Recovery and Resilience Plan PRR - 02/C05-i01.02/2022 Center for Responsible AI (CRAI): The aim of CRAI is to find solutions in the area of "responsible artificial intelligence" by establishing a strategy based on three fundamental pillars - explainability, transparency and sustainability, thus aiming to respond to the risks of current machine learning technologies, such as, the bias and lack of transparency of the generated models.

Education

Instituto Superior Técnico (IST), Portugal
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland

IST-EPFL Joint-Doctoral Program Ph.D., Electrical and Computer Engineering, April 2023

- Thesis Topic: *Non-verbal Communication between Humans and Robots: Imitation, Mutual Understanding and Inferring Object Properties*
- *Summa cum laude*, Pass with Distinction and Honour
- Advisers: Professor José Santos-Victor, Professor Aude Billard

Instituto Superior Técnico (IST), Portugal

M.S., Electrical and Computer Engineering, August 2016

- *Cum laude*, 16/20
- Thesis Topic: *Multi-UAV Mission Coordination using Signal Temporal Logic Specifications*
- Adviser: Professor Pedro U. Lima
- Area of Study: Systems, Decision and Control

B.S., Electrical and Computer Engineering, August 2014

- Systems, Decision and Control specialization (emphasis on control, modelling and simulation)
- Minor in Computers (programming and algorithms)

Professional Experience

Software Developer, IST-ID

Research and Development **June 2023 to August 2023**
Instituto de Sistemas e Robótica

- European Commission H2020-RePAIR-964854: Grasping unknown objects by reconstructing the 3D object models using a RGBD camera mounted on a robotic arm with a gripper. Testing the successfulness of grasping multiple unknown objects using the reconstructed object against the partial object view from the camera. Software: Python, ROS.

Refereed Journal Publications

[1] Nuno F. Duarte, Aude Billard, and José Santos-Victor. The role of object physical properties in human handover actions: Applications in robotics. *IEEE Transactions on Cognitive and Developmental Systems*, pages 1–1, 2022a

[2] Mirko Raković, Nuno Ferreira Duarte, Jorge Marques, Aude Billard, and José Santos-Victor. The gaze dialogue model: Nonverbal communication in hhi and hri. *IEEE Transactions on Cybernetics*, pages 1–0, 2022

[3] R. Sanchez-Matilla, K. Chatzilygeroudis, A. Modas, Nuno Ferreira Duarte, A. Xompero, P. Frossard, A. Billard, and A. Cavallaro. Benchmark for human-to-robot handovers of unseen containers with unknown filling. *IEEE Robotics and Automation Letters*, 5(2):1642–1649, 2020

[4] Nuno Ferreira Duarte, Mirko Raković, Jovica Tasevski, Moreno Ignazio Coco, Aude Billard, and José Santos-Victor. Action Anticipation: Reading the Intentions of Humans and Robots. *IEEE Robotics and Automation Letters*, 3(4):4132–4139, October 2018

Conference Publications

[5] Matteo Bortolon, Nuno Ferreira Duarte, Plinio Moreno, Fabio Poiesi, José Santos-Victor, and Alessio Del Bue. Grasplat: Enabling dexterous grasping through novel view synthesis. *arXiv preprint arXiv:2510.19200*, 2025

[6] Nuno Ferreira Duarte, Seyed S Mohammadi, Plinio Moreno, Alessio Del Bue, and Jose Santos-Victor. Measuring uncertainty in shape completion to improve grasp quality. *arXiv preprint arXiv:2504.16183*, 2025

[7] André Santos, Nuno Ferreira Duarte, Atabak Dehban, and José Santos-Victor. Learning the sequence of packing irregular objects from human demonstrations: Towards autonomous packing robots. In *2024 10th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob)*, pages 951–957. IEEE, 2024

[8] Nuno Ferreira Duarte and José Santos-Victor. Robot imitation of polishing motions by observing humans: From human non-verbal cues to stable limit cycles. In *2024 IEEE International Conference on Development and Learning (ICDL)*, pages 1–7. IEEE, 2024

[9] Linda Lastrico, Nuno Ferreira Duarte, Alessandro Carfí, Francesco Rea, Fulvio Mastrogiovanni, José Santos-Victor, and Alessandra Sciutti. Like robots, like humans: Pupil dilation during collaborative object manipulation. In *2023 21st International Conference on Advanced Robotics (ICAR)*, pages 264–270. IEEE, 2023a

[10] Seyed S Mohammadi, Nuno F Duarte, Dimitrios Dimou, Yiming Wang, Matteo Taiana, Pietro Morerio, Atabak Dehban, Plinio Moreno, Alexandre Bernardino, Alessio Del Bue, et al. 3dsgrasp: 3d shape-completion for robotic grasp. In *2023 IEEE International Conference on Robotics and Automation (ICRA)*, pages 3815–3822. IEEE, 2023

[11] Linda Lastrico, Nuno Ferreira Duarte, Alessandro Carfí, Francesco Rea, Fulvio Mastrogiovanni, Alessandra Sciutti, and José Santos-Victor. If you are careful, so am i! how robot communicative motions can influence human approach in a joint task. In *Social Robotics: 14th International Conference, ICSR 2022, Florence, Italy, December 13–16, 2022, Proceedings, Part I*, pages 267–279. Springer, 2023b

[12] Nuno Ferreira Duarte, Mirko Raković, and José Santos-Victor. Robot learning physical object properties from human visual cues: A novel approach to infer the fullness level in containers. In *2022 International Conference on Robotics and Automation (ICRA)*, pages 10375–10381, 2022b

[13] Nuno Ferreira Duarte, Mirko Raković, and José Santos-Victor. Learning motor resonance in human-human and human-robot interaction with coupled dynamical systems. In *2021 IEEE International Conference on Robotics and Automation (ICRA)*, pages 3662–3668. IEEE, 2021

[14] Nuno Ferreira Duarte, Konstantinos Chatzilygeroudis, José Santos-Victor, and Aude Billard. From human action understanding to robot action execution: how the physical properties of handled objects modulate non-verbal cues. In *2020 Joint IEEE 10th International Conference on Development and Learning and Epigenetic Robotics (ICDL-EpiRob)*, pages 1–6, Valparaiso, Chile, October 2020. IEEE

[15] Nuno Ferreira Duarte, Mirko Raković, Jorge Marques, and José Santos-Victor. Action Alignment from Gaze Cues in Human-Human and Human-Robot Interaction. In *Computer Vision ECCV 2018 Workshops*, volume 11131, pages 197–212. Springer International Publishing, 2019a

[16] Nuno Ferreira Duarte, Mirko Rakovic, and José Santos-Victor. Coupling of Arm Movements during Human-Robot Interaction: the handover case. In *2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, pages 1–6, New Delhi, India, October 2019d. IEEE

[17] Nuno Ferreira Duarte, Mirko Raković, and José Santos-Victor. Biologically inspired controller of human action behaviour for a humanoid robot in a dyadic scenario. In *IEEE EUROCON 2019-18th International Conference on Smart Technologies*, pages 1–6. IEEE, 2019b

[18] Danilo Nikić, Nikola Ilić, Darko Todorović, Nuno Ferreira Duarte, José Santor-Victor, Branislav Borovac, and Mirko Raković. Eye gaze and body motion synchronization in dyadic interaction

[19] Mirko Raković, Nuno Duarte, Jovica Tasevski, Joé Santos-Victor, and Branislav Borovac. A dataset of head and eye gaze during dyadic interaction task for modeling robot gaze behavior. *MATEC Web of Conferences*, 161:03002, 2018

[20] Hugo Simão, João Avelino, Nuno Duarte, and Rui Figueiredo. Geebot: A robotic platform for refugee integration. In *Companion of the 2018 ACM/IEEE International Conference on Human-Robot Interaction*, pages 365–366, 2018

[21] João Avelino, Hugo Simão, Ricardo Ribeiro, Plinio Moreno, Rui Figueiredo, Nuno Duarte, Ricardo Nunes, Alexandre Bernardino, Martina Čaić, Dominik Mahr, et al. Experiments with vizzy as a coach for elderly exercise. In *Companion of the 2018 ACM/IEEE International Conference on Human-Robot Interaction*, 2018

Conference Talks

[22] N. Ferreira Duarte. "Measuring Uncertainty in Shape Completion to Improve Grasp Quality", in *IEEE 2025 iROS* in Hangzhou, China. October 19 - 25.

[23] N. Ferreira Duarte. "Learning the sequence of packing irregular objects from human demonstrations: Towards autonomous packing robots", in *IEEE 2024 BioRob* in Heilderberg. September 1 - 4.

[24] N. Ferreira Duarte. "Robot imitation of polishing motions by observing humans: From human non-verbal cues to stable limit cycles", in *IEEE 2024 ICDL* in Texas. May 20 - 23.

[25] N. Ferreira Duarte. "3dsgrasp: 3d shape-completion for robotic grasp", in *IEEE 2023 ICRA* in London. 29 May - 2 June.

[26] N. Ferreira Duarte. "Robot Learning physical object properties from Human Visual Cues:A novel approach to infer the fullness level in containers", in *IEEE 2022 ICRA* in Philadelphia. May 23 - 27.

[27] N. Ferreira Duarte. "Learning Motor Resonance in Human-Human and Human-Robot Interaction with Coupled Dynamical Systems", in *IEEE 2021 ICRA* in China (Online). May 30 - June 5.

[28] N. Ferreira Duarte. "From human action understanding to robot action execution: how the physical properties of handled objects modulate non-verbal cues", in *IEEE 2020 RO-MAN* in Chile (Online). October 26–30.

[29] Nuno Ferreira Duarte, Mirko Raković, and José Santos-Victor. Should robots behave like humans? an approach to analyse non-verbal gaze cues in human-robot interaction. In *ICDL-EpiRob 2019 Workshops*. Presented but no publication, 2019c in Olso, Norway. August 19–22

[30] N. Ferreira Duarte. "Coupling of Arm Movements during Human-Robot Interaction: the handover case", in *IEEE 2019 RO-MAN* in New Delhi, India. October 14–18.

[31] N. Ferreira Duarte. "Biologically Inspired Controller of Human Action Behaviour for a Humanoid Robot in a Dyadic Scenario", in *IEEE 2013 EUROCON* in Novi Sad, Serbia. July 1–4.

[32] N. Ferreira Duarte. "Studying the human behavior in dyadic interactions and applications to human-robot interactions", *2018 Mind Brain College* in Lisbon, Portugal. November 14–15.

[33] N. Ferreira Duarte. "Action Alignment from Gaze Cues in Human-Human and Human-Robot Interaction", The *2018 Computer Vision (ECCV) 2018 Workshops* in Munique, Germany. September 8–14.

[34] N. Ferreira Duarte. "Studying the human behavior in dyadic interactions and applications to human-robot interactions", The *2018 LARSys Meeting* in Lisbon, Portugal. June 14–15.

[35] N. Ferreira Duarte. "A dataset of head and eye gaze during dyadic interaction task for modeling robot gaze behavior", The *2018 Conference* in Saint Petersburg, Russia. April 18–21.

[36] N. Ferreira Duarte. "GeeBot: A Robotic Platform for Refugee Integration", The *2018 ACM/IEEE International Conference on Human-Robot Interaction* in Chicago, USA. March 5–8.

[37] N. Ferreira Duarte. "Experiments with Vizzy as a Coach for Elderly Exercise", The *2018 ACM/IEEE International Conference on Human-Robot Interaction* in Chicago, USA. March 5–8.

Invited Talks

[38] Ferreira Duarte, N. Where AI and Robotics meet cultural heritage. In: *The 5th Macao Symposium on Cloud Computing and Intelligent Driving, University of Macau, Macau*, December 9, 2025.

[39] Ferreira Duarte, N. Where AI and Robotics meet cultural heritage. In: *The 13th Sino-European Engineering Education Platform (SEEEP), Dalian, China*, October 27, 2025.

[40] Ferreira Duarte, N. The updates accomplished during the Integration week in Genova, Italy for the RePAIR project. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, January 21, 2025.

[41] Ferreira Duarte, N. From human action understanding to robot action execution: how the physical proper-ties of handled objects modulate non-verbal cue. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, April 14, 2022.

[42] Ferreira Duarte, N. A Dataset Design for Human-Human and Human-Robot Collaboration. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, March 12, 2019.

[43] Ferreira Duarte, N. On going work of my Ph.D. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, January 29, 2019.

[44] Ferreira Duarte, N. Studying the human non-verbal communication behavior in dyadic interactions and applications to human-robot interactions. In: *LASA, EPFL, Lausanne, Switzerland*, September 21, 2018.

[45] Ferreira Duarte, N. Action Alignment from Gaze Cues in Human-Human and Human-Robot Interaction. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, September 4, 2018.

[46] Ferreira Duarte, N. A Dataset of Head and Eye Gaze during Dyadic Interaction Task For Modeling Robot Gaze Behavior. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon* May 8, 2018.

[47] Ferreira Duarte, N. GeeBot - A robotic platform for refugee integration. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, January 16, 2018.

[48] Ferreira Duarte, N. Action Anticipation: Reading the Intentions of Humans and Robots. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, October 17, 2017.

[49] Ferreira Duarte, N. "Facilitating Intention Prediction for Humans by Optimizing Robot Motions" paper by Manuel Lopes. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, March 28, 2017.

Other Publications

[50] Ferreira Duarte, N. *Non-verbal Communication between Humans and Robots: Imitation, Mutual Understanding and Inferring Object Properties.* PhD thesis, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, 2023.

[51] Ferreira Duarte, N. *Non-verbal Communication between Humans and Robots: Imitation, Mutual Understanding and Inferring Object Properties.* PhD thesis, Instituto Superior Técnico, Lisbon, Portugal, 2023.

[52] Ferreira Duarte, N. *Multi-UAV Mission Coordination using Signal Temporal Logic Specifications.* Master's thesis, Instituto Superior Técnico, Lisbon, Portugal, 2016.

Papers in Preparation

[53] Gojko Perovic, Nuno Ferreira Duarte, Atabak Dehban, Gonçalo Teixeira, Egidio Falotico, and José Santos-Victor. Herb: Human-augmented efficient reinforcement learning for bin-packing. *arXiv preprint arXiv:2504.16595*, 2025

Teaching Experience

École Polytechnique Fédérale de Lausanne, Switzerland

Teaching Assistant **February 2020 to October 2020**

- Assisted Applied Machine Learning instructional team.
- Provided support to fourth-year engineering students (MICRO-455).
- Assisted students in Practical and Lab sessions.

Professional Service

Referee Service

- *IEEE International Conference on Advanced Intelligent Mechatronics*
- *IEEE International Symposium on Intelligent Systems and Informatics*
- *IEEE International Conference on Robotics and Automation*
- *IEEE/RSJ International Conference on Intelligent Robots and Systems*
- *IEEE International Conference on Development and Learning*
- *IEEE International Conference on Human Robot Interaction*
- *IEEE Transactions on Cognitive and Developmental Systems*
- *The International Journal of Robotics Research*
- *Journal of Frontiers in Robotics and AI*
- *Journal John Benjamins - Interaction Studies*
- *Journal of Interaction Studies*
- *Elsevier Cognitive Systems Research*
- *International Journal of Social Robotics*
- *MDPI Journals on Algorithms, Applied Sciences, and Electronics*

Professional Memberships

Institute for Electrical and Electronics Engineers (IEEE), Member, 2016–present

- IEEE Robotics and Automation Society (2021–present)
- IEEE Industrial Electronics Society (2025–present)

Other Meeting Attendance

Invited Participant

- LarSys Annual Meeting 2025, July, 2025
- AI for Robotics workshop, April 2024, Tilburg, Netherlands
- LarSys Annual Meeting 2024, July, 2024
- LarSys Annual Meeting 2023, July, 2023
- LarSys Annual Meeting 2022, July, 2022
- LarSys Annual Meeting 2019, July, 2019
- 4th Meeting Mind-Brain College Lisbon, November 14–15, 2018
- LarSys Annual Meeting 2018, July, 2018

Application Areas

Physical Human-Robot Interaction, Human-inspired Modeling, Grasping, Eye-tracking, Motion-tracking,Human-Human Interaction, Human-Robot Interaction, Non-verbal Communication

Hardware and Software Skills

Computer Programming:

- C++, Python, UNIX shell scripting, GNU make

Robot Programming:
- ROS, YARP

Numerical Analysis:
- MATLAB

MATLAB skill set:
- Linear algebra, Monte Carlo analysis, nonlinear numerical methods, polynomials, statistics, N-dimensional filters, visualization

Information/Internet Technology:
- Networking (UDP, TCP)

Desktop Editing and Productivity Software:
- Vim, PyCharm, Gedit
- TEX (LATEX, BIBTEX),
- Microsoft Office, LibreOffice, Apple iWork
- GIMP, Mathcha.io

Operating Systems:
- Microsoft Windows family, Apple OS X, Linux, Ubuntu, Fedora, and other UNIX variants

EXPERTISE

Mathematics:
- Applied Mathematics, Differential Equations, Linear Algebra, Calculus,

Sensors and Actuators:
- Pupil-Labs Eye-tracker glasses, Pupil Capture, Pupil Record
- OptiTrack 12 camera system, OptiTrack bar, OptiTrack Motive,
- Myo EMG

Robots:
- KUKA iiwa
- Kinova gen-3
- iCub
- Baxter

Control Theory and Engineering:
- Linear and Nonlinear Systems Theory, Dynamic Optimization, Multivariable Control Theory, Biomimicry, Bioinspiration

Communications and Signal Processing:
- Probability, Random Variables, Stochastic Processes, Estimation, Networks

Machine Learning and Engineering:
- Clustering, Component Analysis, Gaussian Mixture Modelling Regression, Markov Models, Neural Networks, among others

AWARDS

IEEE IES Member Support Program
- iROS 2025 Travel Grant, 2025

AI for Robotics Workshop
- AI for Robotics Workshop Registration Grant, 2024

IEEE RAS Member Support Program
- iROS 2023 Registration Grant, 2023

FCT: Foundation for Science and Technology (Portugal)
- PhD Scholarship, 2016–2020

Research Intern at Caltech (United States)

- SURF: Summer Undergraduate Research Fellowships, 2015

References Available to Contact

Dr. José Santos-Victor (e-mail: jasv@isr.tecnico.ulisboa.pt; phone: +351 21.8418.294)
- Full Professor, Department of Electrical and Computer Engineering, Instituto Superior Técnico
  - ◇ Instituto Superior Técnico, ISR - Torre Norte Av. Rovisco Pais, 1049-001 Lisboa, Portugal
  - ⋆ *Dr. Santos-Victor was my PhD co-supervisor.*

Dr. Aude Billard (e-mail: aude.billard@epfl.ch; phone: +41 21 693 54 64)
- Full Professor, Institute of Electrical and Micro Engineering, EPFL
  - ◇ EPFL STI IMT LASA, ME A3 393 (Bâtiment ME) Station 9, CH-1015 Lausanne
  - ⋆ *Dr. Billard was my PhD co-supervisor.*