PHD IN SIGNAL PROCESSING AND AI FOR NAVIGATION WITH GUIDE DOGS FOR THE VISUALLY IMPAIRED

Research Topic

Digital systems are the main focus of research on mobility aids for visually impaired people: GPS guidance applications on smartphones, instrumented blind canes, auditory description of the environment, etc., and to a lesser extent on the assistance provided by guide dogs. The latter research focuses on animal mediation [1], training adult or minor beneficiaries [2], and selecting and training dogs [3-4]. The matching of guide dogs and beneficiaries, which plays a crucial role in the success of mobility assistance, has received little research attention. The current process relies mainly on qualitative data, such as assessing beneficiary needs, dog profiling and supervised meetings. This approach can lead to incompatibilities that affect the effectiveness and well-being of the duo. In this context, this thesis aims to evolve this matching process by introducing qualitative and automatable approaches with a tool for accurately measuring dog-human compatibility based on behavioural, emotional and biomechanical criteria as well as walking patterns learned from dogs and recipients.

This thesis is part of an international collaboration between MIRA in Canada, a key player in training guide and assistance dogs, the Valentin Haüy Association, a long-standing player in helping the visually impaired in France, and the Gustave Eiffel University. The thesis will develop a methodology to collect precise data on the walking styles of the beneficiaries and the dogs, as well as their behavioural and emotional states, using wearable motion sensors and advanced behavioural analysis tools from INMOB labcom [5]. The research will start by developing and adapting motion capture and behavioural analysis devices for easy and effective use with dogs and beneficiaries, and by developing and integrating acquisition systems. During pairing sessions and in a variety of situations, gait, behavioural and emotional data will be collected to create detailed profiles. The collected data will be processed and analysed to develop a dog-beneficiary matching model based on compatibility of gait and behavioural profiles. Finally, the model will be integrated into the MIRA matching process for evaluation and adjustment based on feedback and matching success.

This work will mobilise interdisciplinary skills in geomatics, etiology, and artificial intelligence to process the collected data and integrate it into a decision-support tool. The methodology will involve capturing movement using inertial sensors, analyzing gait dynamics using signal processing algorithms, and observing and quantifying behaviour during human-dog interactions.

The expected benefits of this project are manifold. The research will have an impact on the quality of dog-recipient matches, with a reduction in the number of failures and re-assignments. It will also contribute to an improvement in the well-being of both the dogs and the recipients by ensuring a better match right from the selection stage. Finally, scientific advances are expected in understanding the dynamic interactions between assistance dogs and humans, particularly regarding gait and behaviour. This research will also strengthen interdisciplinary collaboration between the fields of ethology and movement analysis, and illustrate the potential of integrated approaches to solving complex problems. The work will be carried out in a framework of academic, industrial and associative collaboration, with a strong potential for technology transfer to organisations involved in the training of guide and assistance dogs.

Reference

[1] Alice Mignot, « Bénéfices de l'approche pluridisciplinaire dans la compréhension de la médiation animale ainsi que dans l'évaluation du bien-être du chien médiateur », thèse doctorale, Université de Nanterre - Paris X, 2022.
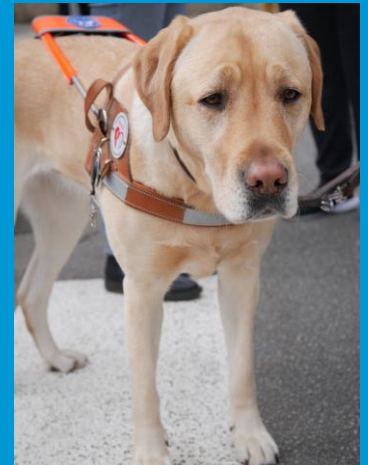
3 Year Full PhD

Location

Campus of Nantes
FRANCE

Discipline (s)

Signal Processing
Artificial Intelligence

Starting date

October 2025

[2] Fanny Menuge, Identification of factors influencing the acquisition of skills necessary to work as a guide dog for blind children : conception d'un programme d'optimisation. Animal biology. Institut National Polytechnique de Toulouse - INPT, 2022. English.

[3] Fondation MIRA, Chiens-guides pour les personnes non-voyantes ou ayant une déficience visuelle https://www.mira.ca/fr/programmes/chien-guide-deficience-visuelle

[4] Dollion, N., Paulus, A., Champagne, N., St-Pierre, N., St-Pierre, É, Trudel, M., & Plusquellec, P. (2019). Fear/reactivity in working dogs: An analysis of 37 years of behavioural data from the Mira Foundation's future service dogs. Applied Animal Behaviour Science, 221, 104864. https://doi.org/10.1016/j.applanim.2019.104864

[5] Publications du labcom INMOB (cartographie du handicap par mesure INertielle pour faciliter la MOBilité) financé par l'ANR, https://anr.hal.science/search/index/?q=*&anrProjectReference_s=ANR-20-LCV1-0002

Keyword

Navigation, Mobility assistance, Guide dogs, Biomechanical analysis, Artificial intelligence, Sustainable mobility

Expected Profile

We are looking for a candidate with a passion for human-animal interaction and navigation technologies, an MSc degree with competences in:

- Signal processing and analysis of time series of data
- Artificial intelligence and machine learning
- Motion sensors and instrumentation

Experience in scientific programming (Python, MATLAB, etc.) and behavioural modelling will be a plus. Interest in ethology applied to human-animal interactions.appreciated. Scientific rigour, as well as autonomy and organisational skills, are obviously expected.

How to apply?

Send all documents (covering letter, CV, diplomas, list of productions/publications) in a single pdf document to valerie.renaudin@univ-eiffel.fr

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Application Deadline

14 March 2025

Application Process

Written Application
Oral Presentation

Salary

25k€ brut / year

Benefit

International Team
Flexible Working Hours
Possibility of Teleworking
International Environment
On-site Subsidized Catering
Public Transport Refund
Cultural and Sport Activity

Knowledge

- Signal Processing
- Artificial Intelligence
- Motion Sensors

Skills / Know-how

- Python, matlab
- English and/or French
- Scientific writing

Soft skills

- Communication
- Teamwork
- Organization and rigor

TEAM GEOLOC

The University Gustave Eiffel

The University Gustave Eiffel, created on January 1, 2020 from the merger of the Ifsttar (French Institute of Transport, Planning and Network Sciences and Technologies) and the Université Paris-Est Marne-la-Vallée, is a major player in European research on cities and territories, transport and construction. It is a scientific, cultural and professional public institution (like all French universities) with an experimental status and a national presence, which makes it a unique university in France. It aims to be a major player in the field of transportation and urban research. The research laboratories of the Université Gustave Eiffel conduct both upstream and downstream research and expertise in a wide range of disciplines (mathematics and computer science, electronics, materials, chemistry, civil engineering, geosciences, social sciences, psychology, economics, management, innovation sciences, communication, ethics, history, art, literature, etc.) and in areas with a strong social impact such as transport, infrastructures, natural hazards and cities, to improve the living conditions of our fellow citizens and, in a broader sense, promote the sustainable development of our societies.

https://www.univ-gustave-eiffel.fr/

The host laboratory

The GEOLOC laboratory brings together an international team of dynamic researchers with expertise in positioning and navigation solutions, developing innovative algorithms and devices to improve the mobility of people and vehicles. Localization, which has become widespread thanks to the use of smartphones, offers new opportunities to better support daily mobility adapted to each individual. Our research takes into account the specific needs of location-based applications and services to create algorithms adapted to new forms of mobility, responding to climate change, encouraging the sharing of means of transport, or providing better navigation aids for vulnerable people.

The positioning solutions we are looking for are ubiquitous, accurate, reliable, and secure, to support critical soft mobility applications. They also need to be certified to ensure that they are part of an economic and industrial reality that is having an impact on our society. This research is based on signals and measurements from inertial sensors, magnetometers, GNSS receivers, and cameras, as well as relevant map data. To carry out this research, the laboratory uses original equipment, such as an instrumented vehicle (VERT), connected smart devices (ULISS, PERSY) that replace a smartphone, and a multi-sensor reference solution that models human body movements in 3D. The GEOLOC laboratory is also actively involved in international scientific activities, steering international conferences and standardization groups, organizing indoor positioning competitions, and leading a new open-access scientific journal.

https://geoloc.univ-gustave-eiffel.fr/en/

Contact

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