Université Gustave Eiffel

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TEAM GEOLOC

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3 Years Ph.D. funding

Individualization of self-contained pedestrian positioning technologies by including disability profiles in inertial signal based models

KEYWORDS

Positioning • Navigation • Pedestrian Dead Reckoning • Artificial Intelligence • Handicap • IMU • GNSS • Smartphone • Mobility • Accessibility

SUMMARY

Accessing accurate positioning and navigation on smartphones is globally considered a commodity technology by mobility service operators. However, there is no solution with sufficient performance to meet the needs of people with disabilities. The commercialized technologies principally rely on a dense network of beacons to guarantee sufficient positioning performance. It raises coverage issues in terms of equipped areas, continuity of service, maintenance and simply cost. A lot of research efforts have been made to overcome the need for infrastructure, mainly in buildings, by relying on radio propagation mapping, cooperative crowd-based approaches or the inclusion of biomechanical data to model movements with inertial signals. Although promising, the improvement in the performance of inertial positioning technologies has been stalled in recent years. One of the reasons is that scientific approaches do not rely on individual modeling that allows customizing positioning and navigation approaches according to disability typologies. But handicapped people are equipped with smartphones that should allow this individualization. This thesis hypothesizes that the singularity of individuals in a handicap situation should make it possible to go beyond these limits and lead to a self-contained technology to improve the mobility of the disabled.

The objective of the research is to propose methods for improving the performance of pedestrian dead-reckoning approaches by integrating the specificities of the handicap into a novel on-the-fly learning of the models that are necessary to calculate the foot tracks of the disabled. The first challenge is to fix the features (dimensions, parameters) of the inertial signal based models to achieve stability over time and a model faithful to the disability profile. The second challenge is to propose methods for automatic learning of these models by exploiting the data collected daily by a smartphone. Reducing the impact of the highly noisy measurements of low-quality sensors integrated into smartphones and correctly labeling everyday movements are all questions that this thesis will have to address. The final challenge will be to bring these signal processing methods into a real-time approach on smartphones.

APPLICATION

PROFILE	The candidate must hold a European Master 2 or equivalent degree in one of the following research fields: Signal Processing • Geomatics Engineering • Artificial Intelligence Computer Science
COMPETENCES	Signal Processing • Machine Learning • Navigation and Positioning • Statistics • Modelling • Physics
RESEARCH UNIT	GEOLOC Laboratory, AME department University Gustave Eiffel • Campus Nantes • FRANCE
FUNDING	3 years PhD scholarship in partnership with an industrial company
CONTACT	Send letter and motivation letter to valerie.renaudin@univ-eiffel.fr tel +33 (0)2 40 84 56 47