FRAUNHOFER PORTUGAL AICOS

Research Center for Assistive Information and Communication Solutions

APPLIED SCIENCE BY FRAUNHOFER – MADE IN PORTUGAL

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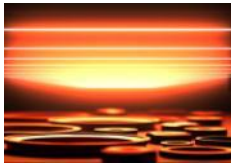
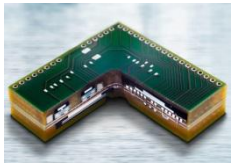
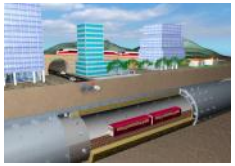
PORTUGAL

1. Fraunhofer Portugal

Fraunhofer-Gesellschaft



69 Institutes

> 80 Research Units

~ 24.500 employees

> € 2,1 billion R&D budget

(€ 1,9 billion from contract research)

7 Groups

- Information and Communication Technology
- Life Sciences
- Light & Surfaces
- Microelectronics
- Production
- Materials & Components
- Defense & Security

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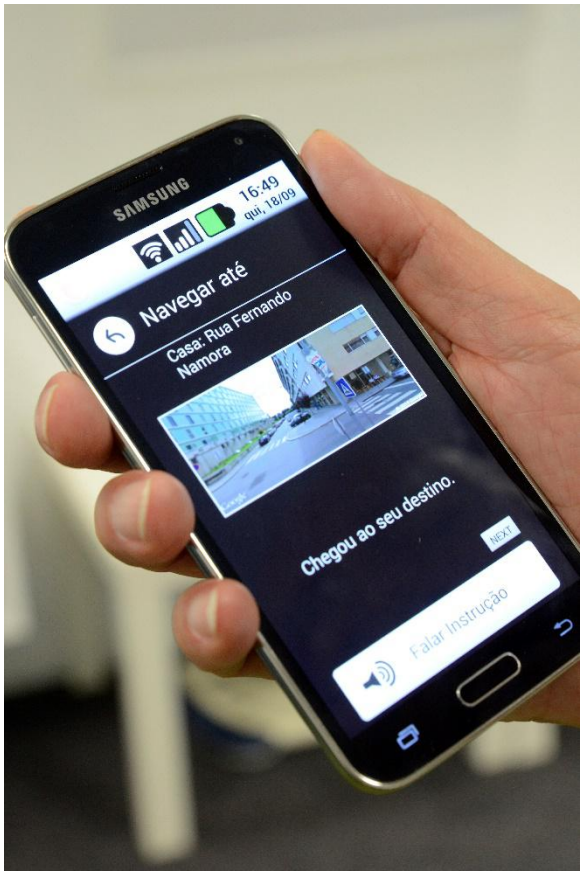
Mission

'Remarkable Technology, Easy to Use'

- Offering specialized competences centred on end-user experience and usability of applications;
- Generating applied research solutions capable of contributing to the market success of our clients' products and services and increasing value for their customers.



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Achievements (2009 – 2014)

2009

Mover

5th Place
2nd Android Developers Challenge

2011

AlzNav

1 of 3 Finalists
Vodafone Smart Accessibility Awards

Smart Companion

2nd Place
Zon Prémio Criatividade

2012

Dance! Don't Fall

Top 25 Apps
CES[1] Mobile Apps Showdown

AlzNav

Portugal Nominee by APDC[2]
World Summit Awards

PostboxWeb

Honourable Mention
Vodafone Mobile Data Challenge

ULF-MC

1st Place
ESNC[3] European (Galileo Master Award)

2013

Melanoma Detection

European Young Researcher of the Year
AAL Forum

PHAR (MSc thesis)

Finalist
Vodafone Mobile Data Challenge

2014

FCC

Young Scientist Best Paper Award
pHealth

[1] **CES:** Consumer Electronics Show.

[2] **APDC:** Portuguese Association for the Promotion of Communications.

[3] **ESNC:** European Satellite Navigation Competition.

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Achievements (2015 – 2017)

PIL

3rd Place
Microsoft Indoor Location Competition

ShopView

1st Place
Sonae Companies Innovation Award

ChefMyself

1 of 3 Finalists
AAL Award
AAL Forum

Finalist
Innova eVIA Awards

E-No FALLS

Best Poster
EU Falls Festival

EyeFundusScope

Honourable Mention
Os melhores do Portugal Técnológico

Exame Informática

2015

OurMoz

1st Place
#APPS4MAPUTO
(World Bank Contest)

GoLivePhone
(Smart Companion)

Excellent Smart Health Innovation Entrepreneurs with guts and spirit
Community of Regions for Assisted Living AAL Forum

2016

PIL

2nd Place
Microsoft Indoor Location Competition

2017

FhP Team

Honourable Mention
VISUM Summer School

INESC TEC

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Headquarters & Branch Office




- Our Headquarter in UPTEC was voted 'Building of the Year 2011' in a competition hosted by ArchDaily.com and provides the most inspiring environment to our team!
- The project was once again awarded in **2016, as the winner of the Green GOOD DESIGN™ Award**;
- Since July 2015, Fraunhofer Portugal AICOS has **expanded to Lisbon** with the **creation of a branch office** in the Institute for Interdisciplinary Research;
- The new branch office allows to **expand capacity of hosting additional researchers**, **higher integration with scientific organizations** and **proximity to industry clients**.

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3. Fraunhofer Portugal AICOS

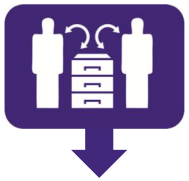
Strategic Research Agenda – Scientific Areas

Human-Computer Interaction

Adapting **interaction** to **specific user needs**

- **User & Social Experience**
- **Mobile & Future Devices**
- **Evaluation & Usability**

Information Processing



From **raw** data … **To meaningful** information

- **Content Retrieval**
- **Context Awareness**
- **Multimodal Information Fusion**

Autonomic Computing

Smarter machines: less configuration & maintenance

- **Remote Management, Control and Configuration**

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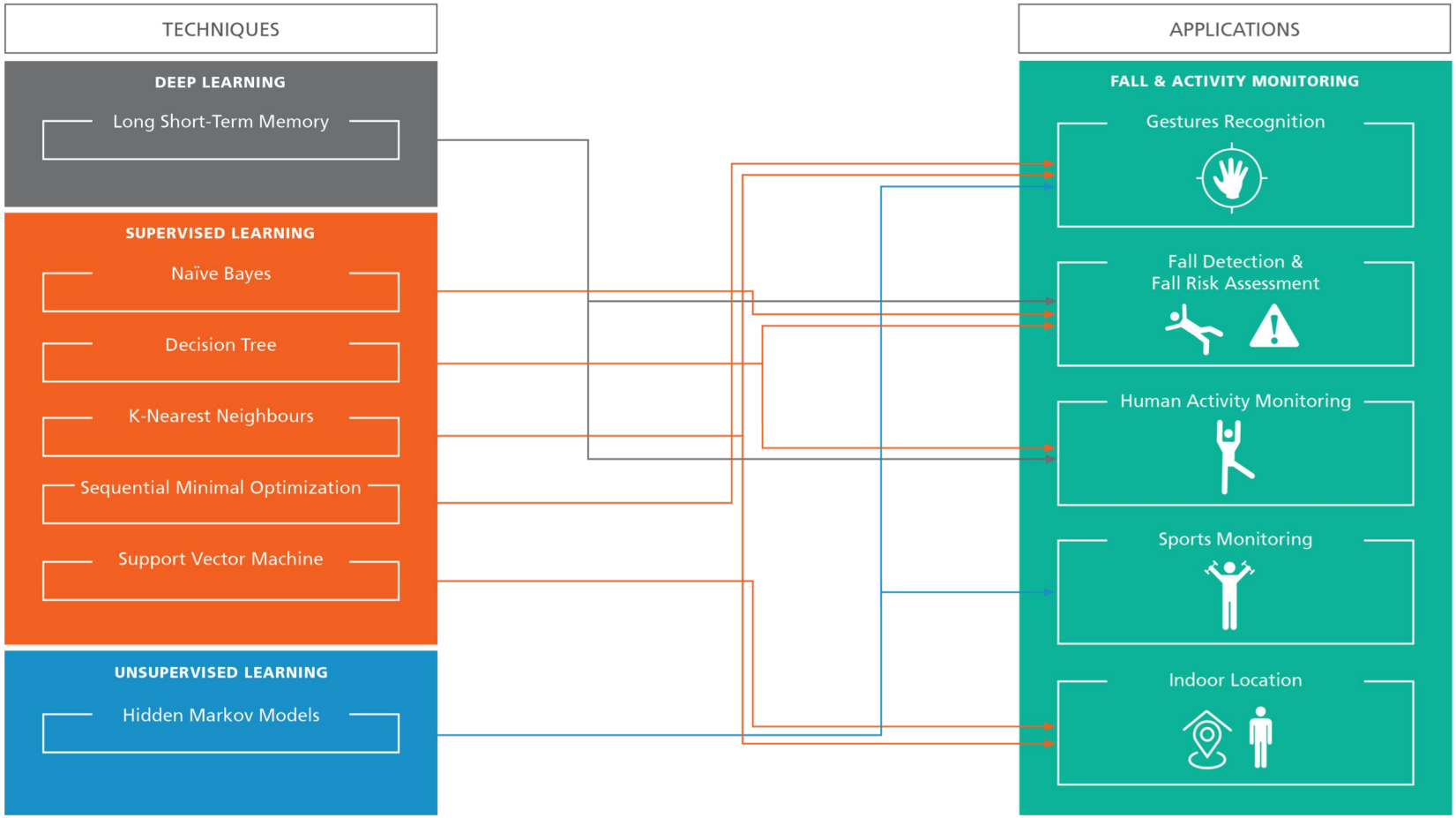
4. Machine Learning at Fraunhofer

Competences on Intelligent Systems



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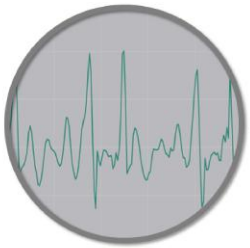
4. Machine Learning at Fraunhofer

Data classification

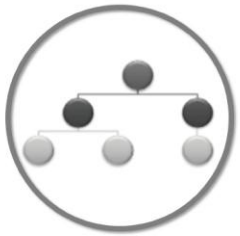
DATA ACQUISITION

- Multiple source signal acquisition



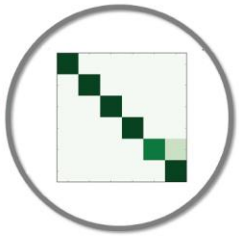
SIGNAL PROCESSING

- Sampling Frequency and Time Complexity Analysis
- Feature Extraction and Selection



MACHINE LEARNING TECHNIQUES

- Classification Algorithms



VALIDATION

- Accuracy
- Confusion Matrix

Offline and online classification

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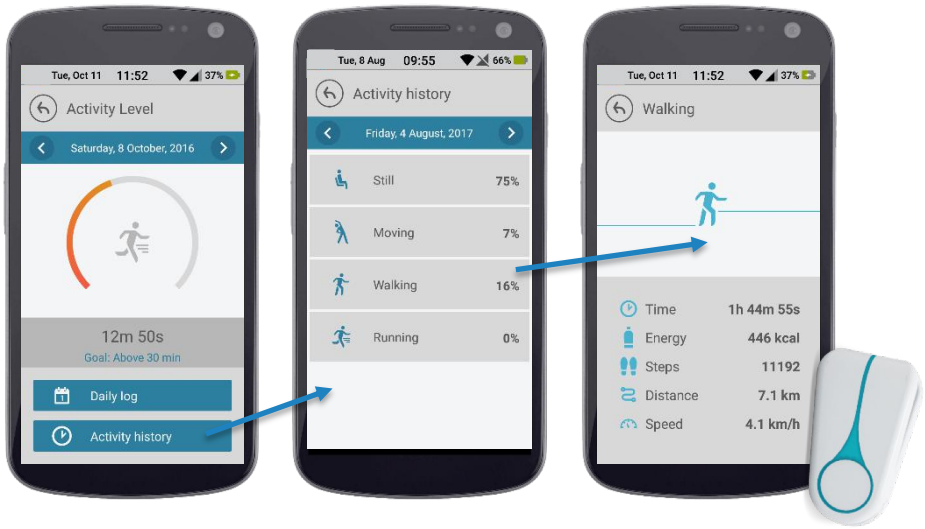
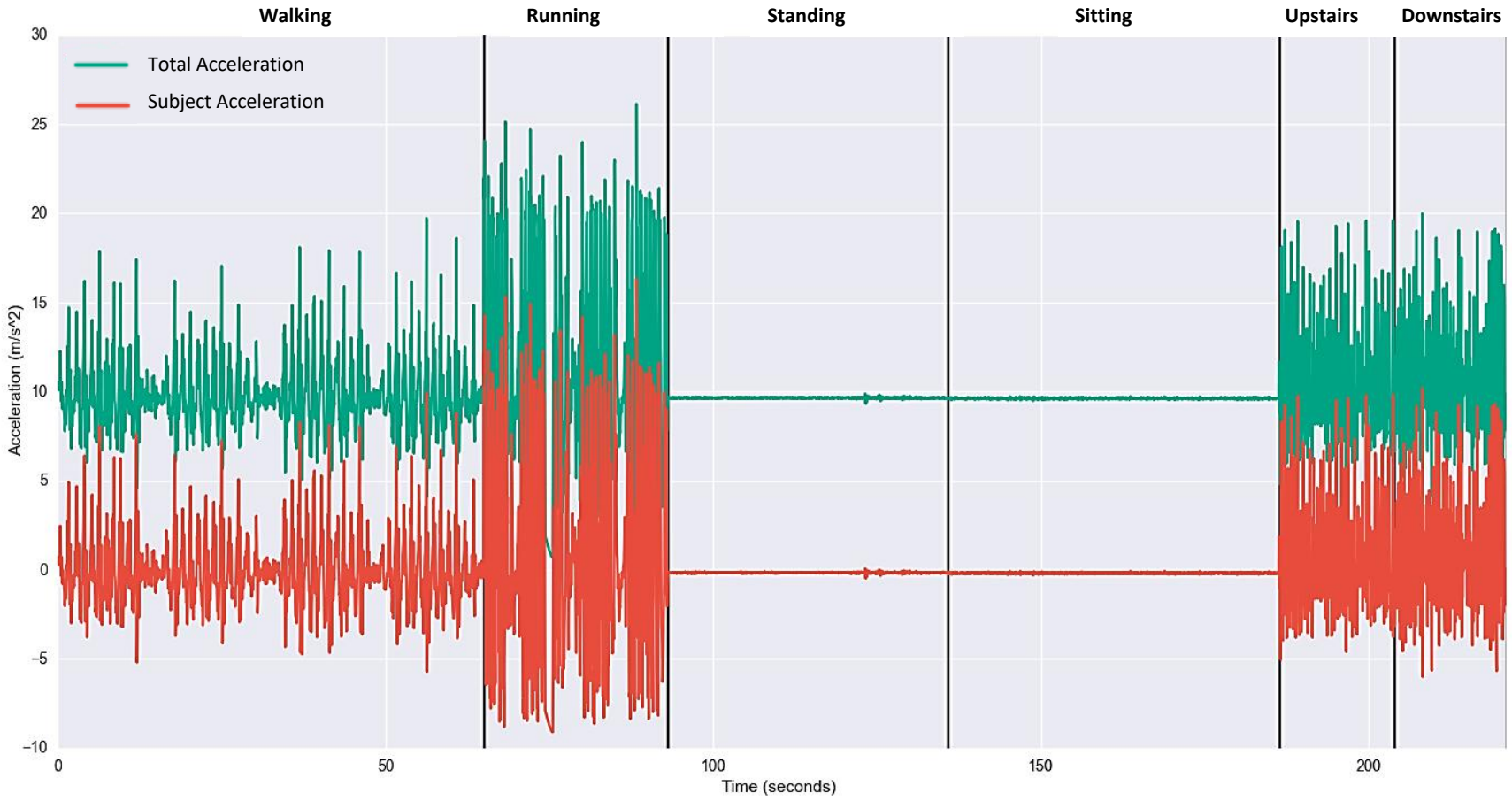


What am I doing?

ACTIVITY MONITORING

6. Activity Monitoring

Signal Processing – Accelerometer



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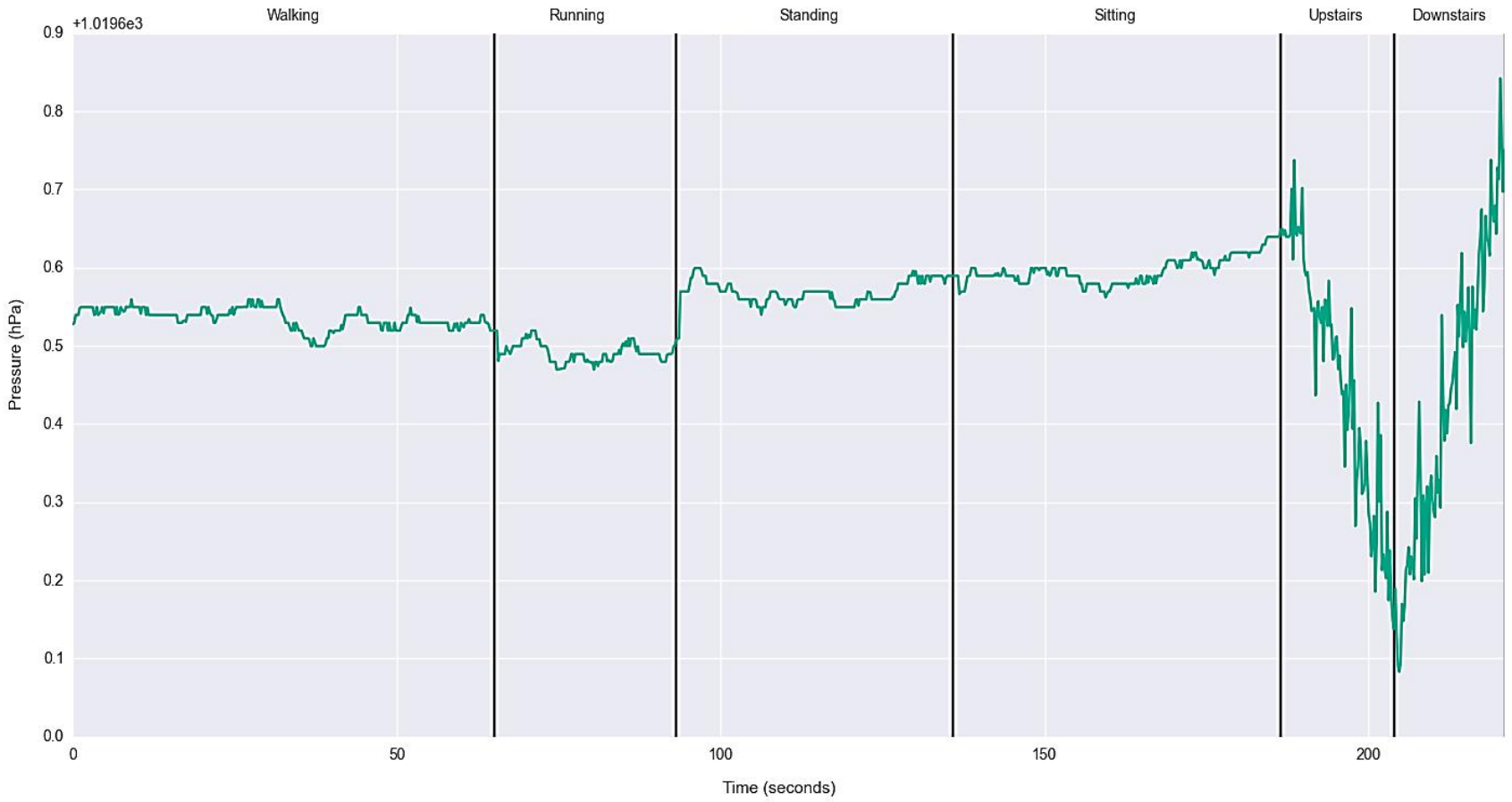
6. Activity Monitoring

Signal Processing – Barometer



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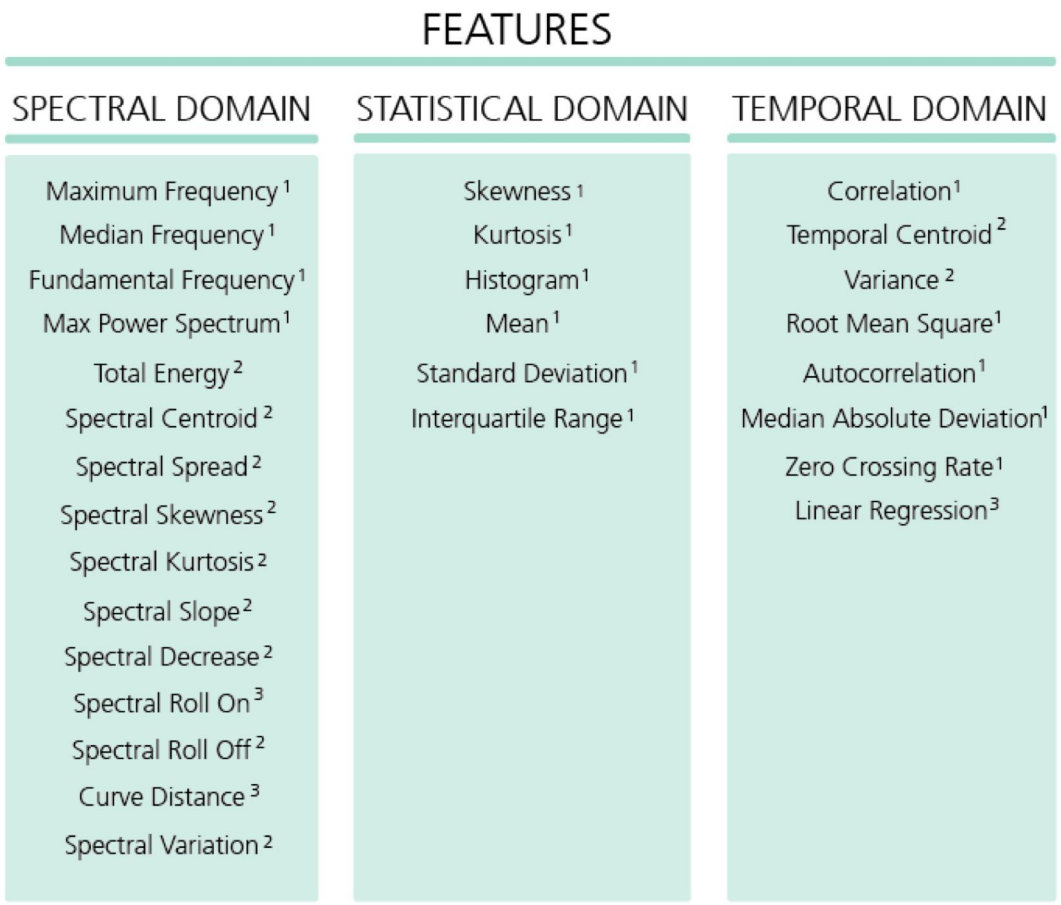
6. Activity Monitoring

Feature extraction



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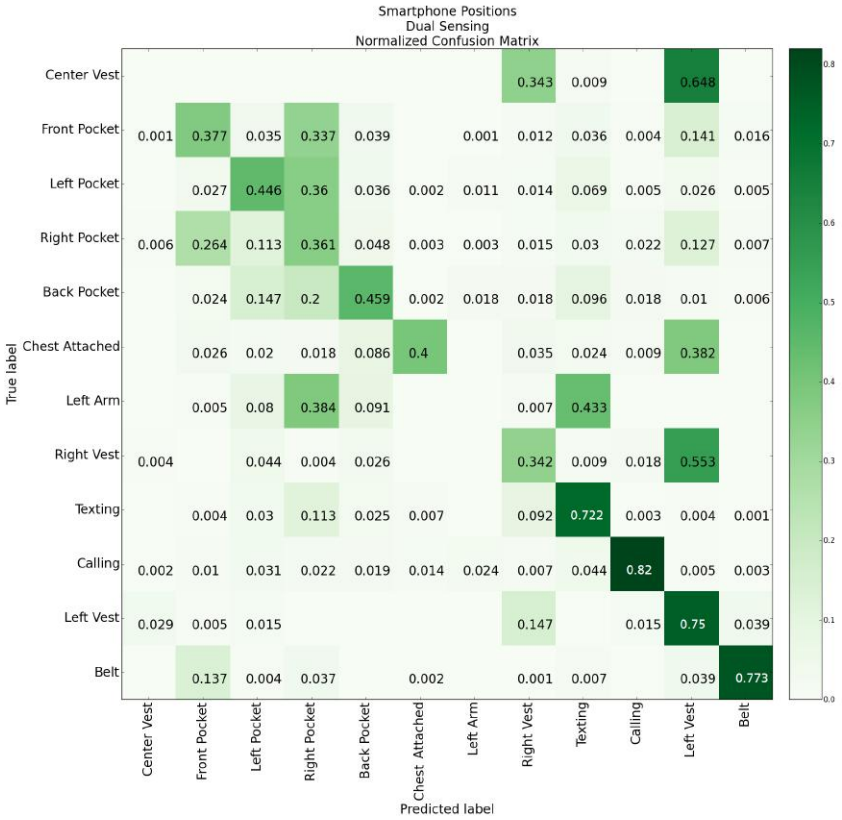
6. Activity Monitoring

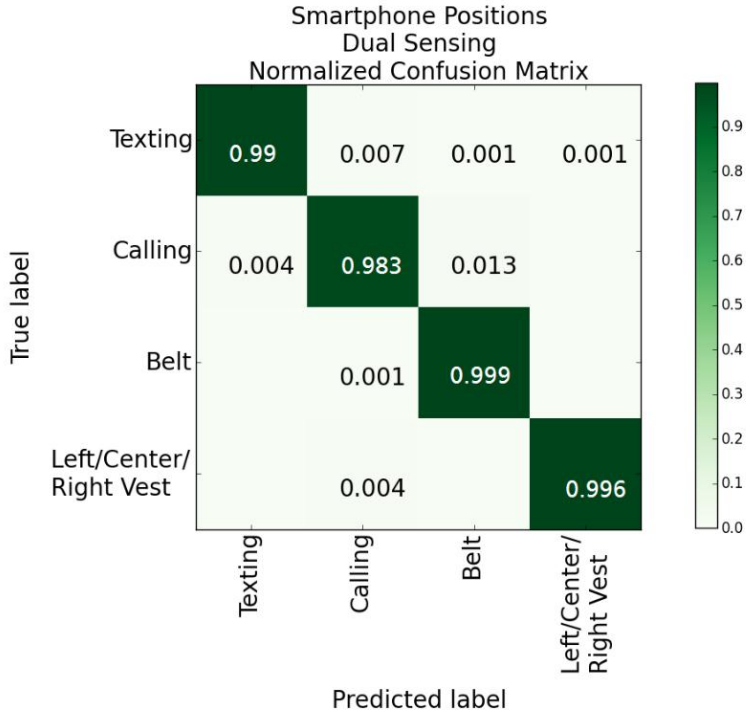
Position Followed by Activity Recognition Approach



Accuracy: 71%

6. Activity Monitoring

Position Followed by Activity Recognition Approach



Accuracy: 99%

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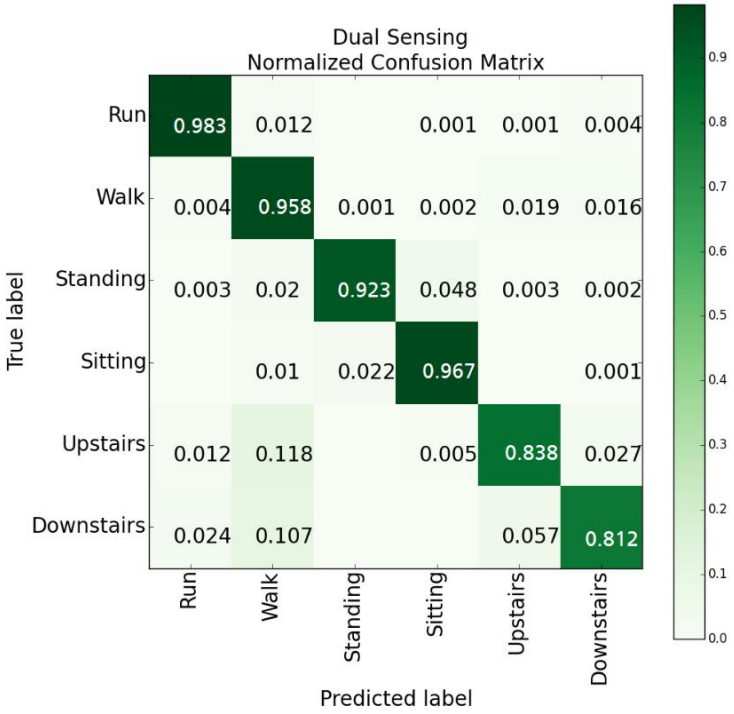
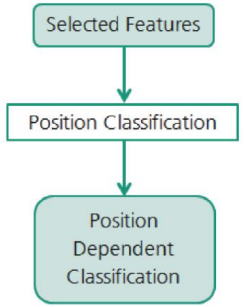
6. Activity Monitoring

Position Independent (Accelerometer + Barometer)





Accuracy: 92%

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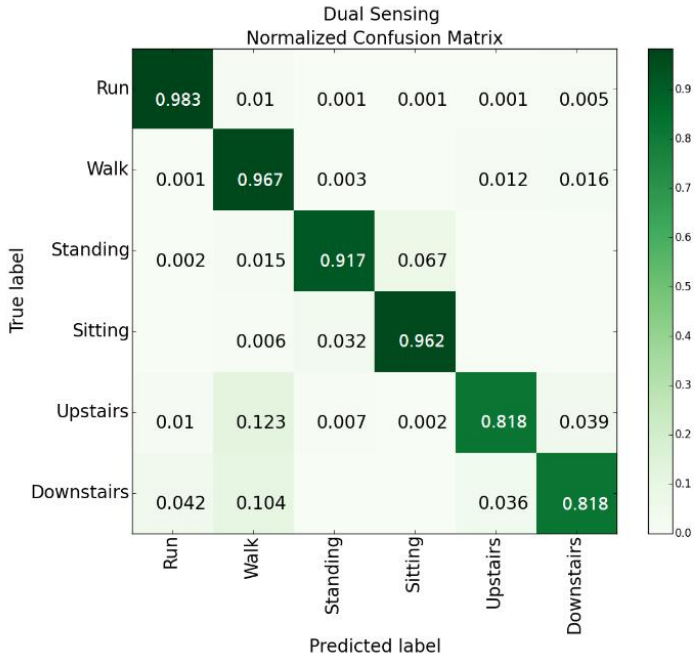
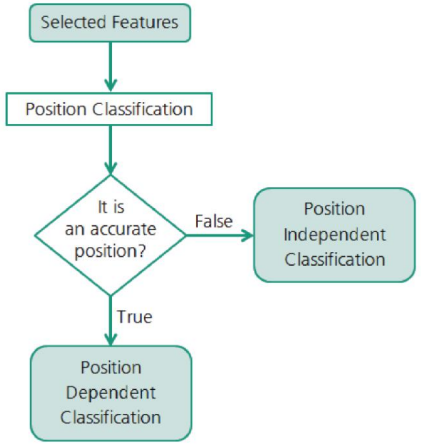
6. Activity Monitoring

Position Dependent and Independent Combination Approach





Accuracy: 95%

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Where am I?

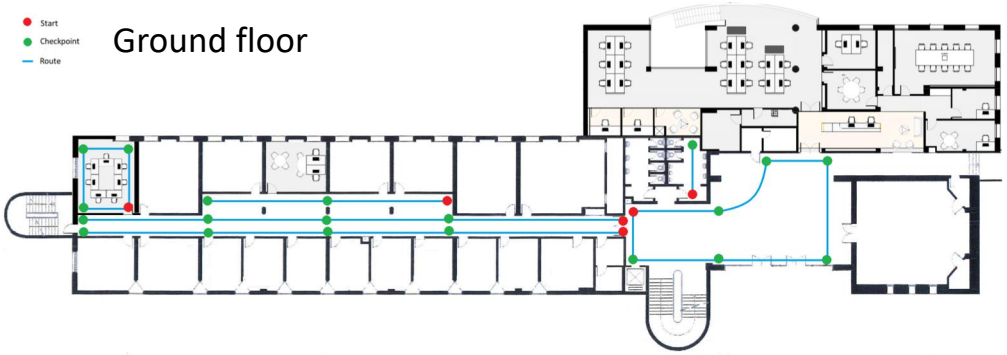
SOUNDSIGNATURE

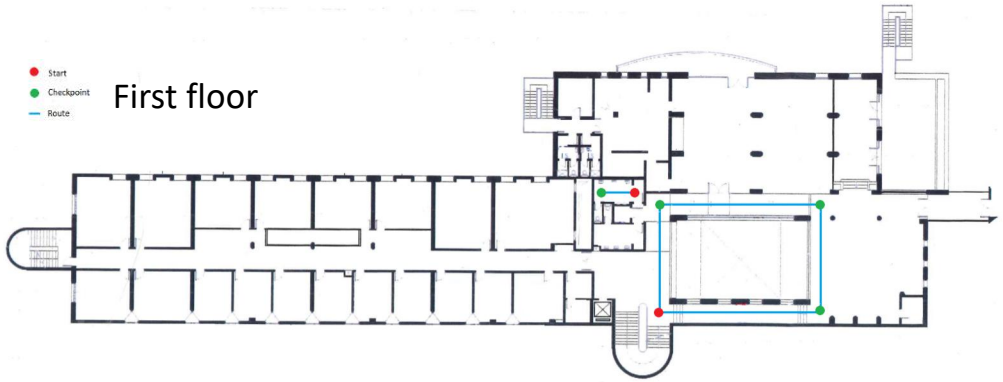
7. SoundSignature

Data Acquisition

42 min of data:

- The subject walks through a predetermined route





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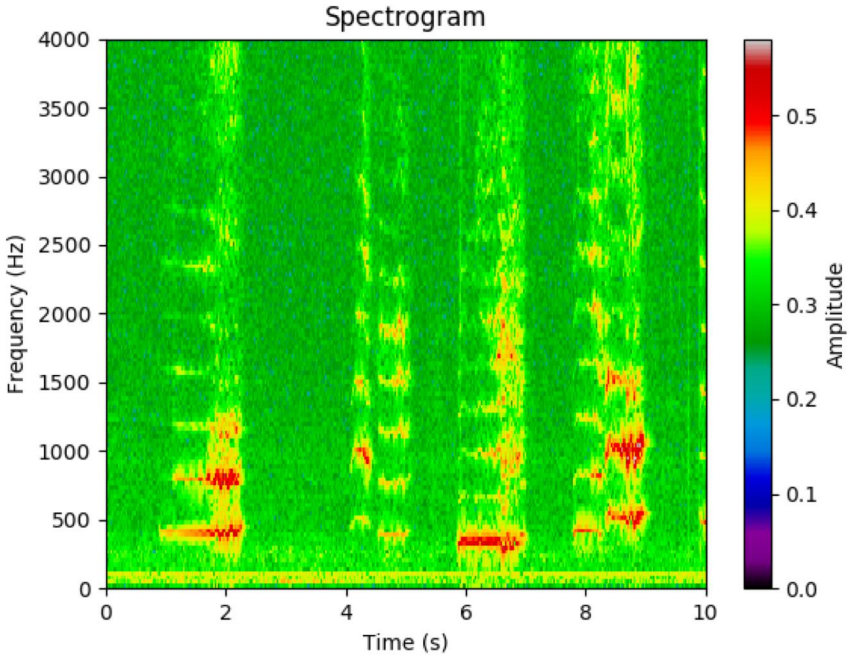
7. SoundSignature

Acoustic Fingerprint Extraction

Two components in spectrogram:

- Short duration transient noises;
- Background noise frequency spectrum.



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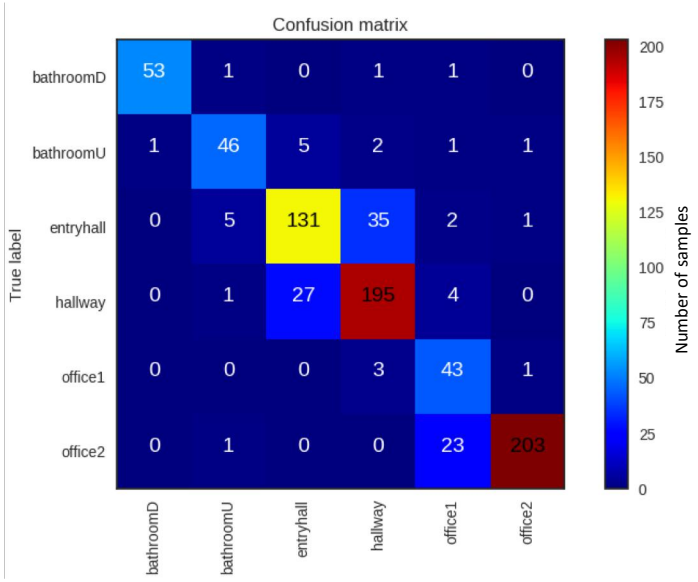
7. SoundSignature

Classification

For location between rooms:

- By applying SoundSignature algorithm, the achieved accuracy was 85,37%.



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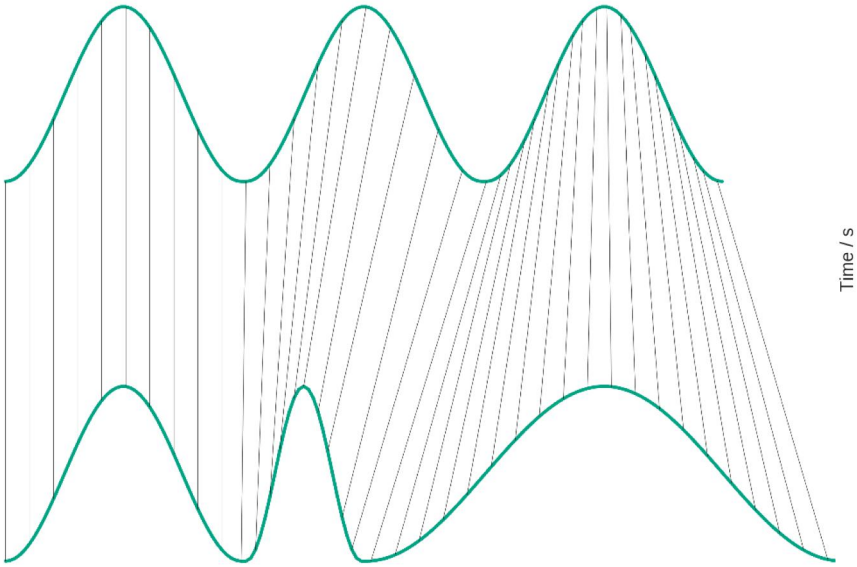
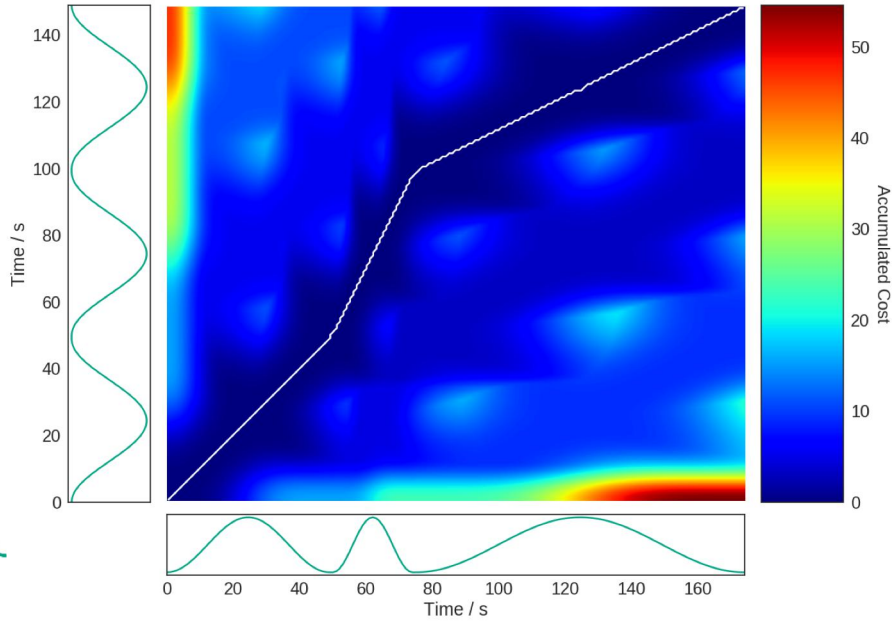
TIME SERIES DISTANCES

5. Time Series Distances

Dynamic Time Warping





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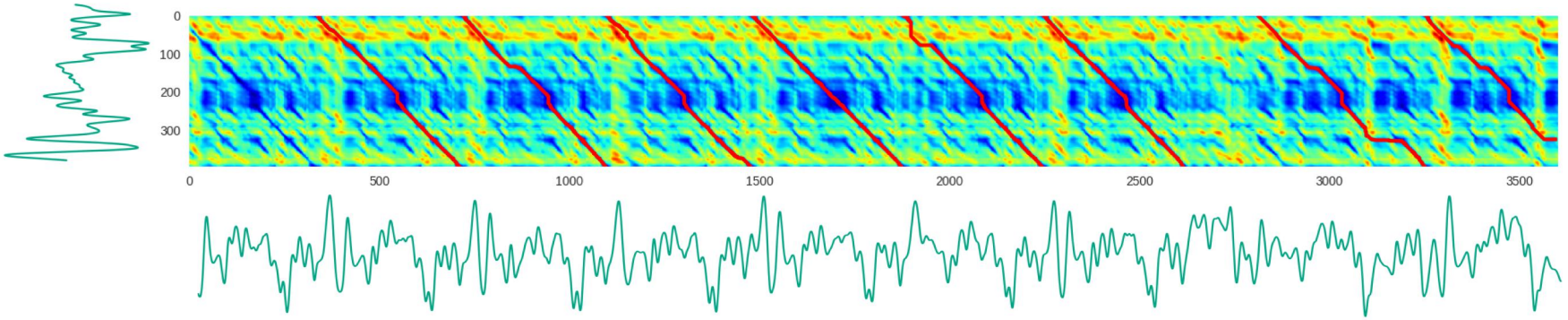
5. Time Series Distances

Robust query search on long-term time series

- Uses DTW to find all the occurrences of a given query in a long time series.
- The occurrences can be later described by their distance to the query



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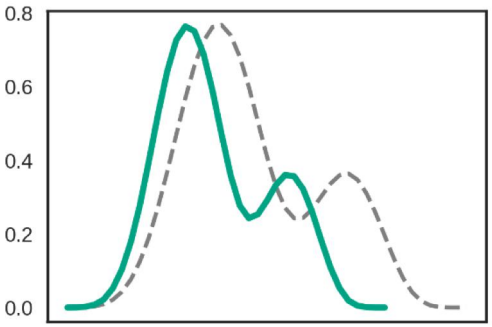
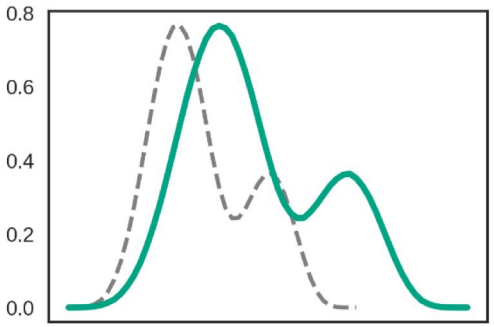
5. Time Series Distances

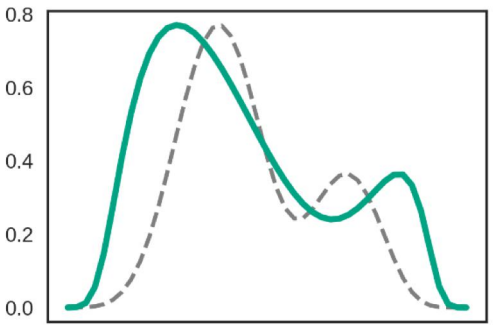
Time Alignment Measurement



DTW = 0 | TAM = 0.20



DTW = 0 | TAM = 0.29



DTW = 0 | TAM = 0.82

$$\Gamma = \overrightarrow{\psi} + \overleftarrow{\psi} + (1 - \overline{\psi}), \qquad \Gamma \in \{\mathbb{R}_0^+ | \Gamma \in [0:3]\}$$

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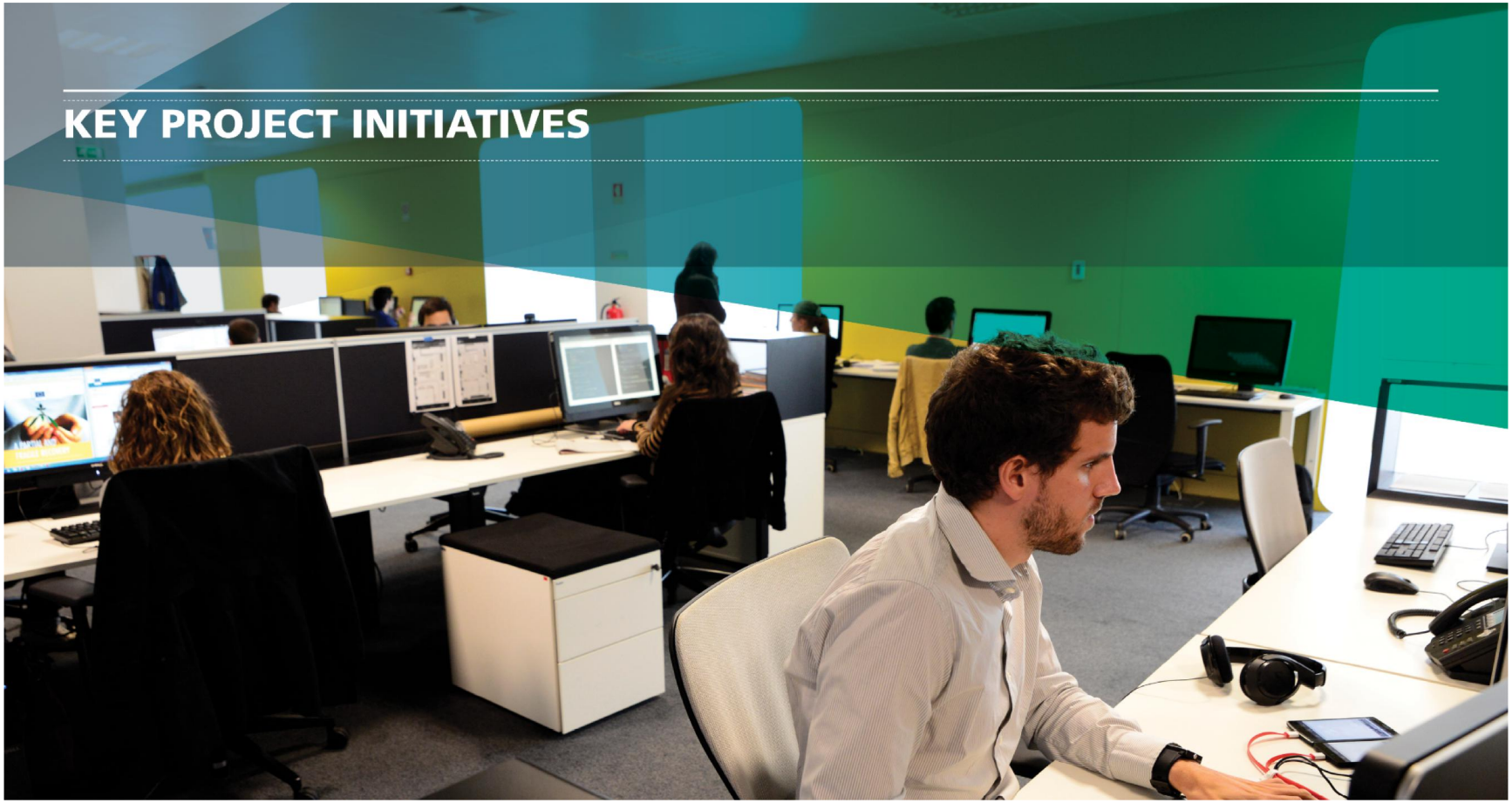

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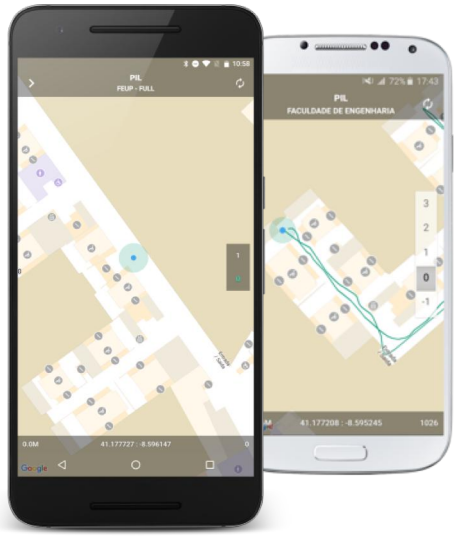
Key Project Initiatives – Ambient Assisted Living

PIL (Precise Indoor Location)

PRECISE INDOOR LOCATION



- A solution that allows **accurate indoor localization** using an existing smartphone;
- **Precise Indoor Location** relies on:
  - Human walking model-based **motion tracking** algorithms;
  - **Opportunistic sensing** of widely available signals and naturally occurring references (WiFi, magnetic fields, etc.).
- Targeted for **real usage scenarios** (pocket, in call, texting) and can be used in **different applications** (indoor navigation, emergency, user behaviour analysis, among others).

2nd place in the Microsoft Indoor Localization Competition – IPSN 2016

3rd place in the Microsoft Indoor Localization Competition – IPSN 2015

Co-funded by:
CCDRN Comissão de Coordenação e Desenvolvimento Regional do Norte
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PORTUGAL 2020
UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional

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Key Project Initiatives – Ambient Assisted Living

Fall Detect

- **Data from inertial sensors is analysed** using a state machine based on artificial intelligence to detect the fall signal pattern;
- When a fall is detected **an alarm with the user location** is sent to caregivers;
- Tested by the University of Maastricht and in long term field trials;
- Laboratory tests show fall detection **accuracy above 97%** for smartphones in pocket or belt.

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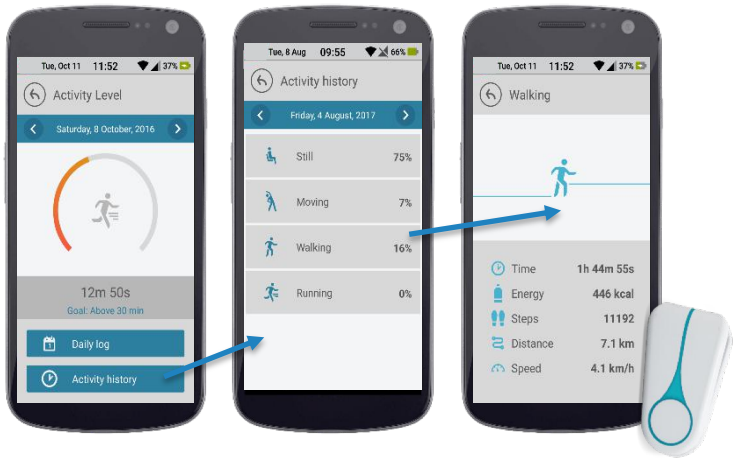
Key Project Initiatives – Ambient Assisted Living

Smart Companion

- Result of **internal research project**, already **licensed** to an industrial customer;
- Android customization for **ageing and elderly people**;
- **Highly simplified interface**, which allows it to be easily used and adopted by seniors;
- Includes many useful features, such as **medication reminders**, **pedestrian navigation**, **fall detection** and **fall risk evaluation**.



Excellent Smart Health Innovation Award with GoLivePhone in the AAL Forum 2015

2nd place in the Zon Prémio Criatividade 2011 Contest

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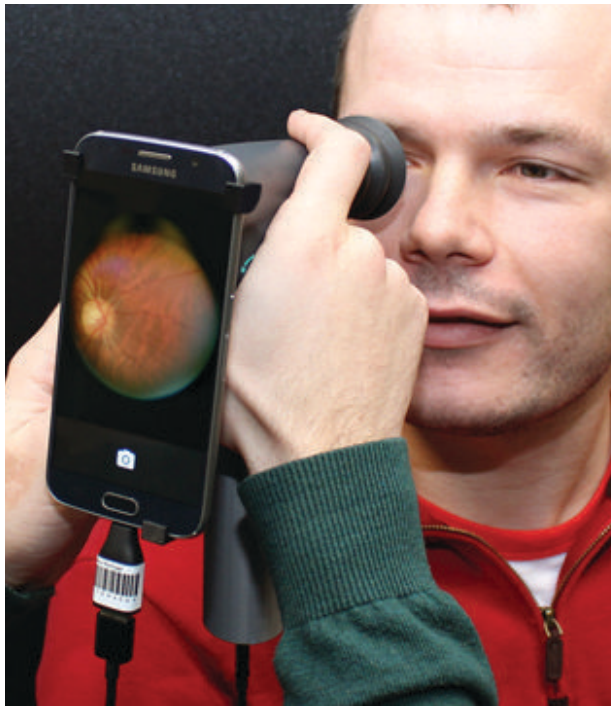
Key Project Initiatives – Ambient Assisted Living

EyeFundusScope

- A self-contained **mobile-based system** capable of **detecting** early signs of sight threatening **diabetic retinopathy** on retinal images acquired through an ophthalmoscopic adapter and a smartphone;
- Objectives:
  - Prevent loss of sight by early detection:
    - Disease shows **no signs until late stages**.
  - Decrease the burden in screening the diabetic population:
    - **>150.000 patients** in Northern Portugal alone.
  - **Empower non-experts** to acquire retinal images.



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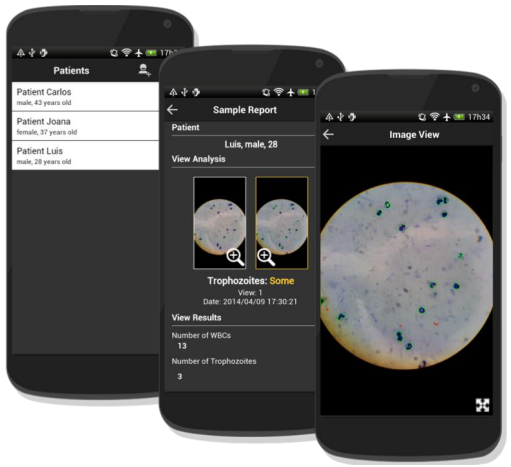
Key Project Initiatives – ICT4D

MalariaScope

- Perform automatic detection of malaria parasites using **image processing techniques and smartphones** (**cooperation** with the National Health Institute Dr. Ricardo Jorge);
- Develop a mobile-based solution for **pre-diagnosis of Malaria** in medically underserved areas;
- Create a **low cost alternative** to current microscopes;
- First triage framework to provide the **correct medication**.



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Key Project Initiatives – Ambient Assisted Living

Shopview2Market

ShopView

- Solution to **plan and control** shelf layouts:
  - **Virtual navigation** in retail **stores** for micro space control with **panoramic views**;
  - High quality photos in **fast motion**;
  - Automatic detection of **invalid labels** or **misplaced products**;
  - Notifications through **Web Services**.
- National and international **demonstrations** in real **operational environment**.

COMPETE

QREN Quadro de Referência Estratégico Nacional

União Europeia – Fundo Europeu de Desenvolvimento Regional

Sonae Companies Innovation Award 2015

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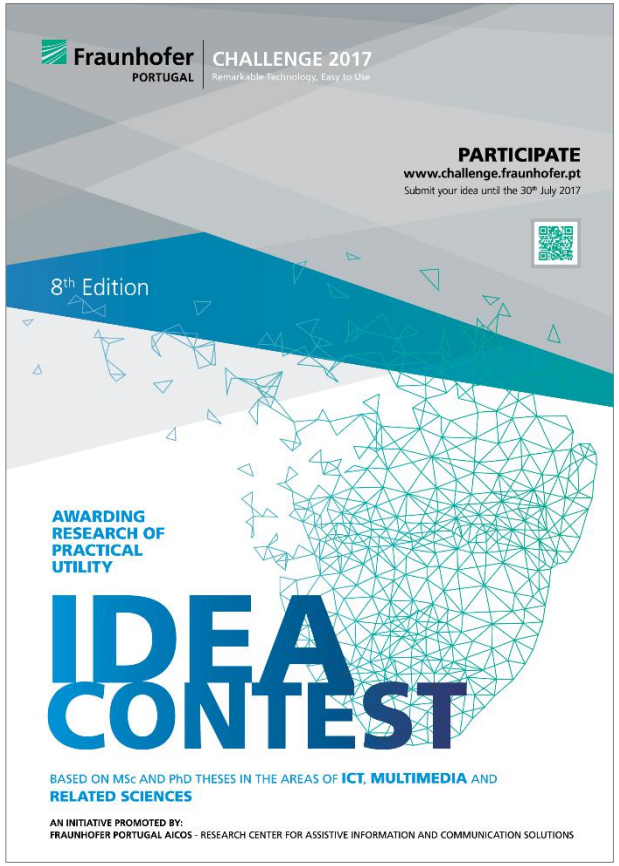
7. Fraunhofer Portugal AICOS

Fraunhofer Portugal Challenge | 8th Edition

- **Promote 'Research of Practical Utility'** Among Portuguese university students and researchers;
- **Idea contest for MSc and PhD Theses**

  Already on its 8th edition, the Challenge is based on MSc and PhD theses from Portuguese universities;
- **Scientific Prizes for the Best Ideas**

  Winning participants are awarded monetary prizes and get media coverage of their work.



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Fraunhofer Portugal AICOS

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