PHILHUMANS

Personal Health Interfaces Leveraging Human-Machine Natural interactions

an interdisciplinary training program for young researchers

European Industrial Doctorate Fellowship

Call for Application

DEADLINE: 1 of April 2019 – 17.00 CET

ESR1 - COMPUTATIONAL INTELLIGENCE FOR BEHAVIOR UNDERSTANDING

ESR2 - A CONVERSATIONAL AGENT AS A DIGITAL COUNSELLOR FOR AUTOMATED THERAPY

ESR3 – DEEP PROGRAM INDUCTION FOR PERSONAL HEALTH SERVICES

ESR4 – NLP, SEMANTICS AND SENTIMENT ANALYSIS FROM TEXT

ESR5 - SCENE UNDERSTANDING AND INTERACTION ANTICIPATION FROM FIRST PERSON VISION DATA

ESR6 - FACE ANALYSIS AND BODY LANGUAGE UNDERSTANDING FROM EGOCENTRIC CAMERAS

ESR7 - NATURAL LANGUAGE GENERATION FOR PERSONALIZED HEALTH COMMUNICATION

ESR8 - BUSINESS ECONOMICS AND ROBOTICS

BACKGROUND OF THE PHILHUMANS RESEARCH PROJECT

Eight industrial doctorate research fellowships are offered within the framework of **PHILHUMANS: Personal Health Interfaces Leveraging Human-MAchine Natural interactionS,** a project funded by the European Union's Horizon 2020 research & innovation programme under the Marie Skłodowska-Curie – ITN, Industrial Doctorate (GA n. 812882).

PHILHUMANS is an international, inter-sectoral, interdisciplinary project providing Marie Skłodowska-Curie PhD Fellowships to 8 Early Stage Researchers (ESRs), with the potential to become the leaders of tomorrow innovative Artificial Intelligence (AI) and establish user interaction with their personal health devices.

More specifically, the PHILHUMANS research program will investigate novel AI methods for human-machine interaction in the personal health domain through a well-designed and well-structured research training programme. It will require the creation of a blend of interdisciplinary understanding of personal digital assistant, cognitive computing, (deep) ML, (multilingual) NLP, advanced Computer Vision, Big Data, within the inter-sectoral academic, medical and industrial environment of the beneficiaries and partners.

The PhD students (also indicated as Early Stage Researchers- ESR) will collaborate within the PHILHUMANS ITN research program.

TRAINING AND MOBILITY

The project will offer an ambitious and innovative doctoral program for eight new PhD students, combining academic excellence with strong international business attitude, inspired to innovation-oriented mind-set.

PhD students will develop a completely new profile, based on a strong interdisciplinary attitude, integrating technical skills, socio-economic sciences' perspectives, creativity and entrepreneurial allure.

Mobility plays a central role in the programme: PhD students will follow a secondment scheme training them in academic institutions as well as companies, moving from analytics, business, security and privacy as well as between academic research and company based development projects (all PhD students are required to spend at least 50% of their time at non-academic institution, mainly at Philips' premises). Mobility periods are foreseen both in European countries. Indicative planned secondments for each PhD position are illustrated in the attachment.

The rotation of PhD students among the partners will bring PhD students to learn complementary techniques and methods, which will broaden their perspectives and capabilities, and enhance their career development.

POST DESCRIPTION

Number of available positions: 8 positions (ESR1, ESR2, ESR3, ESR4, ESR5, ESR6, ESR7, ESR8) as listed in the attachment.

Title: Marie-Sklodowska-Curie Doctoral Fellow

Hiring institutions and PhD Enrollment

ESR1 and ESR2 will be hired by Philips Electronics Nederland B.V. (the Netherlands);
ESR3 will be hired by TU/e (the Netherlands);
ESR4 will be hired by University of Cagliari (Italy)
ESR5 and ESR6 will be hired by the University of Catania (Italy)
ESR7 will be hired by University of Aberdeen (United Kingdom)
ESR8 will be hired by R2M solution (Spain)

PhD Enrollment: ESR1 and ESR7 will be enrolled at the Doctoral School of the University of Aberdeen, while ESR2, ESR4 and ESR8 will be enrolled at the Doctoral School of the University of Cagliari. ESR5 and ESR6 will be enrolled at the Doctoral School of the University of Catania.

DESCRIPTION OF HIRING INSTITUTIONS

Philips Research is the source of many advanced developments in Healthcare, Lifestyle and Technology. Royal Philips is a diversified health and well-being company, focused on improving people's lives through meaningful innovation in the areas of Healthcare and Consumer Lifestyle. The company is a leader in cardiac care, acute care and home healthcare. Philips posted 2015 sales of EUR 24.2 billion and employs approximately 113,000 employees with sales and services in more than 100 countries. Philips Research Laboratories in Eindhoven, which are part of the Philips Group Innovation, employs approximately 1000 researchers. Within Philips Research Eindhoven work is carried in two programs aligned with Philips businesses: healthcare and consumer lifestyle. Data driven research and service orientation is common for both programs. Philips Research Eindhoven is involved in many research projects in this domain, both internal for Philips businesses as external. Philips Research is very active in partnering with universities and currently has more than 70 PhD students working in several flagship programs with different universities.

Technische Universiteit Eindhoven
Eindhoven University of Technology (TU/e) is a leading, research driven, and design oriented university of technology. The participating Department of Mathematics and Computer Science is a place that brings motivated students, lecturers and researchers together. It offers a varied study program that provides students with a wide range of options to choose from. It carries out world-class research in the fields of Data Science, Software & Systems, Computational Science and Fundamental Mathematics and Computer Science. TU/e is privileged to form part of Brainport, the world's smartest region, and it maintains good contacts with the regional business community and authorities. Thanks to these collaborative partnerships, TU/e offers exceptional future prospects to all who collaborate with.

University of Cagliari
The University of Cagliari (UNICA) is the biggest university of its region, Sardinia, and was founded in 1606. It consists of 11 faculties and 16 departments, which are organizational structures devoted to carrying out scientific research, teaching and other related activities that serve the surrounding area. In this project, the University of Cagliari participates with the Department of Mathematics and Computer Science (DMI). The DMI has 43 people in its teaching staff (8 full, 15 associate, 14 assistants, 6 temporary assistant professors). The Department includes several laboratories (robotics, semantic web (http://swlab.unica.it/), computer vision, big data) and equipment for research activities. The Department provides courses to 22 Degree Programs at the University of Cagliari (both bachelor and master). The Department has also an Administrative Secretariat consisting of an Administrative Officer and two collaborators.

University of Catania
The Department of Mathematics and Computer Science (DMI) of the University of Catania (UNICT) has more than 75 researchers among Professors and Assistant Professors. The Department is promoting and coordinating researchers in the areas of Pure and Applied Mathematics, and Computer Science. It offers PhD programs both in Mathematics and Computer Science. The laboratory which will be involved in PhilHumans project is the Image Processing Laboratory (IPLAB – http://iplab.dmi.unict.it). IPLAB is part of the Department of Mathematics and Computer Science and leading the areas of Image Processing, Computer Vision, Machine Learning and Computer Graphics. The laboratory was established in 2005 and currently employs 21 researchers: 2 Full Professors, 1 Associate Professor, 1 Tenure Track Assistant Professor, 3 PostDoc, 14 Ph.D. Students. The research group has strong collaboration with industries leader in the field of expertise of the Image Processing Laboratory. The group has published more than 300 papers on topics related to the mentioned disciplines and 25 Patents. IPLAB has been involved in different international projects for the development of advanced algorithms with applications in different domains: embedded, mobile and wearable devices, first person (egocentric) vision (http://iplab.dmi.unict.it/fpv/), assistive and quality of life, forensics, medical, cultural heritage. It has established a number of international relationship with academic/industrial partners for research purposes. The IPLAB Research Group is one of the main organizers of the International Computer Vision Summer School (http://www.dmi.unict.it/icvss) and of the Medical Imaging Summer School (http://www.dmi.unict.it/miss).

University of Aberdeen
The University of Aberdeen is a research intensive university which was founded in 1495. It is ranked 159 in the QS World University Rankings. Aberdeen's Department of Computing Science focuses on applications of Artificial Intelligence, and has one of the world's strongest research groups in Natural Language Generation (NLG). In addition to numerous research outputs, this group has worked with many companies, and has spun out Arria NLG, which today is one of the world's leading NLG companies. One of the group's current research priorities is to understand how NLG and AI technology can be used to encourage safer and healthier behavior, in areas such as driving, diet, exercise, and mental health.

R2M solution
R2M Solution is an integrated and multi-disciplinary entrepreneurial innovation company that aggressively targets filling the gap between research activities and market implementation across the fields of Innovation, Engineering, Energy Services & Sustainability and ICT/Automation. R2M is a strategic innovator itself and as part of its business model helps organizations and projects plan and execute the strategic use research funding carried out over a comprehensive development strategy from idea to market. In doing so, R2M provides leadership, links high performance exploitation oriented networks, and leverages public and private funding instruments.

Duration of the employment: expected start date 1 of June 2019, duration 36 months.

Income

Stage	Gross Salary (without family)	Gross Salary (with family)
ESR	€39,000 p.a.	€44,000 p.a.

Note: figures for indication only, country correction factors apply as per MSCA rules

Benefits
600€ Mobility Allowance per month (7200€ / year)
500€ Family Allowance per month (6000€ / year) - When applicable according to the Marie Skłodowska-Curie.

Note: this is a gross EU contribution to the salary cost of the researcher. The net salary will result from deducting all compulsory (employer/employee) national social security contributions as well as direct taxes

CAREER DEVELOPMENT PROSPECTS

ESRs will gain highly valuable research skills, linked to disruptive and innovative technology for AI-assisted human-machines interfaces, employing language technology, cognitive computing, computer vision, and machine learning (ML). Fellows will be also provided with transversal skills (IPRs, grant application, etc.) and with the capacity to conduct their specific research according to an **interdisciplinary approach and to create innovation**. This combination of skills will increase their attractiveness for both academic and business sector. Moreover, exposure to the Chinese context and enhanced capacity to create business/research relationships will make all ESRs.

NON-DISCRIMINATION

Philips has adopted family friendly policies as part of its equal opportunities policies for male and female employees. The ESRs will be located at the Philips premises at the High Tech Campus in Eindhoven, with the following facilities at hand:
- Dedicated breast feeding rooms in every building
- On-site day care facilities for young children
- An international school, within 5 kilometers of the High Tech Campus

ELIGIBILITY CRITERIA

Degree: Master degree or equivalent providing access to PhD programs. See attachment for required degree for each position.

Language: English proficiency must be attested either through a previous English language diploma, or an internationally recognized proficiency test (at least C1 level of the Common European Framework of Reference for Languages i.e. IELTS, IBT, TOEFL or Cambridge).

Career: When starting their contract (June 2019), selected researchers should be within the first four years of their careers. This means being both within a four years window following their most recent graduation and not having been awarded a prior doctoral degree so far.

Mobility: At the time of recruitment, the researcher must not have resided, or carried out his/her activity in the country of the hiring institution for more than 12 months in the 3 years prior to recruitment date.

Application: Complete and timely submission exclusively via the PHILHUMANS on-line application system. Documents submitted must be in English. If supporting documents (e.g. letters of academic references and scan of degree qualification) are not in English, they must be submitted together with a certified translation in English).

Please note that, in addition to the above mentioned eligibility criteria further essential or desirable requirements are detailed for each PhD position (see attachment).

HOW TO APPLY

The hiring process will be managed by the partner's own HR departments. Candidates can apply through the PHILHUMANS website (https://www.philhumans.eu/), via the EU portal or via local partner recruitment channels. The selected candidates will be invited to apply for the position through the partner organization that is in charge for hiring the candidate. Applications must be sent exclusively in English.

Candidates will be requested to provide the following information:

1. a complete CV in Euro pass Format in English that must highlight activities and place where the activities have been carried out in order to give evidence of fulfilling the mobility eligibility criterion (see above). Use the template available at
   https://europass.cedefop.europa.eu/it/documents/curriculum-vitae/templates-instructions
2. a complete academic CV in English with references to past research and training experiences;

3. a motivation letter, in English, highlighting the consistency between the candidate 's profile and the chosen ESR position for which they are applying;
4. at least 2 references (could be also a reference letter which should then be in English or in certified translation)
5. scan of the degree qualification, with certified translation in English (if the degree qualification is not in English).
6. scanned copy of valid identification document (identity card or passport)
7. Declaration of Honour according to the template available in the website.
8. (OPTIONAL) any further and relevant supporting documents (e.g. research publications).

Candidates possessing the relevant requirements, may opt for applying for one or more positions. If candidates apply for more than one position they are required to submit one application for each position.

INTENDED TIMING OF SELECTION PHASE

- **By 1st April 2019** Candidates must apply by submitting required documents through the PHILHUMANS online application system available at www.philhumans.eu
- **By 19th April 2019** Shortlisted candidates will be invited to submit to a interview (also via videoconference) with their supervisory team.
- **By 30th April 2019** Shortlisted candidates will be informed about final decision.
- **15th May 2019** Selected candidates will have to confirm in writing their decision to accept the offered position, otherwise they will lose the position and the following candidate in the ranking list will be recruited.
- **Within May 2019** Selected candidates will be recruited by hiring institutions.
- **Within June 2019** employment contracts will start**.**

SELECTION CRITERIA

All eligible applications will be assessed by a Selection panel according to the following criteria:

Selection criteria for the admission to the shortlist	Score
Qualifications and previous experience:	**0-50,0**
A. Master degree in the scientific field relevant to the project	
B. Other qualifications relevant to project/area, incl. letter of references	
C. Authorship of research outputs	
D. Previous experience of research in specific project area	
Total maximum score to be assigned	**50,0**

Candidates will be ranked for each foreseen position they have applied to. The threshold to be shortlisted is 35. If candidates have been awarded with the same score, priority will be based on scores for the sub criterion B "Other qualifications relevant to project/area, incl. letter of references".

For each position, up to 5 candidates awarded with the highest scores in the ranking list will be invited for an interview. The interview may be conducted also using a videoconference system.

During the interview the candidates will be evaluated according to the following criterion "Research abilities and personal skills".

Selection criteria of shortlisted candidates	Score
Research abilities and Personal skills:	**0-50,0**
1. Abilities to design, conduct and project manage original research in the subject area; 2. Ability in relevant research methods 3. Other relevant skills specific to project, including industry experience	
4. Excellent oral communication in English, including the ability to communicate complex subject orally 5. Good communication and interpersonal skills	
6. attitude of a natural team player and capability to work in an international research group 7. Enthusiasm, proactivity, creativity and commitment	
Total maximum score to be assigned	**50,0**

For each position the final ranking list will be obtained by adding the score obtained by the shortlisted candidate according to the criterion "Qualifications and previous experience" with the score obtained after the interview assessment according to the criterion B "Research abilities and personal skills". When scores are equal, priority will be based on scores for the sub criterion 3 "Other relevant skills specific to project, including industry experience".

The selection panel (supervisors) will assess the profile of each candidate according to the above mentioned criteria; In case a candidate will not reach a minimum score of 35 points out of 50 points on the criterion "Research abilities and personal skills", the selection panel has the right to not proceed with recruitment.

CONTACT: Enquiries can be sent to the relevant project supervisor(s) via email.

ATTACHMENT - DESCRIPTION OF EACH ESR POSITION

ESR1 - COMPUTATIONAL INTELLIGENCE FOR BEHAVIOR UNDERSTANDING

ESR2 - A CONVERSATIONAL AGENT AS A DIGITAL COUNSELLOR FOR AUTOMATED THERAPY

ESR3 - DEEP PROGRAM INDUCTION FOR PERSONAL HEALTH SERVICES

ESR4 - NLP, SEMANTICS AND SENTIMENT ANALYSIS FROM TEXT

ESR5 - SCENE UNDERSTANDING AND INTERACTION ANTICIPATION FROM FIRST PERSON VISION DATA

ESR6 - FACE ANALYSIS AND BODY LANGUAGE UNDERSTANDING FROM EGOCENTRIC CAMERAS

ESR7 – NATURAL LANGUAGE GENERATION FOR PERSONALIZED HEALTH COMMUNICATION

ESR8 – BUSINESS ECONOMICS AND ROBOTICS

ESR1 - COMPUTATIONAL INTELLIGENCE FOR BEHAVIOR UNDERSTANDING

HIRING INSTITUTION: Philips Electronics Nederland B.V. (the Netherlands)
PHD ENROLLMENT: PhD position in Computer Science at the University of Aberdeen (Doctoral School Aberdeen) (UK, https://www.abdn.ac.uk/)

YOUR TEAM

You will work in the Data Science department of Philips Research Europe.

GOAL

The goal of this work will be to help a person to improve the daily behaviour, or learn to use a new product or service, to reach a better health status through interaction with the service. The system has to understand the current lifestyle and behaviours of the user to be able to address them in the content. In addition, the content should be relevant for the user and the goals of the service. The main focus of the ERS will be model-based automatic discovery of insights that relate to actionable factors that can be influenced by the subject. For example, the sleep patterns of an infant should be considered in the context of the lifestyle of the rest of the family. The discovery of this kind of insights require a holistic model of the baby sleep in the family context.

ESR ACTIVITIES

• Gain generic knowledge and data representations for the lifestyle, behaviours, and their effects to the expected health outcomes;
• Integrate categorical knowledge, clinical guidelines, and statistics of sensor data into the same modelling framework;
• Optimise multi-objective techniques for the selection of simultaneously statistically significant, clinically meaningful, and actionable insights;
• Perform probabilistic insight mining techniques for comparing complex statistics;
• Integrate of individual insights into longitudinal narratives using graph-based chaining, and into summaries using NLG techniques;
• Perform proof of concept demonstrations in concrete use cases.

EXPECTED RESULTS

The result of this ERS project will be new computational technology for model-based data mining applicable for all interactive health and wellness services. The understanding of the behavior requires semantic and statistical modelling of the lifestyle and health status of the individual in the context of social, economic, environmental, and cultural structure around the individual. In some parts it is possible to reuse existing resources. In the modelling of the health effects, for example, some results of the Virtual Physiological Human (VPH) initiative of EU may be applicable.

INDICATIVE PLANNED SECONDMENTS- *Institution, place and timing expressed in contract month (M)*

Host	Timing	Length	Purpose
UNICT	M12	1–2 weeks	Training on advanced machine learning algorithms
UNICA	M17	1–2 weeks	Training on natural language processing tools in healthcare
R2M	M28	1–2 weeks	Training on Exploitation and Dissemination of Results

SUPERVISORS:

Ehud Reiter (UNIABDN) Aki Harma (PHILIPS), Rim Helaoui(PHILIPS)

ADDITIONAL ESSENTIAL REQUIREMENTS:

– Master degree in Computer Science, Information Engineering (or equivalent). A degree with distinction (cum laude) is an advantage;

ESR2 - A CONVERSATIONAL AGENT AS A DIGITAL COUNSELLOR FOR AUTOMATED THERAPY

HIRING INSTITUTION: Philips Electronics Nederland B.V. (the Netherlands)
PHD ENROLLMENT: Doctoral School of the University of Cagliari

YOUR TEAM

You will work in the Brain, Behavior and Cognition department of Philips Research Europe.

GOAL

The goal of this thesis is to design and implement a conversational agent that can act as an automated therapeutic assistant based on best practices in human-human health communication. The agent's goal would be to deliver automated behaviour change counselling interventions for a particular health problem such as smoking cessation to help promote the user's health status and prevent adverse consequences of their status quo. The agent can be linked to other interaction interfaces beyond speech to enhance the intervention content and tailor it to the user's lifestyle, feelings, preferences and context. Examples of such additional interfaces are context-acquisition sensors (wearable physiological/ activity sensors, cameras, environmental sensors)

ESR ACTIVITIES

• Acquire and pre-process conversational databases for the selected application domain(s);
• Identify key features in the user's interaction (speech and beyond), conversation flow and common topics relevant for driving the counselling dialogue conversation in a particular direction;
• Conceptualize characteristics and their relationships in a computational model;
• Set requirements and testing of the NLP/G technology from ROs 1&2 including other state of the art techniques such as topic modelling;
• Develop a hybrid computational model & logic for conversation management;
• Develop a learning system that adapts and optimizes the conversational logic based on the conversational data with the user over time;
• Test conversational models in real application cases (with volunteers/patients);
• Investigate the dynamics between the different counselling techniques and components integrated on one hand and the success and quality of the conversation on the other.

EXPECTED RESULTS

The result of this ESRs project will be an intelligent agent that combines novel approaches over different AI subfields such as computational linguistics, knowledge representation and reasoning, and ML. The resulting framework requires interdisciplinary contributions including formalizing counselling know-how, NLP/G technologies and statistical-relational learning and reasoning approaches. Adopting a hybrid nature, the system will allow the integration of different paradigms (i.e. data-driven and knowledge-based) into one unified framework. Both domain knowledge and data collection play a crucial role in the design and implementation of the computational logic driving the agent.

INDICATIVE PLANNED SECONDMENTS- *Institution, place and timing expressed in contract month (M)*

Host	Timing	Length	Purpose
TILBURG	M12	1–2 weeks	Training on natural language generation tools in healthcare
UP13	M17	1–2 weeks	Get acquainted with tools and models for semantic sentiment analysis
R2M	M28	1-2 weeks	Training on Exploitation and Dissemination of Results

SUPERVISORS:
Diego Reforgiato Recupero (UNICA), Daniele Riboni (UNICA), Rim Helaoui (PHILIPS), Arlette van Wissen (PHILIPS)

ADDITIONAL ESSENTIAL REQUIREMENTS: Master degree in Computer Science, Information Engineering (or equivalent). A degree with distinction (cum laude) is an advantage;

ESR3 – DEEP PROGRAM INDUCTION FOR PERSONAL HEALTH SERVICES

HIRING INSTITUTION: Technische Universiteit Eindhoven
PHD ENROLLMENT: Doctoral School of Technische Universiteit Eindhoven

YOUR TEAM

You will work in the Security and Embedded Networked Systems department of the Technical University Eindhoven.

GOAL

A personal health service, for example, in a smartphone app, helps a user to follow a care program or adopt healthier behaviors to reach certain health benefits. Typical examples are interactive self-management services for fitness or maternity, or apps and dialog systems for chronic disease management or substance abuse. A program should be engaging, lead to the target results as safely, efficiently, and conveniently as possible, and adapt to any changes on the way. Designing software that optimally meets all these goals has turned out to be very difficult.

One of the growing areas of computational intelligence is automatic programming, where a learning algorithm produces software that is executable, for example, in an *abstract machine*, which is a mathematical model of a computer. The abstract machine may be a universal computer or a specific sequential machine with limited functionality. The program may be learned from data (program induction) or generated based a high-level specification of the goals (program synthesis). The optimization of the program uses the knowledge that is inserted into and accumulated by the system during the operation. Program synthesis has been popular in automatic game playing and robotics. In the PhD project the goal is to develop program induction/synthesis technology for health services based on deep learning techniques. A successful candidate should have a strong background in machine learning and computer science, and good skills in programming (Python, Java).

ESR ACTIVITIES & RESULTS

The fellow will build on several interconnected competences including automata theory, machine learning, statistics, probability models, and pattern recognition.

- Develop computable models of goal-oriented interactive health self-management systems;
- Develop hands-on experience with ML, data analysis, and optimization techniques for personal health applications and services containing sensor data, natural language content, and user interaction data;
- Acquire an in-depth understanding of the state-of-the-art ML techniques for Neural Abstract Machines (NAS) and program induction;
- Create novel computational methods that combine data-driven and knowledge-driven approaches and validating them in concrete personal health propositions;
- Explore, experiment and pilot project concepts creation for personal health

INDICATIVE PLANNED SECONDMENTS- *Institution, place and timing expressed in contract month (M)*

Host	Timing	Length	Purpose
NUI GALWAY	M9	1–2 weeks	Training on big data in healthcare
UNICT	M12	1–2 weeks	Training on advanced machine learning algorithms
FBK	M25	1–2 weeks	Training on cognitive computing technology
R2M	M28	1-2 weeks	Training on Exploitation and Dissemination of Results

SUPERVISORS:

Milan Petkovic (TU/e), Aki Harma (PHILIPS), Diego Reforgiato Recupero (UNICA)

ADDITIONAL ESSENTIAL REQUIREMENTS: Master degree in Computer Science, Information Engineering (or equivalent). A degree with distinction (cum laude) is an advantage

ESR4 - NLP, SEMANTICS AND SENTIMENT ANALYSIS FROM TEXT

HIRING INSTITUTION: Doctoral School of the University of Cagliari

PHD ENROLLMENT: Doctoral School of the University of Cagliari

YOUR TEAM

You will work in the Department of Mathematics and Computer Science of the University of Cagliari

GOAL

The overall goal of this thesis is to identify and understand the personal health of the user from the emotions expressed along the text or said from speech, for example in applications in Mother&Child care and healthy-living and assisted care. We aim at: (i) using ontology of personal health terms which includes terms related to body organs, symptoms, treatment, medical professional designations; (ii) using lexical and semantic resources to identify terms that hold only health-related meaning and more ambiguous terms; (iii) leveraging NLP services defined within RO1 and semantics to come up with a system for emotion detection and associated REST APIs. For such a research objective, NLP techniques and tools will be analysed to detect those that can be applied to the Sentiment Analysis problem in personal health. Supervised and unsupervised approaches will be identified to have a clear overview of the current state of art. Then, lexical resources and frameworks such as (not limited to) FrameNet, SentiWordNet, WordNet, VerbNet, FrameBase, BabelNet, FRED, FrameSter will be taken into account with the purpose of defining a multi-disciplinary approach to sentiment analysis at the cross-roads between affective computing and common sense computing focused in personal health. The overall goal is to better recognize, interpret and process opinions and sentiment out of a text document or speech of a certain user within the personal health domain.

ESR ACTIVITIES & RESULTS

• To bridge the semantic gap between word-level natural language data and the concept-level opinions conveyed by these so as to provide a more efficient passage from unstructured textual information to structured machine-processable data. For such a purpose, model ontologies (especially the existing ones in personal health domain) will be defined and developed using best practices of Semantic Web.
• Identify the opinions (statement by somebody, called the holder), the opinion holders, and facts/topics (e.g. ailment, treatment, medications, and other topics within the personal health domain) where the opinions are expressed on by representing the semantics of a sentence and modelling the roles played by its elements with respect to a model of opinion sentences.
• Defining a new Semantic Role Labelling exploiting new lexical and semantic resources in personal health context.
• Build a new emotion detection system focused in personal health on top of SENTILO, a Sentiment Analysis system that we recently built, http://wit.istc.cnr.it/stlab-tools/sentilo/service, that performs sentence-based sentiment analysis and relies on FRED, a machine reader for the Semantic Web. FRED relies on Combinatory Categorial Grammar, Discourse Representation Theory, Frame Semantics (e.g. Semantic Role Labelling), and Ontology Design Patterns and performs Named Entity Resolution, Coreference Resolution, Word Sense Disambiguation.
• Creation of new lexical resources for Sentiment Analysis (e.g. annotated dataset, word embeddings within the health domain, etc.)
• Provision of REST services for the provided Emotion detection system.

INDICATIVE PLANNED SECONDMENTS- *Institution, place and timing expressed in contract month (M)*

Host	Timing	Length	Purpose
NUI GALWAY	M9	1–2 weeks	Training on big data in healthcare

UP13	M12	1–2 weeks	Get acquainted with tools and models for semantic sentiment analysis
FBK	M25	1–2 weeks	Training on cognitive computing technology
R2M	M28	1–2 weeks	Training on Exploitation and Dissemination of Results

Principal Investigator: Prof. Diego Reforgiato Recupero, (UNICA)
Academic PhD Supervisor: Diego Reforgiato Recupero (UNICA)
Academic PhD co-Supervisor: Daniele Riboni (UNICA)
Industrial PhD Supervisor: Rim Helaoui (PHILIPS)
Industrial PhD co-Supervisor: Aki Harma (PHILIPS)

Online Application: https://www.philhumans.eu/esrs/esr-4/

Main contact: Prof. Diego Reforgiato Recupero
Email: diego.reforgiato@unica.it

ESSENTIAL REQUIREMENTS

Degree in Computer Science, Information Engineering (or equivalent).

ADDITIONAL ESSENTIAL REQUIREMENTS:

– A degree with distinction (cum laude) is an advantage;
– Prior knowledge in Machine Learning and Deep Learning is an advantage;
– Prior publications at international conferences or journals are desirable;
– Ability to program in Python is an advantage;
– Communication skill and team play are desirable.

ESR5 - SCENE UNDERSTANDING AND INTERACTION ANTICIPATION FROM FIRST PERSON VISION DATA

HIRING INSTITUTION: University of Catania
PHD ENROLLMENT: Doctoral School in Computer Science of the university of Catania

YOUR TEAM

You will work at the Department of Mathematics and Computer Science of the University of Catania

OBJECTIVES

The objective of this project is to design and develop algorithms to allow a First Person Vision System to observe the scene from the point of view of the user in order to understand and anticipate the location or context in which the user is operating, the object he is interacting with and the action he performs. These algorithms can be exploited to support people with cognitive decline or disabilities (e.g., people with Alzheimer's disease) for memory augmentation purposes (e.g., showing a video on how to use an object after the recognition of the object) or to make summaries (e.g., albums) of the acquired first person videos for personalised health (e.g., build a short video summary of a mother during pregnancy in different time instants, or build mother and baby journey albums). Moreover, the inferred information can be exploited by an external agent, e.g., a robot, to make decisions and assist the user during daily activities. Specifically, the

ESR ACTIVITIES AND RESULTS

- localization and context identification, i.e., recognizing the location in which the user is operating;
- object recognition and object-interaction anticipation, i.e., recognizing the object the user is interacting with and anticipating user-object interactions:
- recognition and prediction of actions, i.e., recognizing the actions performed by the user and anticipate future actions.
- To allow for the construction of innovative techniques for scene understanding and interaction anticipation from First Person Vision data, the PhD fellow will first research the state of the art techniques related to the objectives of the project. This process will also require the acquisition of basic knowledge on Computer Vision and ML technologies such as: 3D reconstruction and Deep Learning based techniques. The production of a survey of the related state of the art is expected within the first year of the PhD programme;
- The ESR fellow will research and study the publicly available datasets which could be useful for the intended research and highlight whether the available material is sufficient to carry out each aspect of the planned research. If the available data is deemed to be insufficient to cover some aspects of the research, the acquisition of new datasets will be planned and carried out. The expected output of this process is the construction of a repository of existing or new data. All collected data will be documented to facilitate future research;
- The ESR fellow will investigate and develop algorithms to localize the user and recognize the context in which he is operating. The level according to which such location aware algorithms need to be developed will be studied keeping in mind the use-cases related to the project. The output consists in the definition of a set of algorithmic tools useful to implement the needed degree of location awareness to the developed First Person Vision system;
- The ESR fellow will investigate algorithms for object detection from First Person Visual data, as well as algorithms to anticipate (i.e., detect before they occur) the object the user is going to interact with. This will allow an external agent, e.g., a robot, to know in advance which objects the user is going to interact with in order to make decisions and plan its reaction;
- The ESR fellow will investigate algorithms to recognize the actions performed by the user and anticipate them (i.e., detecting actions before they are performed) will also be developed. Such algorithms will

allow an external agent, e.g. a robot, to anticipate the user's intention to help the user accomplishing a goal, send alarms in the case of missing actions or prevent a dangerous action to be performed;

- The results of the research will be disseminated in international conferences and journals in order to foster research in the area and facilitate the advancement of the field. Patents on the innovative algorithms will be considered together with the other partners.

INDICATIVE PLANNED SECONDMENTS- *Institution, place and timing expressed in contract month (M)*

Host	Timing	Length	Purpose
TU/d	M9	1-2 weeks	Training on Computer Vision and Machine Learning for Embedded Systems
ESSEX	M12	1-2 weeks	Training on Active Egocentric Vision Models
PHILIPS	M25	1–2 weeks	Training on virtual reality and social face perception
R2M	M28	1–2 weeks	Training on Exploitation and Dissemination of Results

Principal Investigator: Prof. Giovanni Maria Farinella, UNICT

Academic PhD Supervisor: Giovanni Maria Farinella (UNICT)

Academic PhD Co-Supervisor: Sebastiano Battiato (UNICT)

Industrial PhD Supervisor: Dimitrios Mavroeidis (PHILIPS)

Online Application: https://www.philhumans.eu/esrs/esr-5/

Main Contact: Prof. Giovanni Maria Farinella

Email: gfarinella@dmi.unict.it

ADDITIONAL ESSENTIAL REQUIREMENTS:

– Master degree in Computer Science, Information Engineering (or equivalent). A degree with distinction (cum laude) is an advantage;
– Prior knowledge in Computer Vision, Machine Learning and Deep Learning is an advantage;
– Prior publications at international conferences or journals are desirable;
– Ability to program in Python is an advantage;
– Communication skill and team play are desirable.

ESR6 - FACE ANALYSIS AND BODY LANGUAGE UNDERSTANDING FROM EGOCENTRIC CAMERAS

HIRING INSTITUTION: University of Catania
PHD ENROLLMENT: Doctoral School in Computer Science of the university of Catania

YOUR TEAM

You will work at the Department of Mathematics and Computer Science of the University of Catania

OBJECTIVES

The objective of this project is to develop algorithms to enable a mobile egocentric vision system on board to an agent, e.g., a robot, to observe the user during a conversation and infer socially-relevant information which could help improve human-machine interaction. The developed algorithms can be useful to support the users during daily activities and to build short video summaries of the days (e.g., of a mother during pregnancy) to support further analysis by experts (e.g., doctors) for personalised health. Among the other sources of information, attention will also be paid to speech analysis. The algorithms will be able to infer age, gender and emotions of the user, as well as to estimate his pose and understand his body language. Among the others, information obtained by First Person Vision Systems worn by a user will be considered as external source data to make more accurate inferences.

ESR ACTIVITIES
• Face analysis: this includes face detection, extraction of facial landmark points, face recognition, and estimation of soft biometrics i.e. as age and gender;
• Body language understanding: this includes inferring the pose of user and building a biometric body signature (e.g., to identify user from his movements);
• Speech analysis: this includes the identification of emotions and the semantic topic of conversation from speech analysis;

EXPECTED RESULTS
• The ESR fellow will study the state of the art of the algorithms related to project objectives. This will require the acquisition of basic knowledge of Computer Vision, ML and Data Mining. This will allow the production of a survey identifying the state of the art technologies, as well as directions for future research;
• The ESR fellow will study the datasets already available to the public useful for the research and survey the characteristics needed to acquire new domain-specific data. All the data will be collected in a repository, which will be documented in order to be available for future research;
• Techniques for face analysis will be investigated. Such techniques include algorithms to detect face, extract facial landmark points and perform face recognition. As a form of soft biometric, algorithms to estimate age and gender of the user will also be investigated;
• The ESR fellow will investigate and develop algorithms for body language understanding. This includes techniques to infer the pose of the user and to build a biometric body signature useful to identify the user from the way he moves;
• Speech analysis will also be investigated to identify emotions and infer the semantic topic of conversation;
• Data fusion techniques will be investigated to consider external data sources (e.g., provided by a first person vision worn by a user) during the inferences;
• A number of personal health applications will be exploited, with emphasis to Mother&Child care, healthy-living and assisted care.
The research project will also produce high quality scientific publication in international conferences and journals.

INDICATIVE PLANNED SECONDMENTS- *Institution, place and timing expressed in contract month (M)*

Host	Timing	Length	Purpose
TU/d	M9	1-2 weeks	Training on Computer Vision and Machine Learning for Embedded Systems
ESSEX	M12	1-2 weeks	Training on models for Human-Robot Collaboration and Interaction
PHILIPS	M25	1–2 weeks	Training on virtual reality and social face perception
R2M	M28	1–2 weeks	Training on Exploitation and Dissemination of Results

Principal Investigator: Prof. Giovanni Maria Farinella, (UNICT)
Academic PhD Supervisor: Sebastiano Battiato (UNICT)
Academic PhD Co-Supervisor: Giovanni Maria Farinella (UNICT)
Industrial PhD Supervisor: Binyam Gebre (PHILIPS)

Online Application: https://www.philhumans.eu/esrs/esr-6/

Main contact: Prof. Giovanni Maria Farinella
Email: gfarinella@dmi.unict.it

ADDITIONAL ESSENTIAL REQUIREMENTS:

– Master degree in Computer Science, Information Engineering (or equivalent). A degree with distinction (cum laude) is an advantage;
– Prior knowledge in Computer Vision, Machine Learning and Deep Learning is an advantage;
– Prior publications at international conferences or journals are desirable;
– Ability to program in Python is an advantage;
– Communication skill and team play are desirable.

ESR7 – NATURAL LANGUAGE GENERATION FOR PERSONALISED HEALTH COMMUNICATION

HIRING INSTITUTION: University of Aberdeen
PHD ENROLLMENT: Doctoral school of University of Aberdeen

YOUR TEAM

You will spend 18 months in the School of Natural and Computing Sciences at the University of Aberdeen, and 18 months at Philips Research in Eindhoven.

GOAL

The aim of this project is to develop Natural Language Generation (NLG) technology which communicates health data, analyses, and insights to users. The focus will be on effective communication with users who have limited literacy, numeracy, and domain knowledge.

EXPECTED RESULTS

ESR 7 will focus on specific health domain(s) of interest to Philips, such as parents of babies and young children. Expected results are:
- Literature review and analysis of how information is currently presented in personal health apps.
- Analysis of what users want to know, and where current apps do not effectively communicate with them. This will focus on the target Philips apps, and include discussions with users and domain experts.
- Development of NLG algorithms, informed by the above analysis, which effectively communicate health information in this context.
- Implementation of the algorithms within one or more of the targeted Philips systems.
- Evaluation of the understandability and effectiveness of the algorithms
- Scientific papers and written PhD thesis based on above work

The student will be encouraged to include user-modelling, multimodality, dialogue, and machine learning techniques in the project where they seem appropriate. He or she will also be expected to collaborate with and support other PhilHumans researchers.

INDICATIVE SCHEDULE - *Institution, place and timing expressed in contract month (M)*

Host	Timing	Length	Purpose
Philips	M1-M9	9 months	Lit review, analyse existing apps, work with users and domain experts
Aberdeen	M10-M27	18 months	Develop models, algorithms, systems
Philips	M28-36	9 months	Evaluation, writing up

Whilst in Aberdeen the researcher will be expected to make regular visits to Philips Eindhoven, and vice-versa. The researcher will also be encouraged to visit Tilburg University (Prof Pauws is a faculty member at Tilburg as well as a researcher at Philips) and the other universities in the PhilHumans consortium.

The researcher will also be expected to go to training courses, including

- *Aberdeen*: generic PhD training, relevant modules from Aberdeen's AI MSc, such as NLG and evaluation of AI systems
- Philips: Personalising content in e-health systems, human interaction with embodied conversational agents
- R2M: Exploitation and dissemination

SUPERVISORS:

Ehud Reiter (UNIABDN), Steffen Pauws (PHILIPS), Rim Helaoui (PHILIPS)

ADDITIONAL ESSENTIAL ATTRIBUTES:

- Master degree in Computer Science or related field
- Passionate about health care and empowering patients
- Excellent interpersonal and communication skills, for talking to users, domain experts, and fellow researchers
- Strong programming and software development skills

ADDITIONAL DESIRABLE ATTRIBUTES

- Experience in evaluating AI systems with human users
- Experience with NLG or other aspects of Natural Language Processing
- Experience with digital healthcare or other aspects of medical informatics
- Fluency in Dutch (we may work with users in Netherlands)
- Good understanding of commercial perspective on research

ESR8 – BUSINESS ECONOMICS AND ROBOTICS

HIRING INSTITUTION: R2M Solution Spain SL

PHD ENROLLMENT: Doctoral School of the University of Cagliari

YOUR TEAM: You will work at R2M Solution in Spain (Madrid).

GOAL

The goal of this combined Business Economics and Information Technology thesis is to study and exploit business development plans in the EU market, and economic technological aspects of AI-supported human-machine interfaces for personal health services, with a specific focus in Robotics for personal health and Carebots. The PhD researcher will explore exploitation routes and market implementation of industrial use cases relate to artificial intelligence, human-machine interactions and robotics in the context of EU. The candidate will leverage the outcomes of the other PhilHumans ESRs by identifying the innovation level and market potential of the technological innovations that arise from those efforts. More precisely, by pinning down specific use case scenarios one can study and measure the market potential of PhilHumans innovations, with the purpose of defining comprehensive business development plans and business models. Particular attention will be devoted to the route to market, the analysis of public opinion stance and evolution about robots and –generally speaking- human/machine interactions

EXPECTED RESULTS

• Conceptualize of business models and plans,

• Create concept strategic plan (road map),
• Analyse potential market and trends in EU for Robotics and human/robotics interaction

• Gather information that is required to take strategic decisions,

• Define PhilHumans services and issues (infrastructure, revenue stream, maintenance, development, innovation, and continuous improvement),

• Analyse different perspectives of technological aspects and governance (technology, innovation, co-innovation).

• Analyse social networks and traditional media coverage data, obtain country-specific measures of the project results acceptance by public opinion.

INDICATIVE PLANNED SECONDMENTS- *Institution, place and timing expressed in contract month (M)*

Host	Timing	Length	Purpose
UNIPV	M17	1–2 weeks	Training on innovation management & Industry 4.0
PHILIPS	M25	1–2 weeks	Training on human interaction with embodied conversational agents
UNIPV	M32	1-2 weeks	Training on impact of data-driven technologies and AI on firms' business models

UNICA	M13	6 months	Period in PhD giving organisation

SUPERVISORS:

Maria Chiara Di Guardo (UNICA), Raymond Sterling (R2M), Rubén Alonso (R2M), Riccardo Puglisi (R2M), Ron Dotsch (PHILIPS)

ESSENTIAL REQUIREMENTS:

Degree in economics, business and management with major in mathematics, engineering, computer science or equivalents or the other way around (e.g. degree in mathematics, eng., computer science or equivalents and major in economics).

DESIRED REQUIREMENTS:

Programming Skills

Passionate about robotics

Knowledge of marketing and digital marketing