

SmartWork 2021 Abstracts

Area 1 - SmartWork

Full Papers Short Papers

Area 1 - SmartWork

Full Papers

Paper Nr: 2

Title: Breaking up Long Sedentary Periods of Office Workers through a Virtual Coach using Activity Data

Authors: Jasmijn Franke, Christiane Grünloh, Dennis Hofs, Boris Van Schooten, Andreea Bondrea and Miriam Cabrera

Office workers often lead sedentary lifestyles, a lifestyle responsible for higher risks of cardiovascular disease, stroke, diabetes and premature mortality. Improvements towards a more active lifestyle reduce cardiovascular risks and thus changing the sedentary lifestyle might prevent chronic illness. The Recurring Sedentary Period Detection (RSPD) algorithm described in this paper was designed to identify recurring sedentary periods using data from an activity tracker, summarise the sedentary periods and pinpoint notification times at which the user should be motivated to get some movement. The outcome of the RSPD algorithm was validated

Abstract: using data from a 10-week period of one typical office worker. Our results show that the RSPD algorithm could correctly identify the recurring sedentary periods, compute fitting daily summaries and pinpoint the notification times correctly. With minor differences, the RSPD algorithm was successfully implemented in the healthyMe smartphone application, one of the supporting services of the SMARTWORK project. Within the healthyMe application, an embodied virtual agent is used to communicate the daily summaries and motivate the user to move more at the identified notification times. Pilots planned as part of the SMARTWORK project will evaluate whether the RSPD algorithm helps to motivate office workers to break up sedentary periods.

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Paper Nr: 3

Title: SmartWork: An IoT Enabled Unobtrusive Worker Health, Well-being and Functional Ability Monitoring Framework

Authors: Dimitrios Amaxilatis, Nikolaos Tsirois, George Papoulias, Dennis Hofs, Rita Kovordanyi, Hugo Marcos, João Jordão and João Quintas

Staying healthy in our workplaces is one of the most important priorities both for employers and employees, especially after the recent COVID-19 pandemic. Especially for older workers, that are more vulnerable, not only due to COVID-19 but also due to their chronic conditions that may be affecting their performance and productivity. This is more prevalent in western societies where populations are aging and people and governments start to consider staying at work longer to stay as active members of the society and live independently in better conditions.

Abstract: In this paper we present the SmartWork software suite that aims at building a worker-centric Internet of Things enabled system for workability sustainability, integrating unobtrusive sensing and modeling of the worker state with a suite of novel services for context and worker-aware adaptive work support. SmartWork is a ready to use, software suite tested in real-world installations that combines off-the-shelf and novel software and hardware components to provide workers with guidance on how to improve both their personal and professional lives.

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Nr: 3

Title: healthyMe Mobile and iCare Portal: Lifestyle Interventions Management and Privacy-abiding Data Sharing with Carers

Authors: Christiane Grünloh, Andreea Bondrea, Jasmijn Franke, Dennis Hofs and Boris van Schooten

This demo will showcase 1) the modules of the healthyMe smartphone application, 2) the iCare portal and 3) the Interventions Manager Service (IMS), all of which were developed as part of the H2020 SmartWork project. The healthyMe smartphone application is the main mobile entry point for the users to collect and visualise physiological, activity and lifestyle data. It is multi-lingual (English, Danish, Portuguese) and is available on Android and iOS. Each module (steps, sleep, heart rate, food diary, weight, exercises) has its own widget, presenting the collected data in daily, weekly and monthly overviews. The integration of external devices supports automatic retrieval of data on physical activity, sleep and heart rate (via the Fitbit integration) and body weight (via Withings integration). The food diary allows users to manually track their food intake, which raises their awareness of the total amount of energy consumed. The office-friendly exercise widget presents a library of video-guided exercises that have been recorded in collaboration with healthcare professionals. The videos allow users to safely perform physical exercises at home or at work at the time of their best convenience. The integrated filter allows the user to select exercises by body parts (shoulders, neck, back, arms, legs). The virtual coach "Amelia" guides users through the application, starting with an intake dialogue through which users can set their activity goals. Depending on their actual level of physical activity that is tracked later on, the goal is automatically adjusted. If a person is less active, the step goal will be adjusted and increased if a person reached their step goals. To prevent demotivation, the automatically adjusted goal is always slightly higher than was reached in the previous week and hence likely to be achievable for the person. The iCare portal is a service that allows (in)formal carers to support the older office worker reaching their health goals. Strong focus is placed on privacy and control in that the office worker can configure within the healthyMe service which data they want to share, from which period of time and with whom. After configuration, summaries of health-related information collected within the healthyMe service are visualised in a web-based portal. This way, the carer can monitor the health status of the office worker and provide support for the self-management of health conditions. The Interventions Manager Services (IMS) is a centralised component within the SmartWork platform that acts as a smart message hub for triggered interventions. From the back-end service side, the IMS can be called if any of the smart services developed within SmartWork decides that some intervention should be triggered. From the client side, the IMS lets the SmartWork client applications register themselves to be notified of triggered interventions. Through the IMS, all smart services have a single entry-point for delivering intervention triggers, and all client applications have a single entry-point for registering to receive triggers. Another motivation for the single entry-point was to avoid overloading the user with multiple notifications of triggered interventions at the same time. Currently, only one intervention is delivered at a given time, and in the future more sophisticated intervention prioritisation mechanisms can be implemented.

Abstract:

Paper Nr: 5

Title: Micro-moment-based Interventions for a Personalized Support of Healthy and Sustainable Ageing at Work: Development and Application of a Context-sensitive Recommendation Framework

Authors: Georgios Athanassiou, Maria Pateraki and Iraklis Varlamis

Abstract: The paper outlines the sustAGE system, a smart solution that builds upon strategic technology trends, such as Internet-of-Things, machine learning and recommender systems, to support sustainable work environments and increase wellness at work and well-being with a focus on the ageing workforce. Acknowledging the interrelation of the work and private arrays for healthy ageing, the developed solution utilizes a recommendation-based approach providing personalized warnings and preventive recommendations regarding occupational risks, as well as personalized cognitive and physical training activities for the off-work context with the overall goal of maintaining Work Ability and enabling sustainable work. The piloting of the proposed solution in two critical industrial domains provides promising results towards the use of personalized recommendation-based interventions for the working context and beyond for improving workers' occupational safety and health, performance and general well-being.

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Nr: 6

Title: Elaboration of Intervention Strategies for Health and Workability Management

Authors: Tom C. Thomsen, Miriam Cabrita, Christiane Grünloh, Rita Kovordanyi, Otilia Kocsis and Willeke van Staalduinen

Abstract: This poster session describes how the H2020 Smartwork project has elaborated intervention strategies regarding individual health management among office workers at +55 of age. The approach has addressed user demands through questionnaires mapping these onto six intervention domains: Interventions for health self-management; behavioural interventions to promote physical activity, healthy nutrition and wellbeing; cognitive function interventions to maintain cognitive capacity; work management interventions to reduce work related stress; work-related training interventions, facilitate explicit/implicit knowledge acquisition and intergenerational knowledge transfer; and work environment adaptations. Within the domains, interventions are motivated and referenced to the user needs, further shaped by motivation theories and user values to improve impact, setting goals for behavioural and wellbeing changes to achieve viable results for the individual user. The concept of intervention in this context is carefully defined, what it is and what causes an intervention. The approach enables further mapping of the interventions onto the envisaged SmartWork services and modules, hence establishing linkage from user needs to the services. Monitoring of physiological and behavioral parameters are carried out by sensors and wearables, fed into the Smartwork Artificial Intelligence system which unobtrusively and pervasively monitor health, behaviour, cognitive and emotional status of the worker. Additionally, workers will be asked regularly to report their findings and well-being at work for Machine Learning Purposes. By doing this, SmartWork is capable to identify and assess the functional and cognitive decline risks and trigger interventions which will appear on the devices the worker is using, e.g. such as trainings, relax techniques and advises.

Nr: 7

Title: Using Morphic to Promote Inclusion in the Workplace

Authors: Ignacio Peinado, Javier Hernández and Eva de Lera

Abstract: Morphic makes computers easier to use. Morphic unveils the usability and accessibility features present in the computer and is able to download and configure third-party software if required by the user. Once the user has configured a computer, they can apply this configuration in a different Morphic-enabled computer. Power users can create Morphic bundles with pre-configured configurations that can be installed or imported in any compatible computer. The SmartWork project marks the first time Morphic will be tested in Europe, and within a corporate environment. Morphic facilitates the inclusion of people with disabilities in the workplace by providing workers and employers with: - True digital equity. Workers who need assistive technology software are able to sit down at any computer, anywhere in their organization, and have the software they need appear on that computer, configured to their needs and preferences. - Easy discovery of accessibility features and Assistive Technologies, which will hopefully lead to: - Bringing inclusive culture into corporate culture. Morphic can help companies build a more inclusive working culture by raising awareness about the whole range of accessibility needs and solutions, facilitating pre-built configuration bundles for different personae, that will foster empathy and will allow IT staff to involve users with special needs more quickly and efficiently. - Better use of company resources. With Morphic, each computer can be used by any worker in the organization, regardless of their needs and preferences. Finally, Morphic will not only help users with disabilities, but all workers may benefit from the curb cut effect. In the demo, we will present an implementation of some of Morphic's key concepts that have been developed as part of the SmartWork project. In a computer with Morphic installed, we will key in with one user, and the computer will be configured according to the needs and preferences of the demo user, even installing software that was not installed before. Also, we will demonstrate how easy it is to change the settings of the computer using the Morphic Bar and store these settings in the user's needs and preferences set. We will then key the demo user out and we will see how the computer will return to its original state, and the software required by the user will be uninstalled.

Paper Nr: 7

Title: Cardio: An Edge-enabled Wearable ECG Vest for Office Worker's Heart Condition Monitoring

Authors: Dimitrios Amaxilatis, Athanasios Antoniou and Ioannis Chatzigiannakis

Abstract: Heart conditions are one of the most common health problems for people aged above 50 years, with the percentage of people suffering from chronic heart diseases increasing year by year. These problems are more common in modern western societies, where sedentary life and stressful lifestyles are the norms. People at these ages are in the final steps of their professional careers and need to balance the effect of their work on their health while staying safe and productive to achieve the best future quality of life for themselves and their families. In this work, we present a novel wearable ECG Vest that can help them monitor in real-time their known heart conditions while they work, reducing stress and fear. Its operation is simple enough for the device to be worn, as a normal jacket without the need to know where exactly to connect electrodes. Its operation is also controlled with a single button without the need for any further configuration.

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Paper Nr: 8

Title: Low-invasive Neurophysiological Evaluation of Human Emotional State on Teleworkers

Authors: Vincenzo Ronca, Gianluca Di Flumeri, Andrea Giorgi, Alessia Vozzi, Pietro Aricò, Nicolina Sciaraffa, Luca Tamborra, Ilaria Simonetti, Antonello Di Florio, Fabio Babiloni and Gianluca Borghini

Human emotions decoding and assessment is a hot research topic since its implications would be relevant in a huge set of clinical and social applications. Current emotion recognition and evaluation approaches are usually based on interactions between a "patient" and a "specialist". However, this methodology is intrinsically affected by subjective biases and lack of objectiveness. Recent advancements in neuroscience enable the use of traditional biosensors and maybe commercial wearable devices, which lead to a certain grade of invasiveness for the subject. The proposed study explored an innovative low-invasive hybrid method, based on the

Abstract: use of video data and smart bracelet, to overcome such technological limitations. In particular, we investigated the capability of an Emotional Index (EI), computed by combining the Heart Rate (HR) and the Skin Conductance Level (SCL) estimated through video-based and wearable technology, in discriminating Positive and Negative emotional state during interactive webcalls. The results revealed that the computed EI significantly increased during the Positive condition compared to the Negative one ($p = 0.0008$) and the Baseline ($p = 0.003$). Such evidences were confirmed by the subjective data and the classification performance parameters. In this regard, the EI discriminated between two emotional states with an accuracy of 79.4%.

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Paper Nr: 9

Title: Sleep Quality Monitoring with Human Assisted Corrections

Authors: Ioannis Konstantoulas, Otilia Kocsis, Elias Dritsas, Nikos Fakotakis and Konstantinos Moustakas

Quality of life and wellness are heavily affected by sleep health, especially for older people who choose to remain active in the workforce. Work ability and efficiency are correlated to sleep quality. Several non-automated sleep assessment tools have been used by professionals in the healthcare industry. These tools may rely on the user report of sleep quality perception. There also are objective tools that can diagnose sleep disorder only for a limited amount of time in a hospital setting due to increased cost and heavy being very unwieldy in a house setting. This paper aims to present the SmartWork project approach for human assisted automated sleep quality assessment. The suggested method emphasizes the triggering mechanisms based on behavioural and lifestyle routine to assist an automated system in correcting the results for personalized scoring for each user. This work aims to guide older people in adopting a healthier sleep habit to enhance their sleep quality and increase satisfaction.

Abstract:

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Paper Nr: 10

Title: Long-term Cholesterol Risk Prediction using Machine Learning Techniques in ELSA Database

Authors: Nikos Fazakis, Elias Dritsas, Otilia Kocsis, Nikos Fakotakis and Konstantinos Moustakas

Cholesterol is a crucial risk factor for cardiovascular diseases (CVDs) which in their turn are among the main causes of death worldwide and public health concern, with heart diseases being the most prevalent ones. For cholesterol control, the early prediction is considered one of the most effective ways. Utilizing the English Longitudinal Study of Ageing (ELSA), a large-scale database of ageing participants, a dataset is derived to evaluate the long-term cholesterol risk of elderly men and women using Machine Learning (ML) techniques. Several ML prediction models were assessed concerning Accuracy and Recall where the Logistic model tree was the best performer. The ultimate goal of this study is to identify individuals at risk and facilitate earlier intervention to prevent the future development of cholesterol.

Abstract:

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Short Papers

Paper Nr: 1

Title: A Data Quality Assessment Approach in the SmartWork Project's Time-series Data Imputation Paradigm

Authors: Georgios Papoulias, Otilia Kocsis and Konstantinos Moustakas

The plethora of collected data streams of the SmartWork project's sensing system is often accompanied by missing values, yielding the need for estimating these missing values through imputation, which may prove unnecessary or computationally expensive in relation to the outcome. This work introduces a data quality assessment approach that allows for decision making regarding the need/efficiency of data completion in order to save system computational resources and ensure quality of imputed data. Preliminary validation of the proposed approach is performed by assessing the correlation between the proposed data quality assessment scores and the normalized mean square error of the imputation on various simulated missing patterns. The results reinforce our initial hypothesis that the suggested score is a suitable data quality indicator, correlating well with the potential errors introduced by imputation in the case of a given batch of input data.

Abstract:

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Paper Nr: 4

Title: Digital Inclusion at the Workplace Post Covid19

Authors: Ignacio Peinado, Eva de Lera, José M. Usero, Colin Clark, Jutta Treviranus and Gregg Vanderheiden

The rapid advances in information and communication technologies and the widespread adoption of disruptive technologies such as AI and automated systems are changing the work landscape dramatically and are affecting especially older workers and workers with disabilities. Since 2020, the COVID-19 pandemic has accelerated some of these changes, widening the unemployment gap for people with disabilities. To facilitate reskilling and upskilling of older workers and people with disabilities we need to create inclusive work environments that consider their evolving needs and capabilities. The Global Public Inclusive Infrastructure (GPII) provides workers, employers and organizations with tools and methods to include accessibility into their practices and policies. The SmartWork project provides a great opportunity to test how Morphic, the auto-personalization from preference solution provided by the GPII, can help building a more inclusive workplace.

Abstract:

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Paper Nr: 11

Title: Collecting Data for Machine Learning on Office Workers' Attention, Fatigue, Overload, and Stress during Computer Use

Authors: Rita Kovordanyi

Predicting a computer user's covert cognitive state, such as attention, has previously proven to be difficult, as cognitive states are induced through complex interaction of hidden brain processes that are difficult to capture in traditional rule-based methods. An alternative approach to modeling cognitive states is through machine learning, which however, requires that a wide range of data is collected from the user. In this paper, we describe our software for collecting a wide range of data from office workers' during everyday computer work. The data collection process is relatively unobtrusive, as it can be run as a background process on the user's computer and does not require extensive computational resources. We conclude by discussing practical issues, such as data sample frequency, where one wants to strike a balance between good enough data quality for machine learning and unobtrusiveness for the user.

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