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D2.2 Mid-term report on early stage researchers and researchers training activities

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Abstract:

This deliverable provides an overview of activities organized for early-stage researchers and researchers within first 12 months of the project. While all activities listed and briefly described the core of the deliverable is report about progress in the hands-on research training. The deliverable also provides some plans for the next few months.

Keyword list: mid-term report, classical and remote research training, hands-on research training

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Abbreviations

UKIM – Ss Cyril and Methodius University (Skopje, Macedonia)

JSI – Jožef Stefan Institute (Ljubljana, Slovenia)

FC.ID – Fciencias.Id (Lisbon, Portugal)

FBK – Fondazione Bruno Kessler (Trento, Italy)

HPI – Hasso-Plattner Institute (Potsdam, Germany)

DHH – Data-driven healthcare

HFPH – Human factors in pervasive health

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1 Introduction

This deliverable is the mid-term report on early stage researchers and researchers training activities, which take place in WP2 of the project. The deliverable provides an overview of activities organized for early-stage researchers and researchers within first 12 months of the project. While all activities listed and briefly described the core of the deliverable is report about progress in the hands-on research training. The deliverable also provides some plans for the next few months.

Section 2 describes classical and remote research activities – seminars, tutorials, project management workshop and some information of up-coming winter school – which are addressed by Task 2.1. As most of these activities are described in separate deliverables, we only provide a short summary and a reference to the deliverables. For the sake of completeness we also mention research management activities that belong to WP3.

Section 3 focuses on the hands-on research training and provides short summaries on the ongoing research, information about published and planned publications, exchanges, plans for future work and currently established joint co-supervisions. This is addressed by Tasks 2.2 (the core of hands-on research training) 2.3 (joint co-supervision) and 2.4 (exchanges), as these activities are strongly interconnected. We also mention a special case – a trainee who decided to move from one partner (UKIM) to another (JSI) to do her PhD, which directly resulted from initial collaboration on the research problem.

2 Classical and remote research training

Classical and remote research training in the WideHealth project consists of seminars, tutorials, project management workshops and winter/summer schools.

2.1 Seminars

As a part of the WideHealth project we organized several seminars on different topics from areas defined in the project - *Data-driven healthcare* (DDH), *Human factors in Pervasive Health* (HFPH) and *Federated machine learning* (FML). We list the organized seminars in Table 1. On November 2nd we organized a tutorial on Federated Learning (Introduction to FL and examples of usage).

While seminars were organized as live online-events, recordings of the talks are available on the project webpage [1] (Figure 1) with links to Youtube [2] (videos) and Spotify [3] (podcasts). Audio and video recordings of the seminars are meant as training materials for the pervasive healthcare community and are therefore made available to public.

Table 1: List of organized seminars

Tentative date	Title	Topic	Speaker	Bio	Institution	Access
4/5/2021	XPRIZE Pandemic Response Challenge	DDH	Nina Reščič	PhD Student	JSI	Public
18/5/2021	Everyday Text Entry as a Digital Endpoint	HFPH	André Rodrigues	Postdoctoral Researcher	FC.ID	Public
1/6/2021	Synthetic Data generation for Human Activity Recognition	DDH	Orhan Konak	PhD Student	HPI	Public
22/6/2021	Predicting Deterioration of Critically Ill Patients Through Analysis of Blood Lactate Levels	DDH	Venet Osmani	Senior Researcher	FBK	Public
14/9/2021	Recognizing Human Activities with IMU using standard ML and DL	DDH	Hristijan Gjoreski	Researcher	UKIM	Public
19/10/2021	DataPark: Reflections from a Longitudinal Deployment of a Digital Platform for PD Monitoring	HFPH	Diogo Branco	PhD Student	FC.ID	Public

Seminars

Here you can find all the public seminars organized by the **WideHealth** project on the topics of **e-Health** and **Pervasive health**.

The whole Seminar series are available as videos on **Youtube**, and as a podcast on **Spotify**.

For individual seminar details and links, please check the table below.

Title	Speaker	Recordings	Partner	Date	Status	Place
DataPark: Reflections from a Longitudinal Deployment of a Digital Platform for PD Monitoring	Diogo Branco	Youtube Spotify	FCiências.ID - Associação para a Investigação e Desenvolvimento de Ciências	19/10/2021	Completed	Virtual (ZOOM)
Wearable Computing and its Machine-Learning Applications	Hristijan Gjoreski	Youtube Spotify	Ss Cyril and Methodius University	14/09/2021	Completed	Virtual (ZOOM)
Predicting deterioration of critically ill patients	Venet Osmani	Youtube Spotify	Fondazione Bruno Kessler Research Institute	22/06/2021	Completed	Virtual (ZOOM)
IMU-Based Trajectory Image Classification for Human Activity Recognition	Orhan Konak	Youtube Spotify	Hasso-Plattner-Institut	01/06/2021	Completed	Virtual (ZOOM)
WildKey: A Privacy-Aware Keyboard Toolkit for In-The-Wild Data Collection	André Rodrigues	Youtube Spotify	FCiências.ID - Associação para a Investigação e Desenvolvimento de Ciências	18/05/2021	Completed	Virtual (ZOOM)
XPrize Pandemic Response Challenge	Nina Reščič	Youtube Spotify	Jožef Stefan Institute	04/05/2021	Completed	Virtual (ZOOM)

Figure 1: List of seminars with links to YouTube and Spotify as presented on the project website [1]

2.2 Project management webinars

As part of the WideHealth project, we are also organizing webinars about project management tasks. So far, there have been two events – a webinar on project reporting on October 15th and a webinar on deliverable writing on November 4th.

More details about the events can be found in deliverable D3.1 – Mid-term report on research management and administration training.

2.3 Winter School

One of the objectives of the WideHealth is to organize winter/summer schools for early-stage researchers and students. The first school, WideHealth Thematic School on e-Health & Pervasive Technologies, will be organized in February 2022. The school’s focus will be on Pervasive Technologies and e-Health, Data driven Healthcare, Machine Learning for Healthcare, Wearable Computing, Ubiquitous computing and Human Activity Recognition with wearables.

The school will be held from February 14 to February 17, 2022, and is aimed at undergraduate and graduate students interested in Pervasive technologies, Machine Learning and e-Health. The School is planned to be held as a hybrid: some participants will be attending the School using online tools (e.g., Zoom), and some in-person. There will be a Machine Learning Challenge for Human Activity Recognition with wearables for the students participating in the winter school.

At the time of writing this deliverable, the details of the program are not fully decided yet. However, more information will be accessible on the webpage [4].

3 Hands-on research training

The core of the WideHeath project is hands-on research training. Each institution was supposed to involve at least one early-stage researcher that will work on his/her research problems with senior researchers from other institutions. This section first describes the ‘matchmaking event’ where early-stage and senior researchers initially discussed possible collaborations.

Next, we provide the list of established collaborations, information about ongoing work and current or planned outcomes (publications, exchanges and co-supervisions).

3.1 The Matchmaking event

The matchmaking event was an online event organized at the beginning of February 2021. The goal of the ‘matchmaking’ was to discuss possible research collaborations between early-stage researchers (trainees) and senior researchers from other research institutions(trainers).

To imitate the in-person matchmaking as much as possible, the event was organized using GatherTown [5]. This platform allows users to ‘walk around’ as they would in an in-person event, enable them to see who is free to talk and join a conversation bypassing a person or group of people.

Each early-stage researcher prepared a poster-like presentation of the research problem they are working on as a part of their studies. Senior researchers ‘walked around’ the virtual venue, familiarizing themselves with the early-stage researchers’ work and discussing possible collaborations (Figure 1).

Each institution also had a dedicated booth, where early-stage researchers could stop and talk to senior researchers whose topics they found interested (Figure 3).

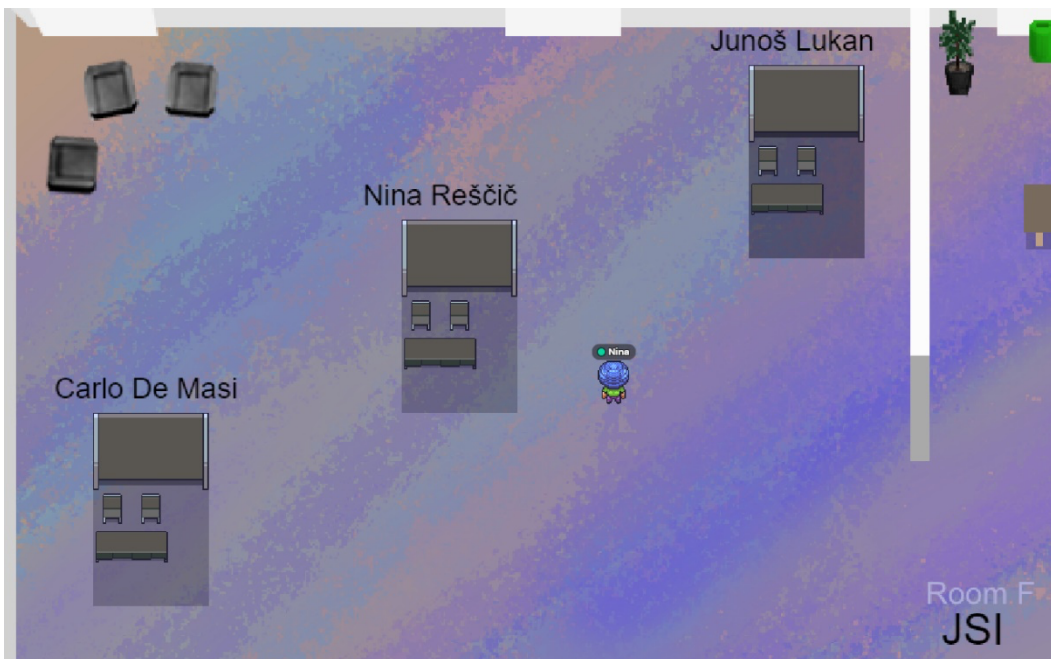


Figure 2: Example of early-stage researchers' space. Each of the early-stage researchers had a private dedicated space, where senior researchers could 'stop' and discuss possible collaborations.



Figure 3: Each institution had a dedicated 'booth' where early-stage or senior researchers from other institutions could 'stop' and discuss possible collaborations.

3.2 Report about ongoing hands-on research collaborations

The matchmaking event described in the previous section was a first step for the hands-on research training. However, since the event, each of the established collaboration had developed further. All of the established collaborations had at least one meeting between the matchmaking event and the time of this deliverable, and in most cases the research problem was already defined clearly and the work has already started. Some of the collaborations have already resulted in exchanges or publications.

In this subsection, we first list the established collaborations and then provide short summaries of work in the hands-on research problems (with the name of the early-stage researcher followed by his/her and the trainer’s institution), information about exchanges that already happened or are planned in the future and a list of published publications or those in progress for each research problem. Finally, we provide information about the planned future work.

Table 2: List of established collaborations between early-stage (trainees) and senior researchers (trainers)

Problem	Early-stage researcher		Senior researcher (Trainer)	
	Name	Institution	Name	Institution
Recognizing Activities of Daily Living for Parkinson’s disease	Diogo Branco	FC.ID	Mitja Luštrek Hristijan Gjoreski	JSI UKIM
Anomaly Detection in IoT Medical Networks using Federated Learning	Ana Cholakoska	UKIM	Bert Arnrich Bjarne Pfitzner	HPI
Intensive Care Units (ICU)	Bojana Velichkovska	UKIM	Venet Osmani	FBK
Cardiovascular Health	Emilija Kizhevskaja	UKIM	Oscar Mayora Mitja Luštrek	FBK JSI
Nutrition Monitoring	Nina Reščič	JSI	Oscar Mayora Claudio Eccher	FBK FBK
Stress Detection	Junoš Lukan	JSI	Venet Osmani Hristijan Gjoreski	FBK UKIM
Detection of Eating Periods Using a Wrist-worn Device	Simon Stankoski	JSI	Hristijan Gjoreski	UKIM
Human Activity Recognition / Deep Learning	Stefan Kalabakov	JSI	Tiago Guerreiro	FC.ID
Nursing Activity Recognition	Orhan Konak	HPI	Hristijan Gjoreski Mitja Luštrek	UKIM JSI
Activity Recognition for OCD	Kristina Kirsten	HPI	Hristijan Gjoreski	UKIM

Health Dialogue Systems	Milene Teixeira	Santos	FBK	Tiago Guerreiro	FC.ID
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3.2.1 Short summaries

3.2.1.1 Parkinson Disease continuous monitoring

Diogo Branco (FC.ID - JSI/UKIM)

The democratization of sensing wearable technologies opened several possibilities in the continuous monitoring of people, and particularly in what relates to their health and wellbeing. Over time, new devices appeared (e.g. smartphones, smartwatches, bracelets) with similar capabilities as the clinical wearable devices. This is relevant because as most people already wear them, it is straightforward to collect data from them. However, objective data collection is not always adapted to a person's daily routine, so they tend to stop wearing these devices. The goal of this collaboration is to improve data collection in free-living environments by giving them more value (e.g. by giving them feedback while using these mechanisms). The plan is to use detection of activities or actions from these patients and give them feedback while using devices to understand the effect on the data collection.

3.2.1.2 Anomaly detection in e-health networks using federated learning

Ana Cholakoska (UKIM - HPI)

The purpose of this research is to explore the usage of machine learning methods for bettering anomaly detection in e-health networks.

Currently, we are working on providing a relevant dataset of IoT medical devices for anomaly detection purposes. Then, we will proceed with training and testing of federated machine learning models for anomaly detection. Evaluating the proposed architecture and solution will be essential to bettering this system further on.

3.2.1.3 eICU Racial Bias

Bojana Velichkovska (UKIM - FBK)

The research aims to analyse eICU (Electronic Intensive Care Unit) data in order to determine whether presence of racial bias can be detected in patients' general information and vital signs.

For the purpose of this research, we used the eICU Collaborative Research Database [6]. Our research focused on general information and vital signs of patients during the first 24 hours of stay in the ICU. Additionally, patients without measured values for either general information or vital signs were not considered as part of the research. Our data pre-processing significantly reduced the number of patients per ethnicity. As a consequence, our research focused on the three most present ethnoraces in the dataset (African American, Caucasian, Hispanic). We combined each of those ethnoraces in pairs and conducted three separate comparative tests, African American vs Caucasian, African American vs Hispanic, and Hispanic vs Caucasian. For each comparative test, we performed an internal 5-fold cross-validation and investigated the results provided by two machine learning

(ML) algorithms: logistic regression and XGBoost. Our findings were published in a conference paper [7].

3.2.1.4 Nutrition monitoring

Nina Reščič (JSI - FBK)

The outcome of the collaboration will be an algorithm for optimization of questionnaires. The algorithm (integrated in existing application) will ask the users about their dietary habits by asking questions from the Food Frequency Questionnaire (FFQ) in an optimized way. FFQs can be quite extensive and therefore it can be overbearing for the users to answer the FFQ on a daily basis. By developing an algorithm that will ask just the important questions depending on the chosen goals and predict the diet quality from very little information, the application's user experience could improve.

So far, the outline of the algorithm has been developed and implemented and the evaluation is in progress. The train set for the machine learning models is currently adopted from the dataset from the national survey EUmenu. In order to evaluate the algorithm properly, a dataset with time series is required. This dataset will either be gathered from previously answered questions within the existing Salute+ application or will have to be gathered in the next few months.

3.2.1.5 Stress detection using context data

Junoš Lukan (JSI – FBK/UKIM)

The main activities so far have been a joint publication of a workshop paper and planning of further collaboration. We tried to align the topic of our collaboration with the PhD topic. We met to discuss current state of the STRAW project and compared it to the FBK's previous Turnout-Burnout project. We decided it would be interesting to compare participants' adherence between the two projects and turned this into a publication. We also discussed potential research problems to tackle in the future. We decided to first carry out data analysis in the STRAW project and see where the preliminary results might take us. An additional constraint will be securing the funding for my continued employment at the JSI.

3.2.1.6 Detection of Eating Periods Using a Wrist-worn Device

Simon Stankoski (JSI – UKIM)

The goal of this research activity is to extend the collaboration between JSI and UKIM by having joint supervision over a master thesis preparation. Furthermore, this collaboration provides extended expertise from multiple experts in the field of research. The supervisor of the thesis is Mitja Luštrek and the co-supervisor is Hristijan Gjoreski. The title of the thesis is "Eating detection with machine learning from imbalanced sensor data with imperfect labels".

The topic of the thesis is related to eating detection with machine learning using data from a commercially available smartwatch. As a part of the thesis development process, both the

supervisor and co-supervisor were part of the problem definition, design of the experiments, analysis of the results, conceptualization and reviewing the thesis.

Additionally, part of the work presented in the thesis was published previously in the journal Sensors (IF=3.576).

3.2.1.7 Nursing Activity Recognition

Orhan Konak (HPI - UKIM)

The project aims to equip real nurses with Inertial Measurement Units (IMU) to reduce documentation time for nursing activities. Two branches of activities are necessary to achieve that: 1) data collection in the wild of real nurses, and 2) evaluating different classification approaches/models. An ethics proposal was already submitted and approved by the ethics board of the University of Potsdam. A nursing home was recruited for that purpose. The goal is to have at least one contribution on each of the strands mentioned above.

3.2.1.8 Repetitive Activity Recognition

Kristina Kirsten (HPI - UKIM)

The primary idea was to identify repetitive acts inside one's home to identify pathological behaviour that indicates an Obsessive-Compulsive Disorder (OCD). Therefore, smartphone accelerometer and gyroscope data are used to analyse daily life activities and to identify their repetitions. Furthermore, indoor positioning data is used to enrich the human activity recognition (HAR) data and increase the accuracy of the machine learning models.

In order to label the data and to achieve a better performance, active and online learning is also investigated. For that, a smartphone application has been developed which enables the subject to indicate when a compulsive act is happening. Thereby, the data is labelled.

Since daily life activities are very unique and diverse from person to person a more recent approach focuses on personalized OCD activity recognition. Therefore, federated learning is used to train the models to achieve personal models for the patients. Since there is no public dataset available I used the publicly available OPPORTUNITY data set and augmented it to represent OCD behaviour.

3.2.1.9 Health Dialogue Systems

Milene Santos Teixeira (FBK - FC.ID)

The purpose of the research is to explore systems for automated generation of dialogue for the healthcare domain. The joint work conducted at the University of Lisbon consisted of three studies that aimed at evaluating the feasibility and usability of the proposed approach. The studies included:

- A qualitative evaluation of the first prototype of the approach (Puffbot). This study was performed by physicians with some degree of expertise in respiratory diseases;

- A quantitative and also qualitative evaluation of the first prototype of the approach (Puffbot). This study was performed by participants with some knowledge of the asthma disease (e.g. asthma patients);
- An evaluation of the costs and feasibility of generating a new chatbot by reusing the proposed approach. The participants of this study were required to have some degree of technical knowledge and, some of them also had knowledge of ontologies.

Besides the realization of the studies, joint activities included recruitment of participants, discussions on which aspects should be evaluated, and the satisfaction of formal requirements to conduct the tests.

Currently, we are working on the analysis of the study results and the next step is to write a conference paper to be submitted by January 2022. A journal paper is also envisioned.

3.2.1.10 HAR/Transfer Learning/Multi-task Learning/Deep Learning

Stefan Kalabakov (JSI - HPI/UKIM)

Transfer Learning (TL) for HAR - *Collaboration between UKIM & JSI*: The goal of this project is to analyse the effectiveness of Transfer Learning (TL) in creating models for HAR which generalize well on data they have not seen before. More specifically, this project focuses on the usefulness of different datasets (and their combination) as sources of knowledge during TL.

So far, we have performed experiments regarding the usefulness of different datasets as sources of knowledge and have published a paper based on a subset of those results. To conclude the project, we need to complete a source selection study which we are currently working on. A journal paper presenting all of the results from this project is planned.

Multi-task Learning (MTL) and TL for the creation of general HAR models - *Collaboration between UKIM & HPI*: This project focuses on using MTL and TL to train a general model for HAR, which would resemble many pre-trained models available in the image detection field. Such a model would need minimal training in order to adapt to a new HAR dataset. Some of the tasks in this project include the selection of HAR and possibly other datasets which include sensor data in a time-series format, unification of the way they present sensor data and finally training and evaluation of models using MTL and TL.

Open-ended HAR - *Collaboration between UKIM & HPI*: The goal of this project is to develop an online clustering algorithm for the discovery of activity clusters in continuous streams of sensor data. These types of algorithms are becoming increasingly more important as the task of activity diarisation from sensor data plays a growing role in assistive technologies, for instance, to support people with dementia.

So far, the algorithm has been developed and partially evaluated on three HAR datasets. The plan is to further extend this evaluation with data from more datasets, potentially ones collected by partners such as the dataset from the Nurse Monitoring project or the “OCD” dataset.

3.2.2 Exchanges

As part of the hands-on research training, early-stage researchers can visit the training institution and collaborate with their trainers in person. We provide a table of exchanges that already happened and those planned in the coming months.

Table 3: Early-stage researchers' exchanges

Trainee	Visiting institution	Exchange done	Exchange planned
Diogo Branco	JSI	/	2022
Ana Cholakoska	HPI	/	1 st quarter of 2022
Bojana Velichkovska	FBK	/	2022
Nina Reščič	FBK	M8-M9	/
Junoš Lukan	FBK		1 st quarter of 2022
Simon Stankoski			
Orhan Konak	/	/	/
Kristina Kirsten			
Milene Santos Teixeira	FC.ID	M10-M11	/
Stefan Kalabakov	/	/	/

3.2.3 Meetings

Early-stage researchers met with their trainers on several occasions. Some of them had regular meetings, some of them discussed when certain milestones were reached. In Table 4 we provide some basic information about meetings for all early-stage researchers.

Table 4: Table about meetings

Trainee	Institutions	Meetings
Diogo Branco	FC.ID JSI/UKIM	Informal discussions about possible research problems to explore have happened. We are now scheduling a meeting to pivot the topic of our collaboration to fit better my PhD research.
Ana Cholakoska	UKIM HPI	Numerous online meetings. The first few meetings were positional, where ideas and possible collaboration were discussed between the two institutes. Then the anomaly detection in e-health networks using federated learning were explored, which resulted in two joint publications.

Trainee	Institutions	Meetings
Bojana Velichkovska	UKIM FBK	<p>Several online meetings happened.</p> <p>An initial couple of meetings were focused on discussing the general idea and defining the goals; later on, the purpose of our meetings was to explore the presence of racial bias between ethnoraces in comparative tests using ML algorithms and internal cross-validation. As a result of these meetings, we developed an ML pipeline, the results of which were published and presented at the ETAI 2021 conference [7].</p> <p>During the last couple of meetings, we discussed applying ML algorithms in a matched cohort study to further understand the complex nature of racial bias, as well as look into the interpretability of the results. Additionally, we mentioned the potential for external validation of our results. The work we are currently conducting is planned as a journal publication for 2022.</p>
Nina Rešičič	JSI FBK	4 online meetings happened before the exchange. In the meetings, specifications of the research problem were discussed and defined
Junoš Lukan	JSI FBK/UKIM	A meeting happened on the 12 July 2021 to discuss potential collaboration. The purpose of the meeting was to pivot the topic of the collaboration to fit better with the PhD research.
Simon Stankoski	JSI UKIM	As a part of the whole process, regular online meetings were happening once in a month over the past ten months.
Orhan Konak	HPI UKIM/JSI	5-6 online meetings happened on different occasions. The general idea was discussed and the goals were defined. Meetings with students interested in subtopics of Human Activity Recognition (HAR) also happened. E.g., a student from UKIM did some preliminary work/experiments on 3D animations, extracted the position of arbitrary locations of an animated character, and further calculated acceleration from it to compare them with real IMU data for HAR.
Kristina Kirsten	HPI UKIM	One online meeting.
Milene Santos Teixeira	FBK FC.ID	Few online meetings. The first meetings had the aim of discussing the possibilities for collaboration between the two institutes. Several in-person meetings were held during the exchange period. These meetings had mainly the purpose of making further definitions for the studies to be conducted. Furthermore, in-person or online meetings with the LASIGE research group were held every Wednesday during the exchange period. After the

Trainee	Institutions	Meetings
		exchange, an online meeting was conducted with the purpose of presenting a summary of the activities conducted during the exchange and defining publications venues to share the results.
Stefan Kalabakov	JSI UKIM/HPI	Four meetings have been organised so far and all of them have been held online. At the meetings, the tasks were planned for each of the projects and the sharing of datasets between the collaborators were discussed.

3.2.4 Publications

In this subsection we provide a list of already accepted/published publications (Table 5) and publications that are planned in the future or are already in progress (Table 6).

More information about publications can be found in deliverable *D5.2 Plan on Output Production*.

Table 5: Table of accepted publications

Trainee	Collaborating institutions	Title	Type
Ana Cholakoska	UKIM HPI	<i>Machine Learning based Anomaly Detection in Ambient Assisted Living Environments</i> [8]	Conference proceedings
		Differentially Private Federated Learning for Anomaly Detection in eHealth Networks [9]	Conference proceedings
Bojana Velichkovska	UKIM FBK	<i>Investigating Presence of Ethnoracial Bias in Clinical Data using Machine Learning</i> [7]	Conference proceedings
Junoš Lukan	JSI FBK, UKIM	<i>Participants' Experience and Adherence in Repeated Measurement Studies Among Office-Based Workers</i> [10]	Conference proceedings
Simon Stankoski	JSI UKIM	<i>Smartwatch-Based Eating Detection: Data Selection for Machine Learning from Imbalanced Data with Imperfect Labels</i> [11]	Journal paper
Stefan Kalabakov		<i>Analysis of Deep Transfer Learning Using DeepConvLSTM for Human Activity Recognition from Wearable Sensors</i> [12]	Journal paper

Table 6: Table of publications in progress or planned publications

Trainee	Collaborating institutions	Title (or working title)	Status
Ana Cholakoska	UKIM HPI	<i>Machine Learning based Anomaly Detection in Ambient Assisted Living Environments [8]</i>	Conference proceedings
Bojana Velichkovska	UKIM FBK	Planned publication in 2022	Planned
Nina Reščič	JSI FBK	<i>Importance of questions in FFQs with Multi-Target Regression</i>	In progress
Orhan Konak	HPI UKIM, JSI	It is planned to have at least two joint publications till the end of the project	Planned
Milene Santos Teixeira	FBK FC.ID	Two joint publications (a conference and a journal) are planned for early 2022.	Planned
Stefan Kalabakov	UKIM HPI	<i>Online Agglomerative Temporal Clustering of Human Activities using Accelerometers</i>	In progress
	UKIM JSI	<i>Source selection analysis for Transfer Learning</i>	In progress
	UKIM HPI	<i>Multi-task and Transfer Learning for creating a general HAR model</i>	Planned

3.2.5 Future work

Some of the established collaborations already resulted in exchanges, publications and even co-supervision, while the work in others is still in progress. In both cases, several other activities are planned. We provide a summary for future work for each of the early-stage researchers in Table 7.

Table 7: Future work and activities in hands-on research training

Trainee	Meetings/Training Activities
Diogo Branco	<ul style="list-style-type: none"> • Defining a data collection procedure for activities of daily living of people with Parkinson’s disease • Tutoring on activity recognition (research visit) • Development of user-facing applications that build upon activity recognition in free living environments
Ana Cholakoska	<ul style="list-style-type: none"> • Exploring options for generating an IoT medical dataset for anomaly detection purposes • Implementation of system architecture that was created for e-health domain • Implementation and analysis of anomaly detection for IoT using federated learning • Exploring the possibility of using split learning for IoT anomaly detection systems
Bojana Velichkovska	<ul style="list-style-type: none"> • Balancing the dataset between ethnoraces through matched cohort. The matched cohort is to be conducted on three distinct features (admission diagnosis, gender and age) and is to be prioritised on each feature. The reason for this is to generate multiple matched cohort datasets. • We intend to investigate the interpretability of our results for the ML algorithms used in the study. • It is planned to conduct an internal validation of the results. Additionally, we are discussing the potential of conducting an external validation of the obtained results.
Nina Reščič	<ul style="list-style-type: none"> • The developed algorithm first has to be evaluated on real-life data. Next, the implementation of the algorithm will first be tested in a web application or integrated into the existing application developed by the FBK.
Junoš Lukan	<ul style="list-style-type: none"> • Discussion of stress detection results in the STRAW project and possible evaluation of models on the FBK’s similar dataset.
Orhan Konak	<ul style="list-style-type: none"> • Labeled IMU data collection from experts and non-experts for HAR • Exploring the impact of synthetic IMU data from videos, like IMUTube, and animations to the overall accuracy on HAR • Development of an android app for real-time activity recognition

	<ul style="list-style-type: none"> Stefan Kalabakov, a student from UKIM, will join and work on research related to transfer learning in HAR
Kristina Kirsten	<ul style="list-style-type: none"> The augmented OPPORTUNITY dataset was given to UKIM. They want to experiment with their clustering algorithm to see if they can also identify the repetitive activities.
Milene Santos Teixeira	<ul style="list-style-type: none"> Paper writing and submission – 2 papers planned
Stefan Kalabakov	<ul style="list-style-type: none"> Evaluation of the online clustering algorithm on real-world activity data, such as the one from the Nurse Monitoring or OCD projects. Finish the source selection analysis for Transfer Learning. Experiments using Multi-task Learning for the creation of a HAR model which needs little training on data it has not seen before.

3.2.6 Joint co-supervision

One of the WP2 objectives is to have at least one co-supervision per each partner. So far there has been one such collaboration established. Simon Stankoski is scheduled to defend his Master *Thesis Eating detection with machine learning from imbalanced sensor data with imperfect label* under co-supervision of Mitja Luštrek (supervisor, JSI) and Hristijan Gjoreski (co-supervisor, UKIM) in January 2022.

3.3 Special case – student transfer between UKIM and JSI

A student involved in the WideHealth project changed her primary institution due to activities related to her research work. After getting involved into the project as a Master student, she decided to do her PhD at JSI. JSI was one of the training institutions for her research problem, described in the deliverable D2.1.

Emilija Kizhevska: "As an early-stage researcher at UKIM, Asst. Prof. Hristijan Gjoreski gave me an opportunity to get involved in the WideHealth project. This project allowed me to pursue my future research career in Slovenia at the Jožef Stefan Institute. The initial contacts and the discussions that we had during the first year of the project were an excellent basis for me to enroll in the PhD program at Jožef Stefan International Postgraduate School and to get a position as a young researcher at JSI under the supervision of Dr. Mitja Lustrek. Doing a PhD abroad in a highly respectable and scientifically recognized institution was something that I always wanted for myself and now I finally have the chance to do it, thanks to the WideHealth project."

4 Conclusion

Deliverable D2.2 provides a mid-term report on activities for early-stage researchers and researchers. Objectives of the project include at least one involved early-stage researcher from each institution. Each partner should also have at least one established co-supervision and a maximum of three one-month visits.

Although the first year of the project is just finishing, we were able to fulfil the first of the above-mentioned objectives without any problem. Some of the established collaborations already resulted in publications, exchanges and one co-supervision. The work in the other research problems is already in progress and some of the publications and exchanges are planned in the first quarter of 2022.

There has already been an established co-supervision between UKIM and JSI, resulting in the Master Thesis of one of the students. More co-supervisions will be established once the work in all of the research problems is in full swing.

There has been a special case where a student decided to transfer from her primary institution (UKIM) to another institution (JSI) to do a PhD with a researcher that was initially supposed to be one of the trainers for her research problem. She will continue to work on a research problem defined and described in deliverables D2.1 and D2.2 with a trainer from the third institution (FBK). This transition is a direct consequence of the WideHealth and although not foreseen in the proposal, it deserves a special mention in the deliverable.

Besides the hands-on training, several other activities were organized in the first year of the Widehealth project – several seminars, webinars, a tutorial, and an upcoming winter school.

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