Project Proposal

Monitoring Pregnancy using Mobile Applications

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Motivation and Background

Monitoring Pregnancy using Mobile Applications

Traditional health care system is supply-based and organized around providers (hospitals, medical practices, clinics, etc.). In most parts of the world, population is aging and becoming less healthy due to consumerism, unhealthy diet, and sedentary life style. Health care costs are rapidly rising and there is a trend of moving health care services to patient homes as much as possible. New technologies make this possible; technology-enabled infrastructure that connects providers, caregivers and patients and links multiple sources of data. Simple collecting and connecting data are not sufficient, these data need to be coupled with medical knowledge and algorithms that help make timely and correct decisions about patient's health needs. New technologies include sensor systems [1,2], wearables [1,3], personal health records [4], and the connectivity of devices through Internet of Things [5,6]. Although these technologies offer a great promise, to date no system has been shown to accurately collect data [7] and truly integrated systems do not exist yet. We propose to develop and implement a system for monitoring pregnancy through integration of wearable devices, medical knowledge and relevant algorithms, and with the use of personal pregnancy record. This system takes input from continuous activity monitoring device (smart watch), smart devices that are used several times a day (smart scale, blood pressure monitor, breathing rate, blood sugar, and temperature). Similar systems have been proposed [8-12] but a truly functional system is not available.

Computer science

We will develop a software system for capturing, processing, storing and the analysis of health data and decision-making support needed for maintenance of healthy pregnancy. The system will focus on comprehensive data collection from wearable devices, linked smart devices, early detection of risks and possible complications that will trigger alarms and recommendations to see health care specialists. The system will use commercially available devices and sensors and we will focus on the development of software system.

Aims and Objectives

This project focusses on applied computer science – we will use computer science techniques and methods to perform health monitoring (data collection, management and processing) and provide automated support for medical decision making through application of machine learning approaches [12]. The main aim of this project is to develop and implement a system

for online analytics of pregnancy monitoring data that can be used to predict various complications and rapidly advise patient about emerging risks. Our application will monitor several basic signs (weight, blood pressure, temperature, physical activity, heart rate, and sleep) and integrate these data into a decision-making system. We will focus on prediction of gestational diabetes [13] and pre-eclampsia [14].

Specific objectives are:

1. Perform the survey of the state-of-the-art solutions for pregnancy monitoring using sensor systems, personal health record, and wearables.
2. Develop and implement a method for standardization of data streams for mobile monitoring of pregnancy.
3. Develop interface for data capture and analytics.
4. Perform a demonstration example using weight gain related risks
5. Prepare an article for publication
6. Complete and submit the final year dissertation.

Project Plan

Software development will utilize Waterfall model of software development [15]. The waterfall model is suitable because this work will result in a working prototype and not a commercial product. The main priority of this project is functional software prototype that will effectively deal with analytics of highly dimensional noisy data. The theoretical technological and engineering aspects of the software development will be considered and deployed as a secondary priority in this project. Specific tasks are:

Preparatory

1.1 Complete and submit supervisor project proposal, detailed project proposal, revised project proposal, and preliminary research ethics checklist
1.2 Review literature, existing pregnancy monitoring solutions
1.3 Develop software project plan document, revise

Software development

2.1 Develop and implement data standardization protocol
2.2 Develop and implement user interface for pregnancy health monitoring
2.3 Develop and implement solution for summary data analytics and decision-making support
2.4 Demonstrate the utility of developed software using gestational diabetes and pre-eclampsia as case studies

Reporting and publication

3.1 Provide weekly incremental progress reports and short monthly written reports
3.2 Complete and submit interim report (deadline January 7, 2019)
3.3 Develop a plan and schedule for preparing the final dissertation, preliminary and revised.
3.4 Write and submit the final dissertation (deadline May 6, 2019).
3.5 Prepare and submit an article for publication (desired but not compulsory)

References

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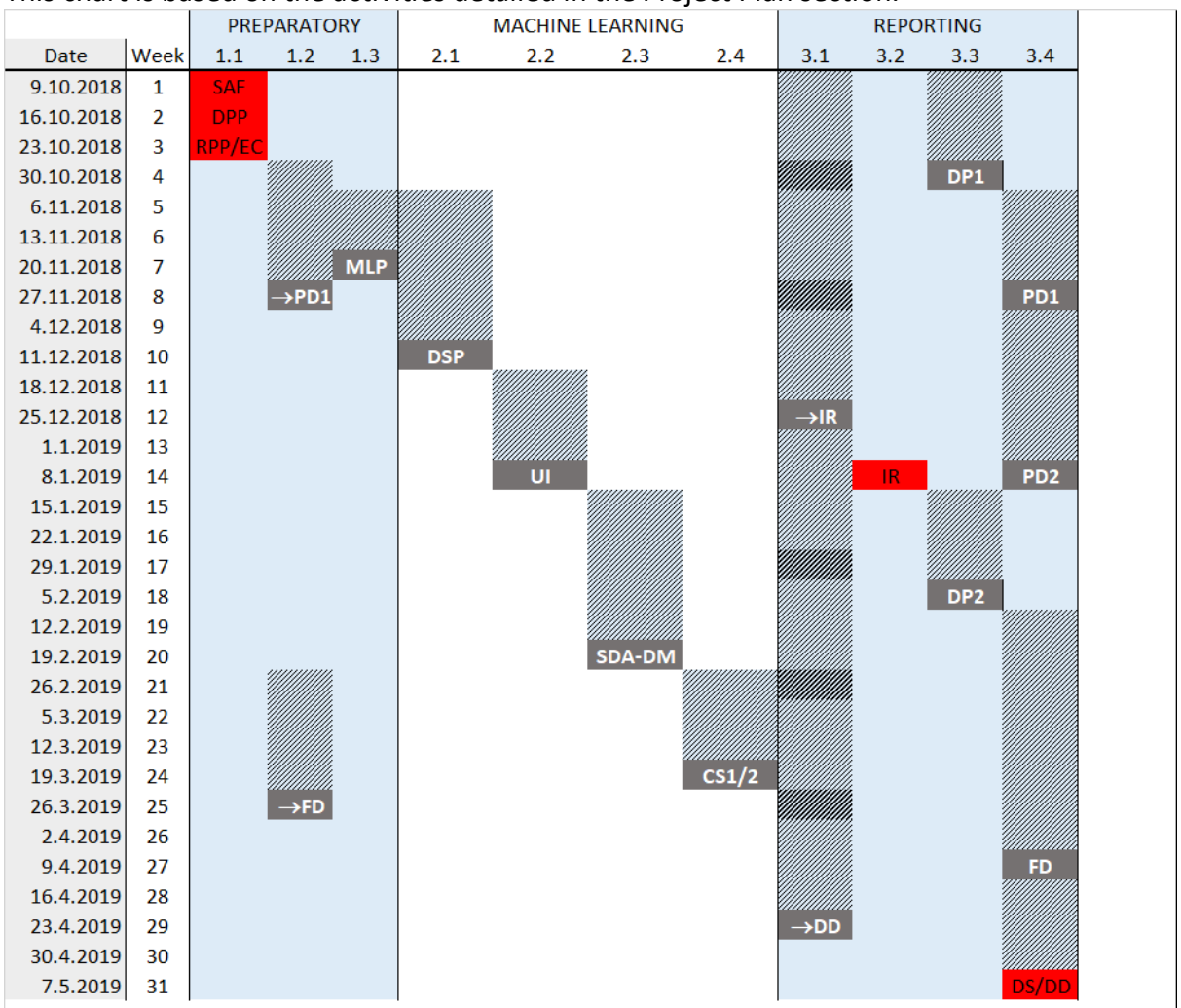
Project schedule and deliverables

This chart is based on the activities detailed in the Project Plan section.



ADMINISTRATIVE DELIVERABLES

12.10.2018	SAF	Supervisor agreement form
15.10.2018	DPP	Detailed project proposal
22.10.2018	RPP	Revised project proposal
22.10.2018	EC	Preliminary research ethics checklist
7.1.2019	IR	Interim report submission
6.5.2019	DS	Dissertation submission
7.5.2019	DD	Demonstration day

INTERIM DELIVERABLES

DP1/2	Dissertation plan and schedule
PD1/2	Preliminary draft (structure)
FD	First draft
SPP	Software project plan
DEMO	Demonstration
MLP	Machine learning plan
DSP	Data standardization protocol
UI	User interface
SDA-DM	Data analytics-decision making
CS1/2	Case studiespsia