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Wearable sensing to facilitate mobile personal Health

In the late 1990s and early 2000s, the wireless mobile telecommunication revolution has shaped the future of communication and electronics. Smartphones with mobile internet access and connected devices via short distance data transfer protocols (e.g. Bluetooth) have enabled an entire new world of applications and opportunities for wellness and health care solutions. Philips, along with other important industries in the HealthCare sector, had and still have to move fast to keep up with this transformation. We will here introduce a connected health device powered by an unobtrusive wearable sensing platform, based on photoplethysmography (PPG) and accelerometry (ACC); and an e-coaching service. Thanks to the combination of PPG and motion signals, several physiological parameters are monitored. These are: pulse rate, pulse rate variability, respiration rate, and arrhythmias. A second layer of features, such as, energy expenditure (EE), activity classification, cardiorespiratory fitness (CRF), and sleep architecture are also derived. This talk will focus on the set of problems and solutions characterizing two key application features, EE and CRF estimation for mobile applications in healthy people and patients. EE, or calorie tracking, is now supported by the large majority of activity monitors. Its main application in healthy people is clearly weight management. However, accurate physical activity level monitoring has been shown to be relevant also in several patient populations. ACC or HR based EE estimation on their own have separate strengths and limitations, our work has investigated the advantages to merge these two signals. CRF is largely used in the sports and health settings. This is because of its predictive power of aerobic performance, but also because of its direct link with exercise capacity and cardiac function. However, the need for a specific protocol, equipment, the use of medications are usually evident barriers for CRF self-monitoring. We have developed a series of innovative ways to estimate CRF in healthy and ill people, of which we will give here an account. We will also show an example of a CRF program provided by a mobile application. Finally, although all this would have been unimaginable just two decades ago, there are still many risks and challenges to be faced and solved in this field to unleash the real potential of mobile health.