What Can Your Smartwatch Tell You About Your Mental Health?

Recognizing Pathological Behavior by Using Smartwatches

Motivation

Mental health problems are a growing public health concern with an increasing public awareness in the last few years [1]. According to the WHO, one in four people in the world will be affected by mental or neurological disorders at some point in their lives. Mental health is a very broad topic which comprises many different disorders. Having a broken leg is obvious and you get a lot of understanding in society. But what about mental disorders? Do you know how to identify if someone is suffering from depression? Or do you even know the mental diseases bipolar disorder or obsessive-compulsive disorder (OCD)? Since most people do not even know these diseases, they obviously cannot identify the symptoms. This master project aims to develop technologies which will revolutionize the diagnosis and treatment of mental diseases, in particular OCD, by recognizing pathological behaviors in daily life with the help of sensor data from smart watches and Internet of Things (IoT).

More than 2% of the world's population are diagnosed with OCD once in their lifetime [2]. Patients suffer from recurrent or persistent thoughts, images, impulses or actions and they have the desire to resist it [3]. These obsessions and compulsions take more than one hour a day. Typical behavior includes, among others, repeatedly checking on things, e.g. if the door is locked or that the oven is off. If at all, OCD is often diagnosed very late. Responsible for this problem is lack of knowledge about the illness or shame of the patient [4]. With the multitude of new connected devices (smartwatch, smartphone, fitness tracker) and other IoT gadgets, compulsive habits could be identified early.

Project Goals

In this master project you can experiment and work with many different connected devices as i.e. smartwatches, fitness tracker or even inertial measurement units (IMUs). Furthermore, you will collect data and generate a dataset. With the help of this dataset you will have the chance to deepen your knowledge about machine learning by applying different methods to real use cases. A possible goal can be to recognize repetitive activities whereby pathological behaviors, such as the ones resembling OCD, can be identified. Nonetheless, there are additional available mental health topics like monitoring of mental stress levels based on physiological sensor data which can be covered during the project as well. Thus, the project can be adapted to your interests and learning objectives.

[1] Mental Health Foundation. (2016). Fundamental Facts About Mental Health 2016. Mental Health Foundation: London
[2] W. K. Goodman, D. E. Grice, K. A. Lapidus and B. J. Coffey, "Obsessive-Compulsive Disorder," Psychiatric Clinics of North America, vol. 37, no. 3, pp. 257-267, 2014.
[3] A. T. Carr, "Compulsive neurosis: A review of the literature," Psychological Bulletin, vol. 81, no. 5, pp. 311-318, 1974.
[4] "Obsessive-Compulsive Disorder," National Institute of Mental Health , 01/2016, https://www.nimh.nih.gov/health/topics/obsessive-compulsive-disorder-ocd/index.shtml

Methodology

On the basis of an existing framework for collecting the data from various available connected devices you can collect a variety of activity data as well as other physiological parameters (e.g. heart rate, electrodermal activity, skin temperature). You will have a determining influence on the setting of your data collection since it will be simulated and not in a real patient environment. By collecting sensor data (e.g. movement, location, environmental, etc.) you can investigate different statistical and machine learning methods, supervised and unsupervised, in order to perform activity recognition. On the one hand, you could identify specific OCD activities by using supervised machine learning techniques (checking if the door is locked or the oven is off). On the other hand, you could try to classify the activities into pathological and normal behavior by just using unsupervised machine learning methods.

About You

- You are interested in working with a multidisciplinary team
- Working with sensors and smartwatches sounds fun to you
- You are motivated to deepen your machine learning knowledge and to try out and compare various approaches
- You are curious about use cases in the field of mental health

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