Chapter 10
Artificial Intelligence in Digital Mental Health

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ABSTRACT

The prevention of diseases considered a scourge of our society, as for example mental illness, particularly anxiety disorders and depressive states, is a primary and urgent goal today and a priority axis of the EU. Mental illness includes many clinical conditions associated with several changes that include limitations related with social interaction or several tasks such as sleeping through the night, doing homework, making friends, thinking capacity and reality understanding, deficits in communication skills, and difficulties in developing appropriate emotional and behavioural response. Artificial intelligence has gained a prominent role in the management and delivery of healthcare. There is a growth in mobile devices applied to health with high mobility, connectivity, and processing capacity. This chapter provides an analysis of the actual trends regarding the main problems that can be dealt with using AI in mental healthcare and the corresponding main techniques used to deal with these problems. Additionally, some case studies for using AI for mental health care are described.

DOI: 10.4018/978-1-7998-8634-1.ch010

INTRODUCTION

Since the primordial days of Artificial Intelligence (AI), many applications in the medical area have been developed. Initially, Knowledge-Based Systems, and in particular, Expert Systems were the first AI approaches to develop applications in the field of medicine. However, the current advances in computational capacity, data acquisition and machine learning techniques have contributed to a growing interest in AI.

One of the difficulties for doctors that arise during the diagnostic process is related to the fact that interactions with the patient only offer an instantaneous image of an individual's mental state, although mental state disorders can be dynamic, changing over time. As the availability of medical teams is limited, psychiatric assessment of patients based on the observation of their mental state can only be carried out for short periods. AI can provide alternative methods, such as audio and video analysis, bringing greater objectivity and may present better predictive behaviour.

AI may be combined with smartphone applications to increase monitoring coverture, during a significative period of the patient's day. These applications can actively query users about their state of mind, sleeping periods and other relevant habits. The behaviour of patients can be tracked by these apps, such as smartphone activity, the variation of the voice, speaking rate, and voice quality. These tracked behaviours can be used as predictors of symptoms of depression and other mental disorders.

Another aspect related to monitoring is the fulfilment of drug prescriptions. This is a problem that accompanies all chronic patients and is of particular importance in mental health problems. There are several examples of applications for smartphones that aim to assist the patient in fulfilling drugs prescriptions, generating alerts about the need for taking medications. The application of machine learning techniques in this context can allow these applications to have the ability to adapt to the patient, thus improving their recommendation capabilities, always with the aim of improving the patient's adherence to medication.

AI can also have an important role in the prevention of episodes of mental disorder. Machine Learning can be effectively used to identify words and emojis that can signal a person at higher risk of suicide ideation or self-harm. Artificial intelligence can allow existing treatments to be provided through new approaches, which can increase availability and effectiveness. Virtual therapists can be powered with AI tools to avoid patients getting embarrassed to share problems with a therapist with whom they interact for the first time.

Recent improvements in conversational systems, allowed chatbots to mimic normal conversational style to increase adherence to treatments and decrease both depression and anxiety. However, these systems are still in a preliminary stage of research but already reveals great potential for improvement.

AI may contribute to providing more time for medical staff to interact with patients and improving the quality of care. Natural Language Processing (NLP) offers a set of techniques allowing the implementation of applications that can be used to save time for psychiatrists. These professionals need an appreciable time to read previous notes that allow them to build the patient's accurate history. For example, NLP techniques can be applied to get a summary of the most relevant data from a patient's health records, providing that way with a succinct summary at the beginning of a clinical visit.

The first National Mental Health Epidemiological Study, carried out as part of the World Mental Health Survey Initiative, ranks Portugal as the second European Union country with the highest prevalence of psychiatric disorders (22.9%), only surpassed by Northern Ireland (23.1%). In this study, anxiety disorders representing the group of mental illnesses with the highest prevalence in our country (16.5%) and the second highest impact in terms of disability adjusted years (daily of 1.8%), with a tendency to