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A review of depression and suicide risk assessment using speech analysis

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Abstract

This paper is the first review into the automatic analysis of speech for use as an objective predictor of depression and suicidality. Both conditions are major public health concerns; depression has long been recognised as a prominent cause of disability and burden worldwide, whilst suicide is a misunderstood and complex course of death that strongly impacts the quality of life and mental health of the families and communities left behind. Despite this prevalence the diagnosis of depression and assessment of suicide risk, due to their complex clinical characterisations, are difficult tasks, nominally achieved by the categorical assessment of a set of specific symptoms. However many of the key symptoms of either condition, such as altered mood and motivation, are not physical in nature; therefore assigning a categorical score to them introduces a range of subjective biases to the diagnostic procedure. Due to these difficulties, research into finding a set of biological, physiological and behavioural markers to aid clinical assessment is gaining in popularity. This review starts by building the case for speech to be considered a key objective marker for both conditions; reviewing current diagnostic and assessment methods for depression and suicidality including key non-speech biological, physiological and behavioural markers and highlighting the expected cognitive and physiological changes associated with both conditions which affect speech production. We then review the key characteristics; size, associated clinical scores and collection paradigm, of active depressed and suicidal speech databases. The main focus of this paper is on how common paralinguistic speech characteristics are affected by depression and suicidality and the application of this information in classification and prediction systems. The paper concludes with an in-depth discussion on the key challenges – improving the generalisability through greater research collaboration and increased standardisation of data collection, and the mitigating unwanted sources of variability – that will shape the future research directions of this rapidly growing field of speech processing research.

Keywords: Depression; Suicide; Automatic assessment; Behavioural markers; Paralinguistics; Classification

Contents

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1. Introduction

Clinical depression is a psychiatric mood disorder, caused by an individual's difficulty in coping with stressful life events, and presents persistent feelings of sadness, negativity and difficulty coping with everyday responsibilities. In 2002 the *World Health Organisation* (WHO) listed unipolar depression as the fourth most significant cause of disability worldwide, and predicted it will be the second leading cause by 2030 (Mathers and Loncar, 2006). Olesen et al. (2012) estimated that in 2010 the cost per patient of depression in Europe was €24,000 (in terms of relative value assessed across 30 European countries) and the total cost of depression in the European Union was €92 billion,