Body motion properties as indicators of depression in elderly*

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Abstract— **Depression is a common mood disorder that is rapidly affecting lives of elderly worldwide. The detection of depression, however, is an issue because the common methods are subjective and depend of patient self-reports. Automated recognition may, therefore, be beneficial. This paper examines the possibility of using body motion properties as potential indicators of depression in elderly, and proposes an experimental method to assess the validity of such measures.**

I. INTRODUCTION

Population ageing is a worldwide trend and the proportion of elderly people is constantly increasing [2]. The growing burden of depression in elderly suggests that there is a need to develop automated depression detection which will help in effective care of patients suffering from depression. Automated depression detection can be used to support clinicians' decisions, to avoid false diagnosis as well as overcome subjective bias associated with self-reports.

Depression is a state of negative mood that may last for a long time and impact the individual's proper functioning [8]. In addition to effects on the person's thoughts, behaviors, feelings, and sense of well-being, depression has an impact to the motor system as well [15]. And indeed, past research has examined the effects of depression on body motion [5]. However, the current knowledge deals with young people. Yet, because aging has an impact on body motion [5], it would be beneficial to examine the effect of depression on body motion in elderly. Thus, the current paper focuses on examining the link between depression and body motion in elderly. It reviews the relevant literature and proposes an experimental methods to investigate the effect.

II. RELATED WORK

Body motion is a central part of the human social communication [3]. It may be defined as the collection of signs such as posture, speed of movement, meaningful coordination of actions expressed by the human body [10].

Psychologists have shown that depressed individuals differ from non-depressed with regard to objectively quantified gross motor activity, body movements and motor reaction time [11]. For instance, sadness and depression are characterized by reduced walking speed, arm swing, and vertical head movements as well as slumped postures and larger lateral body sway [6].

Past research examined visual indicators for depression, including body motion and periodical muscular movements

[7]. Research have also used video data to recognize depression based on general movements [4, 9, 12], posture [9] and head pose [4, 12]. Results have shown that body expressions and head movements can be significant visual cues for depression detection [4].

Researchers dealt with the link between body motion and mood (rather than depression). One research, for example, found upper body postural features can predict people's mood [13]. Mood prediction has so far been tackled mostly through the direct mapping of video features to mood. Decision Tree classification and multimodal fusion of audio-visual and text features is performed by [16]. Head pose and movement features associated with the face are considered by [1] performing classification with Support Vector Machines (SVM) on depression recognition. They concluded that head movements of depressed people are different than that of normal person. Deep learning based approach is presented by [14].

Altogether, the literature demonstrates that automated detection of depression in general population, regardless of age, is an active research area. We propose an experimental method to examine the topic specifically in elderly.

III. PROPOSED METHOD

Research participants will be elderly people who will be recruited based on background information we will collect. We will make sure to recruited both depressed and non-depressed participant. Depression data will rely on self-report.
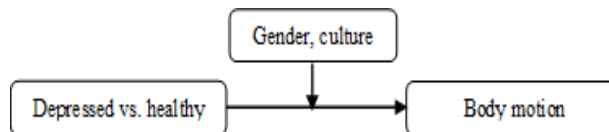
Participants will be asked to walk straight for several minutes in our lab. Movement will be recorded using a motion capture system (Qualisys, Sweden).

Relying on past research conducted in lab setting [5], we will use regression analysis to predict the depression in elderly by learning the relationship between body motion properties (walking, head movements, stability, posture) as features and depression scale. Human-verified examples will be provided to a regression algorithm which learns the mapping and novel video frames can then be interpreted by extrapolating from this learned mapping.

Context knowledge summarizes information about the environment, subject (gender, personality traits and culture), current activities and interactions. The current approaches largely do not take context knowledge into account but

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analyzing the context when a movement is performed may lead to more robust recognition [5].

IV. EXPECTED RESULTS

We expect that the proposed method will define clearly which body motion properties can be successfully used as potential indicators to detect the scale of depression in elderly.

V. CONCLUSION

The expected results can contribute to the field of automated detection of depression in elderly. Such module for automated depression recognition can be integrated into a robot architecture and Human Robot Interaction (HRI) scenario. An additional key contribution of this work will be the design of a new database focused on elderly with the goal to validate experimentally the proposed model. The database will contain local elderly comprised of two groups: (a) diagnosed with depression and (b) elderly that are healthy with no clinical disorders.

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