International Journal of Electrical and Computer Engineering (IJECE)
Vol. 12, No. 6, December 2022, pp. 5998~6009
ISSN: 2088-8708, DOI: 10.11591/ijece.v12i6.pp5998-6009

A survey on bio-signal analysis for human-robot interaction

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Article Info

Article history:

Received Jul 29, 2022
Revised Jun 12, 2022
Accepted Jul 5, 2022

Keywords:

Bio-signals
Health care
Human-robot interaction

ABSTRACT

The use of bio-signals analysis in human-robot interaction is rapidly increasing. There is an urgent demand for it in various applications, including health care, rehabilitation, research, technology, and manufacturing. Despite several state-of-the-art bio-signals analyses in human-robot interaction (HRI) research, it is unclear which one is the best. In this paper, the following topics will be discussed: robotic systems should be given priority in the rehabilitation and aid of amputees and disabled people; second, domains of feature extraction approaches now in use, which are divided into three main sections (time, frequency, and time-frequency). The various domains will be discussed, then a discussion of each domain's benefits and drawbacks, and finally, a recommendation for a new strategy for robotic systems.

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1. INTRODUCTION

Human-robot interaction (HRI) is a rapidly expanding field of study and application. There are numerous complex problems in this field, and solutions that have a positive societal impact are possible. due to their interdisciplinary nature, researchers in the discipline must understand their studies from a larger perspective [1]. HRI is an interdisciplinary topic that encompasses essential research in domains such as human-robot interaction (HCI), artificial intelligence (AI), control systems, pattern recognition, psychology, electronics, mechanics, social communication, behavioral expression systems, and neuroscience, among others. Most HRI experiments involve the development of a robot that interacts with the environment or a specific item. They devised a movement strategy for a particular situation (based on physical attributes) without considering the impulse or stream of thinking that characterizes human activity [2].

To develop the robotics hardware and software needed to create a successful human-robot interface. A range of fields must collaborate, analyze human behavior when interacting with robots in various social circumstances, and design the aesthetics of the robot's embodiment and behavior and the domain knowledge required for specific applications. Due to the numerous disciplinary jargon and processes [3]. Monitoring and evaluating the patient's physiological data is crucial in physical therapy to assess treatment effects and regulate assistive devices during the rehabilitation process. These two forms of data are detected using various sensors, including electromechanical sensors (such as accelerometers) [4]. And biosensors (such as electromyography (EMG) [5], as well as force sensors [6], Electroencephalography (EEG), and magnetoencephalography (MEG) have been used. Electromechanical sensors can effectively detect biological data [5], [7].

The number of possible bio-signals is enormous, given that there are many physiological systems of relevance. Bio-signals include everything from a visual evaluation of the patient to bodily indicators captured