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A Perspective on Advanced Biomedical Image Processing

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Introduction

Nearly three people are added to the world's population every second. Each of these persons is an extremely complex but marvellously organised body that they each live, think, enjoy, worry, lament, and daydream within. Such a system is affected by its surroundings, stimulated by a wide range of stimuli, and capable of adapting to both beneficial and detrimental waves of change in a constantly changing globe. Not only the physiology of the organs, but also their functions and possibly their metabolic activities, need to be reviewed in order to comprehend the structure and functions of the human body as well as the various biological and biochemical processes involved in human physical and mental development..

Description

The majority of these investigations rely on physiological and biological symptoms and signals that are taken from the human body either invasively or noninvasively using a number of sensors and equipment that have been developed over many years. Using these measurements, be represented by time series of brain and muscle electric potentials, pictures captured using various modalities, image sequences, statistics, skin impedance, enzyme, heart and lung sounds, blood pressure, ocular pressure, body temperature, and many other biometrics and information. In light of recent developments, the mechanisms for measuring such information have been enhanced. Technological and scientific advancements along with the creation of new measurement systems and tools in this direction, many mathematical and signal processing algorithms have also been introduced and implemented by thousands of researchers. Numerous scholars from all over the world are interested in the analysis, interpretation, detection, estimate, and modelling of signal events and trends, their evolution, and the irregularities and anomalies that affect them. It's likely that only biological impacts and signals undergo continuous evolution in a variety of ways (domains).

For instance, Depending on numerous factors, a concentration of germs in one place spreads to the neighbouring cells and tissues at varying rates. Biological and biochemical components symbolises changes throughout time and space. Another illustration is the electroencephalography (EEG) signals from the medial temporal lobes of epileptic patients, which can change from chaotic to rhythmic before the commencement of a seizure and gradually decrease in frequency during the ictal period. As a result, such signals evolve over time and over frequency. Think about how the EEG signals for sleep change as another illustration. Throughout the four phases of sleep, their patterns change. Such patterns can be understood and analysed to learn a lot about the functions and defects of the human body. More crucially, as cognitive processes like mental tiredness and brain illnesses like dementia or Alzheimer's grow connection of the brain lobes changes. The processing of brain impulses can greatly enhance clinical diagnosis and monitoring of the diseases and abnormalities. Mutation in genome sequences is a key to understanding of some life-affecting/threatening physiological changes within a live organism. Anomalies in heart beat sequence can be a sign of stroke. Generation of medial temporal spikes can be a sign of seizure development in animals and human. Many of these signals can be fleeting sources which are transient with no regularities in their occurrence. Consequently, the normal body activity changes due to such abnormalities. A complex sensory network within the body transmits information from various sources and processes it to cause coherency, synchronisation, interaction, and stimulation of the human body. The first steps toward recognising, modelling, and monitoring such functions are isolation, discrimination, separation, clustering, and classification of these activities. Additionally, due to numerous chaotic or cyclical natural phenomena, the activities of the human body as a whole vary, and the symptoms alter. Various bodily conditions, such as seizure, different sleep stages, respiration, heart rate, blood circulation, and attention. Characterization, An in-depth understanding of the human organism is provided by the monitoring, measuring, and tracking of such evolution.

Although major research has been dedicated to analysis of signals such as electrocardiogram (ECG), electroencephalography (EEG), and electromyogram (EMG), there have been tremendous activities in some new data acquisition modalities such as functional magnetic resonance imaging (fMRI) sequences, and near infrared spectroscopy (NIRS) imaging. magneto encephalography (MEG), as another brain scanning tool, avoids the problem of non-homogeneity of the head, as a transferring medium, in significantly better localization of synaptic sources within the brain. In another domain, advancing in biometrics, not only for security and surveillance, but also for diagnosis of diseases, disorders, and physical abnormalities in human, have brought eye pattern recognition, cochlear technology, and micro body sensors into the research front. These new modalities complement the traditional finger print, face, and gait recognition systems. A novel method of electrocardiogram beat categorization has been investigated.

The 5th paper of this special issue addresses this problem using machine learning techniques. It however, doesn't provide a good description of the data and its significance. Articular cartilage in health and disease has been investigated using a variety of imaging methods. Conventional radiography cannot identify early chondral deterioration, but it can indirectly quantify articular cartilage by assessing the joint space. Arthrography, which combines CT or x-rays, is used to evaluate the cartilage's surface contour , but it does not provide information on the soft tissues. While the US FDA continues to view radiographic assessment of joint space narrowing as the gold standard modality for diagnosing osteoarthritis (OA), many recent studies, such as the Osteoarthritis Initiative (OAI), use MRI to examine cartilage because it offers exceptional contrast and allows for both morphologic and physiological imaging techniques [1-5].

Conclusion

For feature extraction, the empirical mode decomposition (EMD) and singular value decomposition (SVD) techniques have been applied. The directed acyclic graph (DAG) support vector machine (SVM) has been suggested for classification. Particle swarm optimization has been used to optimise the SVM parameters. The findings show progress toward automatic ECG beat classification, which has a wide range of therapeutic uses. Some recent research has been focused on automatic diagnosis and assessment of diabetes level for Indian community.

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Conflict of Interest

The Author declares there is no conflict of interest associated with this manuscript.

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