

Tuberous Sclerosis Complex (TSC) Disease Prediction Using Optimized Convolutional Neural Network

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ABSTRACT

Tuberous sclerosis Complex (TSC) disease is a multi-system genetic disorder that broadly affect the central nervous system resulting in Epilepsy, seizures, behavior problems, skin abnormalities, kidney disease etc. This hazardous disease is caused by defects or mutations of two genes: TSC1 and TSC2. The key challenge is to analyzing the hidden information that lies into TSC1 and TSC2 gene sequence which can reveal significant information to properly diagnosis the disease. Efficient data mining techniques can play a pivotal role in analyzing the attributes of TSCs in an automatic manner. For efficient classification of TSC, this paper proposes an optimized-CNN algorithm which is a hybridization of Convolution Neural Network (CNN) with Particle Swarms Optimization (PSO). Experimental analysis reveals that the proposed algorithm outperforms other traditional data mining techniques. The paper also generates analysis rules by applying Apriori and Decision Tree algorithms. The promising result of the proposed algorithm makes it a suitable candidate to be used by the medical experts for the diagnosis of the disease.

CCS Concepts

• CCS → Computing methodologies → Machine learning → Machine learning approaches .

Keywords

OneHotEncoder; Tuberous Sclerosis Complex (TSC); CNN optimized by PSO; Apriori Algorithm; TSC1 & TSC2 Gene; Single Nucleotide Protein () Sequence.

1. INTRODUCTION

Tuberous Sclerosis is a rare genetic multisystem disorder resulting from mutations in the sequence of either TSC1 gene or TSC2 gene or both. It also causes tumors in various organs of

human body including Brain, Kidney, Liver, Skin, Eyes etc. various types of symptoms incorporate with each other that may include seizures, intellectual disability, developmental delay, behavioral problems, skin abnormalities, and lung and kidney disease [15]. TSC1 and TSC2 genes are coded for producing Hamartin and Tuberin proteins. Both of the proteins act as tumor growth suppressor and also regulate cell proliferation and differentiation [18]. The physiological disclosure of TSC are because of the growth of hamartia, hamartomas and cancerous hamartoblastomas. The birth causation of Tuberous Sclerosis is 1 in 6000 [16]. Epilepsy [22] which is the long term result of Tuberous Sclerosis is the most common Neurological disorder found in TSC family. Till now this disease is diagnosed clinically by identifying different types of mutations in TSC1 and TSC2 gene sequence. If any of the mutations can be identified in a patient's TSC gene sequence, then that will be enough to diagnosis the disease. Since, the mutations database is increasing day by day and hence, only clinical intervention is not enough to detect TSC disease within a short time. It will be costly as well as time consuming to ensure the presence of the disease. An automated machine assisted mechanism can overcome this limitation very easily. But till now no such technique has been developed to detect and diagnose the disease.

Data mining techniques are basically ensemble types machine algorithms which extracts significant information within huge datasets. Nowadays, various data mining as well as machine learning techniques have a huge impact on medical science. They are able to generate classification rules by formed of IF condition and THEN statement. Hence, data mining approaches can play a significant role to analyze the genes to identify TSC disease.

To handle the problem, this paper proposes an optimized Convolution Neural Network to automatically analyze and predict the disease from the available data sources with an accuracy of 83.17%, outperforming few other classification algorithms. For data mining analysis we have focused on Apriori and decision tree rule induction mechanism and generate a set of association rules which can lead experts to perform accurate diagnosis and develop diagnosis methods depending on the association rules.

The rest of the paper is organized as follows. Section 2 gives an overview of other related works. A brief overview and statistics of the data set is illustrated in Section 3. Our proposed framework is presented in Section 4. The following sections gives the implementation mechanism of the proposed framework. Comparative analysis of the results obtained from various experiment over the data set as well as the generated rules are

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Rainbow Dreams: 35 Years Of Empowering Children With Autism And Other Developmental Challenges Kenneth K Poon, Sze Wee Tan, Faridah Ali Chang, Manoj Pathnapuram, Kenneth Lyen, 2022-11-15 This book discusses the management of individuals on the autistic spectrum as well as other developmental challenges. It provides an excellent resource guide for parents, caregivers, educators, healthcare workers, psychologists, and everyone involved in the care of differently abled and autistic persons. The approach is practical and the aim is to try to gain deeper understanding into these conditions. Based on the experience of the staff and parents of the Rainbow Centre, the management is a person-centred, multidisciplinary and quality of life focused approach to helping these persons. The book also covers the history and future directions across one's lifespan in the care of these individuals.

Absolute Pediatric Neurology Yasser M. Awaad, 2018-07-24 This practical book features more than 1000 questions and answers with illustrations for pediatric neurologists, adult neurologists, general pediatricians, and students taking their initial board examination and maintenance of certification. All questions are in multiple choice format and followed by the correct answer with a full explanation and appropriate references. Chapters are sectioned by different topics in pediatric neurology including Epilepsy, Metabolic Disorders, and Movement Disorders, and other topics. Timely and thorough, this is a handy and succinct resource.

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