

Enhancing Gait Pattern Analysis with Deep Learning on Image Data

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Abstract: Current techniques for analysing gait patterns from picture data lack the sturdiness and precision necessary for real-world clinical applications and extensive research. It is necessary to create and test deep learning models that can efficiently improve gait pattern analysis by taking advantage of differences in subject appearances and ambient variables while extracting useful characteristics from photos. This study looks at and develops deep learning methods for accurate and affordable image-based gait pattern analysis in an effort to solve this issue. In this paper we have proposed deep convolutional neural network (DCNN) that gives best accuracy of 97.80 % and error of 0.04 % than Long Short-Term Memory Model (LSTM), Radial Basis Functional Neural Network and Linear Neural Network (LNN) on image data. This model will be helpful in clinical healthcare to detect human gait pattern with better accuracy and less error.

Keywords: LSTM, RBFNN, BNN, Gait Pattern, DCNN, Deep Learning.

INTRODUCTION

Analysis of gait patterns is an essential component of biomechanical and medical research, with applications in biometrics, orthopedics, and rehabilitation. Traditional gait analysis techniques frequently need pricey and specialized equipment, including motion capture systems or force plates, rendering them unavailable for routine clinical evaluations and extensive research. As a result, non-invasive and economical methods to evaluate human gait patterns are becoming more and more necessary. While image-based gait analysis has become a viable option, there are still certain difficulties with it. It is necessary to get beyond obstacles linked to varying lighting conditions, camera angles, and subject looks in order to extract useful gait data from photos. The effectiveness with which traditional computer vision techniques may address these issues is constrained. The performance of deep learning models in a variety of computer vision tasks, such as object and picture identification and classification, has been remarkably impressive. However, the use of deep learning for the interpretation of gait patterns from picture data is yet largely unexplored [1,4,5]. Gait pattern identification has been explored using skeletal data, sensor data, gait energy concept and machine learning models. Each one has its own merits and demerits. Identification of gait patterns is still a complex task due to its inherent limitations such as person clothes, way of walking, emotions affected walk, cost of gait data recording and clinical constraints [2,3,6]. Gait analysis is called human walk-in which human contains various way of walking. Generally human walk is classified into two major class called normal and abnormal walk. Gait abnormality is abnormal walk in which human walk is badly affected by neurological diseases, injuries and due to lack of skeletal structure [7,8,9].

From above discussion it is clear that there are many approaches and methods are available in literature to classify gait abnormality. The choice of methods depends upon the kind of gait data availability, requirement of applications and objective of problem statements. Machine learning models (ML) and Deep Learning models (DL) have gained huge popularity in recent times where gait dataset is available. Time series data for modelling sequential data using Hidden Markov Model (HMM) and matching similarity patterns using dynamic time wrapping techniques (DTW) have used by many researchers to identify abnormal gait patterns. Apart from this, Explainable Artificial intelligence