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Neural Network and Support Vector Machine for Prediction of Foot Disorders Based on Foot Analysis

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Abstract : Background:- Foot disorders are common in musculoskeletal problems. Plantar pressure distribution measurement is one the most important part of foot disorders diagnosis for quantitative analysis. However, the association of plantar pressure and foot disorders is not clear. With the growth of dataset and machine learning methods, the relationship between foot disorders and plantar pressures can be detected. Significance of the study:- The purpose of this study was to predict the probability of common foot disorders based on peak plantar pressure distribution and center of pressure during walking. Methodologies:- 2323 participants were assessed in a foot therapy clinic between 2015 and 2021. Foot disorders were diagnosed by an experienced physician and then they were asked to walk on a force plate scanner. After the data preprocessing, due to the difference in walking time and foot size, we normalized the samples based on time and foot size. Some of force plate variables were selected as input to a deep neural network (DNN), and the probability of any each foot disorder was measured. In next step, we used support vector machine (SVM) and run dataset for each foot disorder (classification of yes or no). We compared DNN and SVM for foot disorders prediction based on plantar pressure distributions and center of pressure. Findings:- The results demonstrated that the accuracy of deep learning architecture is sufficient for most clinical and research applications in the study population. In addition, the SVM approach has more accuracy for predictions, enabling applications for foot disorders diagnosis. The detection accuracy was 71% by the deep learning algorithm and 78% by the SVM algorithm. Moreover, when we worked with peak plantar pressure distribution, it was more accurate than center of pressure dataset. Conclusion:- Both algorithms- deep learning and SVM will help therapist and patients to improve the data pool and enhance foot disorders prediction with less expense and error after removing some restrictions properly.

Keywords : deep neural network, foot disorder, plantar pressure, support vector machine
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