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Neural Networks for Distinguishing the Performance of Two Hip Joint Implants on the Basis of Hip Implant Side and Ground Reaction Force

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Abstract : In this research work, neural networks were applied to classify two types of hip joint implants based on the relative hip joint implant side speed and three components of each ground reaction force. The condition of walking gait at normal velocity was used and carried out with each of the two hip joint implants assessed. Ground reaction forces' kinetic temporal changes were considered in the first approach followed but discarded in the second one. Ground reaction force components were obtained from eighteen patients under such gait condition, half of which had a hip implant type I-II, whilst the other half had the hip implant, defined as type III by Orthoload®. After pre-processing raw gait kinetic data and selecting the time frames needed for the analysis, the ground reaction force components were used to train a MLP neural network, which learnt to distinguish the two hip joint implants in the abovementioned condition. Further to training, unknown hip implant side and ground reaction force components were presented to the neural networks, which assigned those features into the right class with a reasonably high accuracy for the hip implant type I-II and the type III. The results suggest that neural networks could be successfully applied in the performance assessment of hip joint implants.

Keywords : kinemic gait data, neural networks, hip joint implant, hip arthroplasty, rehabilitation engineering
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