Discrimination and Classification of Vestibular Neuritis Using Combined Fisher and Support Vector Machine Model

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Abstract : Vertigo is a sensation of feeling off balance; the cause of this symptom is very difficult to interpret and needs a complementary exam. Generally, vertigo is caused by an ear problem. Some of the most common causes include: benign paroxysmal positional vertigo (BPPV), Meniere's disease and vestibular neuritis (VN). In clinical practice, different tests of videonystagmographic (VNG) technique are used to detect the presence of vestibular neuritis (VN). The topographical diagnosis of this disease presents a large diversity in its characteristics that confirm a mixture of problems for usual etiological analysis methods. In this study, a vestibular neuritis analysis method is proposed with videonystagmography (VNG) applications using an estimation of pupil movements in the case of an uncontrolled motion to obtain an efficient and reliable diagnosis results. First, an estimation of the pupil displacement vectors using with Hough Transform (HT) is performed to approximate the location of pupil region. Then, temporal and frequency features are computed from the rotation angle variation of the pupil motion. Finally, optimized features are selected using Fisher criterion evaluation for discrimination and classification of the VN disease.Experimental results are analyzed using two categories: normal and pathologic. By classifying the reduced features using the Support Vector Machine (SVM), 94% is achieved as classification accuracy. Compared to recent studies, the proposed expert system is extremely helpful and highly effective to resolve the problem of VNG analysis and provide an accurate diagnostic for medical devices.
Keywords : nystagmus, vestibular neuritis, videonystagmographic system, VNG, Fisher criterion, support vector machine, SVM

Conference Title : ICBEB 2018 : International Conference on Biomedical Engineering and Biosensors
Conference Location : Paris, France
Conference Dates : June 25-26, 2018