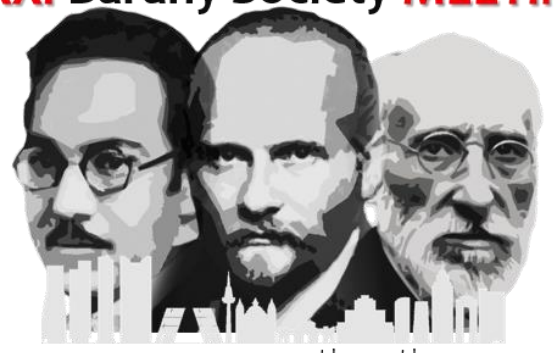
XXXI Bárány Society MEETING



MADRID, MAY 9th-11th 2022

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XXXI Bárány Society MEETING

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Session title: Application of AI & VR for Diagnosis & Management of vestibular disorders

Organizer: Kyu-Sung Kim, Chairman of Korean Balance Society, stedman@inha.ac.kr

(Professor, Department of Otorhinolaryngology-Head and Neck Surgery, Inha University College of Medicine, Korea)

1. Nystagmus classification system using deep learning. Sung Kwang Hong (Professor, Department of Otorhinolaryngology-Head and Neck Surgery, Hallym University College of Medicine, Anyang, Korea)

2. Automatic algorithm of gait/vestibular function-related fall risk problems in vestibular disease using machine learning. Hwan Ho Lee (Professor, Department of Otorhinolaryngology-Head & Neck Surgery, Kosin University College of Medicine, Korea)

3. Development of Software for Diagnosis and Treatment of Benign Paroxysmal Positional Vertigo. Ji-Soo Kim (Department of Neurology, Seoul National University College of Medicine, Seoul, South Korea)

4. Vestibular rehabilitation with virtual reality: Visual stimulation in PPPD. Seo-Young Choi (Professor, Department of Neurology, College of Medicine, Pusan National University, Pusan National University Hospital)

5. Wearable device for dizziness using AR/VR. Jae Jun Song (Professor, Department of Otorhinolaryngology-Head & Neck Surgery, College of Medicine, Korea University, Korea)

A brief description of the theme & target audience

Recently, a lot of progress has been made in the development of medical devices and diagnosis of diseases using the development of AI and VR. Therefore, this symposium aims to understand the

recent trends and development of diagnostic devices and treatments currently being developed using AI and VR.

A 150-word abstract from each of the speakers

Abstract 1

Nystagmus classification system using deep learning.

Sung Kwang Hong (Professor, Department of Otorhinolaryngology-Head and Neck Surgery, Hallym University College of Medicine, Anyang, Republic of Korea)

Artificial intelligence indicates the simulation of the human's cognitive abilities using computers or machines, such as learning and problem solving, to perform tasks similar to humans, accomplished by the "machine learning" technology. Machine learning technology has been increasingly used in the medical field with its significant benefits. The paring of neurotologic data and AI might create a new paradigm in diagnosis and treatment in neurotologic fields. We have developed the automatic nystagmus classification algorithm using deep learning. The main focus of this talk is to introduce our system for nystagmus classification and clinical applications in the neurotologic domain.

Abstract 2

Automatic algorithm of gait/vestibular function-related fall risk problems in vestibular disease using machine learning.

Hwan Ho Lee (Department of Otorhinolaryngology-Head & Neck Surgery, Kosin University College of Medicine)

The vestibular disorders can cause several fatal diseases, such as depression and fall. Specifically, patients with balance disorders and dizziness by vestibular disorders are 2.6 times and 12 times more likely to fall, respectively. Falls lead to more than 80% of all elderly deaths. Our main contribution lies in developing the first machine learning framework that predicts vestibular disorders and their types employing gait patterns such as musculoskeletal disorders, Parkinson's disease. We employed the XGBoost algorithm, which was the most popular gradient boosted decision trees. For developing and evaluating our machine learning model, we collected gait patterns for health and vestibular disorder patients in Kosin hospital. Our machine learning model turns out to offer great performance on our evaluation dataset. Another contribution is that we explain which of the gait features is the most relevant to vestibular disorders. To this end, we exploit the explainable AI techniques such as feature importance and partial dependence plot.

Abstract 3

Development of Software for Diagnosis and Treatment of Benign Paroxysmal Positional Vertigo.

Ji-Soo Kim (Department of Neurology, Seoul National University College of Medicine, Seoul, South Korea)

Benign paroxysmal positional vertigo (BPPV) is the most common cause of vertigo. Appropriate canalith repositioning procedure (CRP) results in immediate resolution of BPPV in about 80% of patients after single application and the success rate increases up to 92% with repetition of the procedure. CRP may be attempted by the patients themselves if instructed appropriately. However, the appropriate CRP should be selected according to the affected canal and subtype (canalolithiactic vs. cupulolithiatic) of BPPV. A few studies have explored the utility of questionnaires in confirming BPPV and determining the subtypes based on the characteristics (positional triggering, duration etc.) of the vertigo and positional changes that mostly induce it. A recent study investigating this questionnaire approach showed an accuracy of 71.2% in diagnosing BPPV and determining the involved canal and type. The questionnaire is comprised of six questions. The first three are designed to diagnose BPPV, and the latter three to determine the subtype and affected ear. Currently, a clinical trial is under way for self-application of CRPs based on the results of web-based questionnaire and online transfer of the video-clip for appropriate CRP (CRIS registry no. KCT00002364).

Abstract 4

Vestibular rehabilitation with virtual reality: Visual stimulation in PPPD

Seo-Young Choi (Department of Neurology, College of Medicine, Pusan National University, Pusan National University Hospital)

Recently, several studies showed significant improvement of subjective symptoms or static posturographic assessment by vestibular exercises using virtual reality programs in patients with persistent postural-perceptual dizziness (PPPD). Especially, habituation program using visual stimuli with optokinetic or complex background is revealed to be effective for improving visual vertigo. Virtual reality may be an optimized tool for promoting habituation, and it can maximize patients' compliance. I present here the effect of vestibular rehabilitation using visual stimuli in virtual reality.

Abstract 5

Wearable device for dizziness using AR/VR.

Jae Jun Song (Professor, Department of Otorhinolaryngology-Head & Neck Surgery, College of Medicine, Korea University, Korea)

The vestibular system is responsible for detecting and regulating body movements, preventing falls and maintaining vision. For this, coordination of vision, vestibular organs, and proprioceptive systems is required. In order to evaluate the balance system, it is important to evaluate the coordination of those systems.

Virtual reality is a technology that can provide an expanded spatial experience, and the patient can experience virtual space in various environments. We have developed a wearable medical device based on virtual reality and will apply to the diagnosis and rehabilitation of dizziness. Existing vestibular rehabilitation treatment requires a lot of space and expensive equipment, but the wearable medical device developed by us can provide a variety of environments without space restrictions, and can provide real-time feedback to the patient. Through this presentation, the authors will discuss the medical application of virtual reality technology and present the usefulness of the device currently under development.