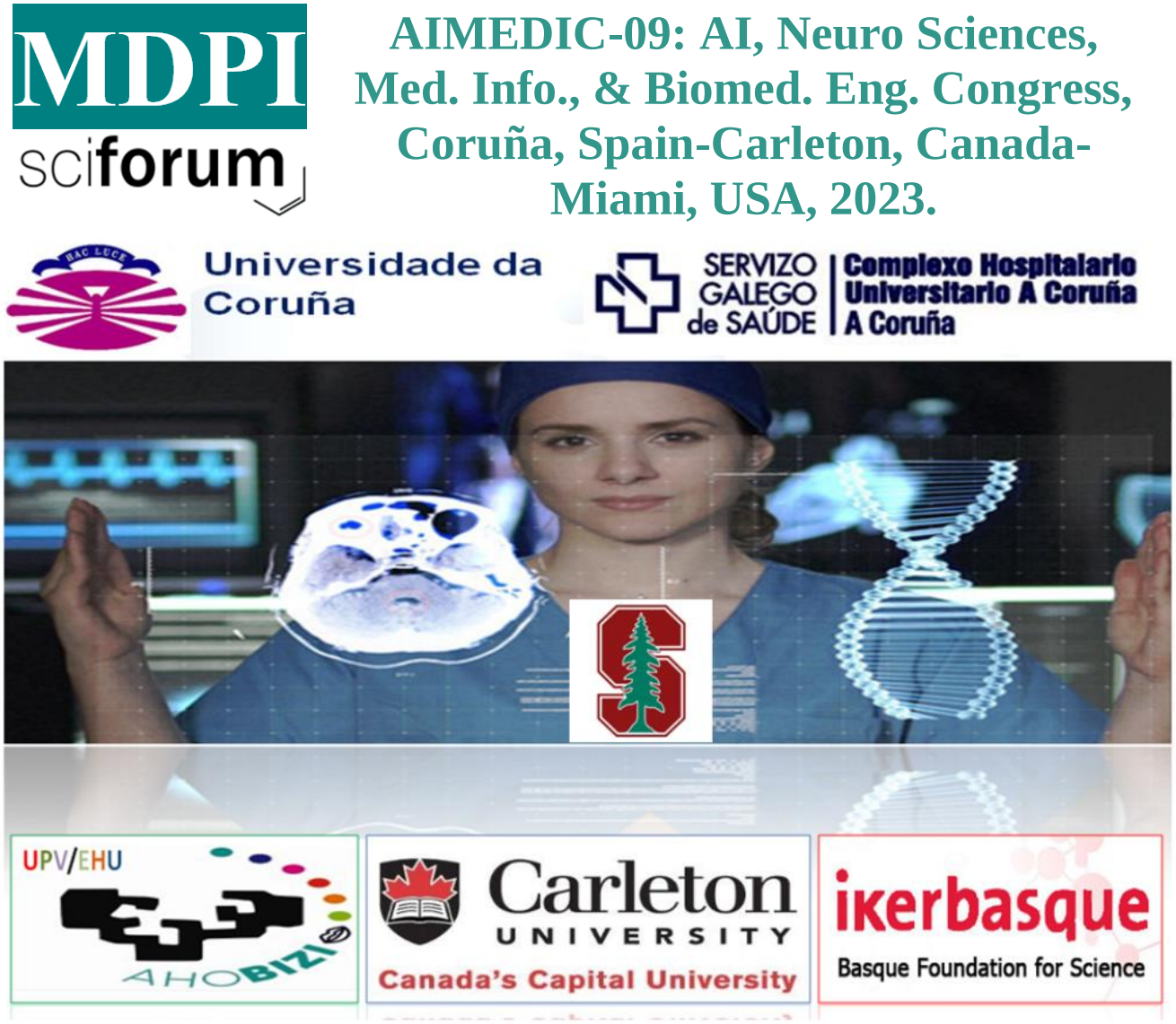

Current Innovative Artificial Intelligence Approach in Neuroscience

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Abstract. Machine learning (ML), the sub-set of AI, is a part of computer science which enables computers to have the ability to learn without being explicitly programmed. This process of leaning involves the study of pattern recognition and computational learning theory. In addition, these algorithms can learn from and make predictions on data. These models obtained enable researchers, data scientists, engineers, and analysts to get reliable, repeatable decisions. Furthermore, the results analysis and discover hidden intuitions are achieved through learning from historical relationships and trends in the data. ML models have been demonstrated the capacity of decision-making by clinicians in neurosurgical

propose. In this mini-review, AI/ML approaches to data pre-processing, modeling and representative applications in neuroscience-related-topic will be introduced.

Machine learning (ML), the sub-set of AI, is a part of computer science which enables computers to have the ability to learn without being explicitly programmed. This process of leaning involves from the study of pattern recognition and computational learning theory. In addition, these algorithms can learn from and make predictions on data. These models obtained enable researchers, data scientists, engineers, and analysts to get reliable, repeatable decisions. Furthermore, the results analysis and discover hidden intuitions, through learning from historical relationships and trends in the data. ML models have been demonstrated the capacity of decision-making by clinicians in neurosurgical propose.[1] AI intends to imitate human cognitive functions. It helps increase the availability of healthcare data and fast advance of systematic methods are addressing to a pattern shift in healthcare.[2] AI speeds up decision-making by experts through discovery clinically applicable evidence hidden in a big data. Most importantly, an AI system obtained valuable information from a wide range patient population. This allows in making real-time inferences.[3] In this mini-review, AI/ML approaches to data pre-processing, modeling and representative applications in neuroscience-related-topic will be introduced.

AI in the Neurosurgical Occupational Therapists (OT)

Identifying functional brain regions through individuals is a difficult task, mainly due to the variability in their location and extent. This process is remarkably important for patients with pathologies such as brain tumors. This disease can cause considerable restructuring of functional systems. In this context, three-dimensional registration created by anatomical data is only limited value. The data requirement depends on the purpose, such as it is to establish correspondences of functional areas among different individuals, or to localize potentially evacuated active regions. The authors proposed to make registration in an alternative space. Gollad *et al.* developed the first implant each brain into a functional map. It could reproduce connectivity patterns during a fMRI experiment. The functional maps obtained were registered, and the correspondences were propagated back to the two brains. With the application to a language fMRI experiment, the authors found preliminary results which illustrated that the proposed method yields better-quality functional correspondences across subjects. This research work is beneficial for the subjects with tumors that affect the language areas and thus cause spatial reorganization of the functional regions.[4]

AI in Neuro-Traumatology

Hsieh *et al.* developed and test diverse models of ML in order to predict the mortality of hospitalized motorcycle riders. This study was focused on a level-1 trauma Centre in China. In addition, they recovered the data from motorcycle riders who were hospitalized from January 2009 to December 2015. This dataset was classified into training/validation set n=6306 and 946, respectively. They used the demographic information, injury characteristics and laboratory data of patients, logistic regression (LR), support vector machine (SVM) and decision tree (DT) analyses. Multiple ML models were applied to determine the mortality of individual motorcycle riders, under different conditions, using all samples or reduced samples, as well as all variables or selected features in the algorithm. They obtained high statistical parameters in both LR and SVM. In particular, the SVM model for all samples with selected features was better than all other models, with an accuracy of 98.73%, sensitivity of 86.96%, specificity of 99.02%, geometric mean of 92.79% and AUC of 0.9517, in mortality prediction.[5]

AI in Neurorehabilitation

Gnnayutham *et* al. performed the design and testing neurorehabiliatory communication interfaces for verbal-difficulty and other brain damaged person. For long time, people within this group could not communicate with the outside world. Therefore, in this study the authors extrated the information from neurologically disabled persons. This can be done by conducting simple communication tasks and developed interfaces for communicating with the outside world for the very first time. The reserach was performed in two phases the first phase is an exploratory study and second phase is the new improved version, which included the results from the first phase. The first phase showed that every disabled person was an individual and could not form a group in designing interfaces. In this step, the VB program was used in order to analysis the direction of the cursor and the cursor movement to help the user. In addition, it illustrated that the pacients found the brain body interface impossible to use without the help of AI so as to steer the cursor on a computer screen. The aim of the second phase was to solve the problem left by the first phase. The main problem was the random cursor movements when brain body interface was used. Therefore, the programming language utilized this time was Visual C++.[6]

In conclusion, the first research the authors demonstrated that registering neuroanatomy approach based on the functional geometry of fMRI signals, could offer an alternative to anatomical registration. The results indicated that the structure in the diffusion map reproduced functional connectivity. It would allow accurate matching of functional regions. However, further research was essential to assess the predictive method for localization of specific functional areas.[4] The second paper, the researchers proved that ML could offer a reasonable level of accuracy in predicting the motorcycle riders mortality. Specifically, the SVM method in the trauma system, would support recognize high-risk patients.[5] The last work, the authors showed how AI could be used to improve a Brain Computer Interface.[6] With the rapid progress of AI/ML, the computer scientist and experts in this area will open new opportunities of research in rehabilitation medicine.

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