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O-FUN-25 - Towards automated targeting of STN in Deep Brain Stimulation Surgery for Parkinson's Disease

J.C.F.V. Lima, M. Herculano de Carvalho, J.M.B. Dias, M. Coelho, B. Cattoni and R.D.L. C. Martins

DBS Surgery Group, Hospital Santa Maria. Instituto Superior Técnico, Universidade de Lisboa.

Resumen

In this collaborative study between Santa Maria Hospital and Instituto Superior Técnico from Lisbon University, we aimed to estimate computationally the optimum location for the chronic implantation of stimulation electrodes in Deep Brain Stimulation (DBS) stereotaxic surgery for PD, and with it auxiliate the judgment of medical teams, potentially increasing precision, accuracy, speed and repeatability of the results. Data, pulled from a database of approximately 130 patients corresponding to more than 5 years of practice, consisted of: a collection of micro-electrode recording (MER) series acquired with Leksell-G® along 5 parallel approximation routes to the anatomo-functional target region in each hemisphere, the Subthalamic Nucleus (STN); and respective qualitative evaluation records of their correspondence to characteristic spontaneous activity of parkinsonian STN, done intraoperatively by a specialist neurologist. Electrophysiologic series were composed of 24 signals, captured in steps of 0.5-1 mm using Microdrive®, between -10 mm and +5 mm to STN position, estimated preoperatively using Framelink® (CT and MR imaging). For the analysis we developed a new Matlab application which incorporates a machine learning pipeline with stages of signal pre-processing, series composition, extraction and selection of 140 different feature, and classification using 6 different models. This software can be trained with previously human classified data to automatically classify newly unseen MER series, in seconds, with a tested precision of at least 92.8%, using information of 9 patients only. System is scalable, increasing performance with size of the database, and generic, allowing the use of other predictors and easily applicable to other functional brain region.

Key words: *DBS. Deep Brain Stimulation. Parkinson&#39s. Functional Neurosurgery. Machine Learning.*