An hybrid AI and Statistics Knowledge Discovery Methodology and its Application to Rehabilitation: Effects on Patients with TBI

K. GIBERT a,b, A. P. GARCÍA c, A. GARCÍA-MOLINA c, T. ROIG-ROVIRA c, M. BERNABEU c, and J. M. TORMOS c

a Statistics and Operation Research Department. Universitat Politècnica de Catalunya. (Barcelona, Spain)
b Knowledge Engineering and Machine Learning group, UPC. Barcelona, Spain

c Institut Guttmann-Hospital de Neurorehabilitació. Badalona, Spain

Keywords: Decision Support and Knowledge Management, Rehabilitation, clinical test, TBI, Knowledge Discovery, exogenous clustering based on rules, Knowledge-based applications in Medicine.

Neuropsychological rehabilitation is a necessary common practice to reduce cognitive deficit after an episode of acquired brain damage. However, till now, there is not enough data to allow exercise of neuropsychological rehabilitation based on scientific evidence type I. In this work a classificatory tool to identify different populations of patients based on the characteristics of deficit and response to rehabilitation treatment is developed. All patients were neuropsychological assessed at admission collecting 38 variables by means of comprehensive tests battery that covered the major cognitive domains. Patients were also assessed after the rehabilitation programme. Differences between pre- and post-treatment scores were used to measure particular patients improvements. Typical responses to rehabilitation are to be identified together with the characteristics of the groups of patients who show each type of response. This Knowledge Discovery (KDD) problem has been faced by using Exogen Clustering Based on Rules (ECIBR), an hybrid AI and Statistics technique, which combines some Inductive Learning (from AI) with clustering (from Statistics) to extract knowledge from ill-structured domains in form of typical profiles. Experts provided prior Knowledge and clustering was made regarding it. ECLBR improves classical clustering results, according to our opinion that hybrid techniques combining AI and Statistics are more powerful for KDD than pure ones, even in Disability. Here, five classes with decreasing degrees of response to rehabilitation were found, and several tools were provided to support interpretation. The results fulfilled clear concepts from the expert’s point of view: Valuable patients with mild to moderate impairment, generally improving after treatment up to normality. Four other profiles contain patients with severe impairment who could not be assessed before the treatment, showing increasing degree of response to rehabilitation: Global Improvement, with the greater improvement regarding their initial conditions. Reach the normality; DisExecutive with satisfactory improvement but persisting executive functions disorder; Resistent, with the lower response to the treatment, remains with important handicaps. Language, including patients with

---

1 Corresponding Author: karina.gilbert@upc.edu
language problems and very severe global cognitive impairment that only improve in correlation with language recovery.