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An adaptive signal processing model for neurological recovery

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In this article, we will apply a classical Adaptive Signal Processing model (ASP) to neurological recovery. This work is the result of a two-fold experience: in the field of ASP in telecommunications, plus 15 years of experience in neurological rehabilitation. Unlike traditional studies, which derive SP algorithms from bio-inspired examples, in this article we shall apply ASP to neurological rehabilitation. The application of this type of theory to the problem of neurological rehabilitation, which is considered to be an adaptive process, subject to various assumptions and considerations, will be detailed in the body of this article. It enables us to shed new light on this type of therapeutic practice and neuropsychology, and deduce a certain number of practical conclusions.

The model is based on the hypothesis that rehabilitation as such is the sum of a very large number of elementary rehabilitations (a function or movement, for instance), each of which corresponds to an adaptive model. In this article, we assume that adaptation follows a very typical stochastic gradient algorithm: this minimises a function known, in conventional ASP, as the Mean Squared Error. In this case we obtain the well-known Least Mean Square (LMS) algorithm, in which there is an error which will be taken here as the error between the result obtained and the “nominal” function.

Like any stochastic gradient algorithm, the convergence speed and precision (residual error, known in this context as a sequela) are governed by a convergence step.

Finally, we will draw a certain number of conclusions that are typical in ASP but also relevant in terms of neurological rehabilitation. Among these, the following will be discussed:

- convergence/recovery speed;
- transitional regime/rapid recovery phase;
- stationary regime/stationary phase;
- local minima/states of incomplete recovery;
- residual error/sequela;
- convergence stability/stability in the patient’s condition;
- time taken to reach a level of residual error/time taken to reach a level of recovery/theoretical limit of neurological recovery. The main conclusion is that there is no theoretical limit to the neurological rehabilitation. The sole limit is the one given by the patient and/or the therapist, in all conscience.

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Nutritional status of patients in Physical and Rehabilitation Medicine (PRM) units

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Keywords: Undernutrition; BMI; PRM
Introduction.-- Nutritional status is a formal quality indicator in post-acute care units to screen for frequently encountered undernutrition.

Objectives.-- Analyse Body Mass Index (BMI) registered at admission and each fortnight. Search for correlations between BMI and patients markers in a PRM unit specialised in musculoskeletal system disease.

Patients and methods.-- The study involved inpatients in the PRM unit between September and November 2011. Patients were classified into 4 groups: low BMI < 18 kg/m², normal 18–25 kg/m², overweight 26–30 kg/m² and obese > 30 kg/m². In each group, average age and average duration of the stay (DoS) were recorded.

Results.-- Sixty-eight patients had a musculoskeletal disease. The average age was 62.7 years. DoS was 25.7 days. The distribution by BMI category was: low (n = 0), normal (n = 16, 23%, mean age 60 years, DoS 24.3 days), overweight (n = 28, 41%, mean age 61.8 years, DoS 26.5 days), and obese (n = 24, 35%, mean age 66.6 years, DoS 24.4 days). The C-reactive protein level, monitored during the postoperative period, normalized in all cases before day 30.

Discussion.-- In this PRM musculoskeletal unit, there were no undernourished patients. This public health problem in geriatrics was not found to be a PRM problem, but overweight affected 76% of patients. The obese subjects were the oldest. The DoS was the same in three groups. Analysis of other indicators of nutritional status disclosed a normal CRP. Albuminaemia is not systematically assayed.

Conclusion.-- Excess weight was a frequent finding (76% of patients), however there were no subjects with low BMI. Work on overweight patients is in progress. The BMI had no impact on the average duration of hospital stay. The study should be completed by research on biological signs of undernutrition.

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Antibiotherapy for urinary tract infections in patient with spinal cord or brain injury: Impact of a professional practices’ clinical audit

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