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双任务事件中脑电信号的熵计算

汤晓军[1]、宋卓[1]、杨卓[2]、张涛*[1]
1 南开大学生命科学学院
2 南开大学医学院

本研究以样品熵方法为非线性工具，计算并分析了受试者在单任务事件以及双任务事件活动过程中的神经电生理数据。在利用样品熵算法对短时程（秒）脑电数据的复杂度和规则度进行计算之前，首先应用了代替数据分析法，以排除所分析的实验数据是由线性加随机部分构成。所有的实验数据分别在单任务和双任务等不同的生理条件下采集。其中单任务为一个听觉辨别任务；双任务有两种形式，分别为听觉任务和不同的震动任务的结合。计算结果显示任何一种双任务过程中脑电信号的熵值都明显的低于单任务状态时脑电信号的熵值（P<0.05-0.001）。研究表明对应于受试者仅仅进行单任务工作而言，当受试者处于双任务工作状态时大脑的神经信息传递可能会受到某种程度的削弱，神经信息流通的范围也可能更为孤立。结果进一步说明对于短时程（秒）脑电信号分析，样品熵算法是有效的非线性分析方法。

Entropy measures of ERP recordings for dual tasks in man

The present study is to investigate the application of sample entropy (SampEn) measures to electrophysiological studies of single and dual tasking performance. The complexity and regularity of short-duration (~s) epochs of electroencephalographic data were analysed using SampEn along with the method of surrogate data. Signals were collected under single and dual tasking conditions. Individual tasks consisted of an auditory discrimination task and two motor tasks of varying difficulty. Dual task conditions were combinations of one auditory and one of motor tasks. EEG entropies were significantly lower in dual tasks compared to that in the single tasks (P<0.05-0.001, for comparison between auditory single task and auditory/motor dual task). The results suggest that the neural information transmission or communication in the subjects who performed auditory dual tasks in either with motor1 or motor2 could be more isolated or impaired compared to that in the subjects who only performed auditory single task. The data demonstrated that entropy measurements could be a useful alternative and nonlinear approach to analysing short duration EEG signals on a time scale of seconds.

关键词