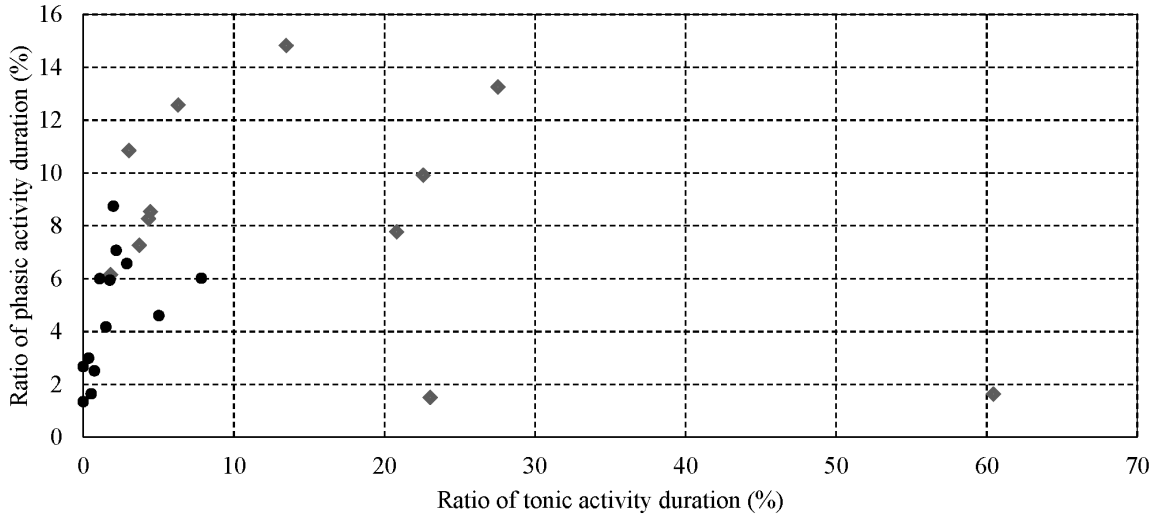

Fig. 2. An example of a scatter plot on plane K for the assessment method described by Montplaisir *et al*. [17] (black circle, healthy subjects; gray diamond, patients).

Table 1. Results of the LDA for each visual assessment method.

	AASM	Montplaisir *et al*.	SINBAR
Λ	0.435	0.467	0.331
F	14.3	12.6	22.2
b_{tonic}	2.53	2.01	1.51
b_{phasic}	1.68	2.00	3.84
MGD	2.19	2.05	2.73
ϵ	0.14	0.15	0.086
r_i	0.84	0.84	0.92

is possible to discriminate the two groups or more.

In Table 1, we listed values of Λ, F, standardized coefficients in the linear discriminant function as

$$\frac{z-\langle z\rangle}{\sigma(z)} = b_{tonic}\frac{\frac{T_{tonic}}{T}-\left\langle\frac{T_{tonic}}{T}\right\rangle}{\sigma\left(\frac{T_{tonic}}{T}\right)} + b_{phasic}\frac{\frac{T_{phasic}}{T}-\left\langle\frac{T_{phasic}}{T}\right\rangle}{\sigma\left(\frac{T_{phasic}}{T}\right)}. \quad (1)$$

Mahalanobis generalized distance (MGD), expected error rate estimation in the LDA; ϵ and the identification rate; r_i for each visual assessment method. Using the algorithm based on the SINBAR assessment method, the error rate was the lowest (0.086).

6. Conclusion

We introduced an example of the development and use of "automatic algorithms" imitating discrimination by persons with specialized knowledge and skills based on sensory information in accordance with the empirical rule not clearly written.

The input signals of the system for development are not specialized for biological signals (EMG), and output signals such as those of robots may also be included. The results of the present study will contribute to studies on the extraction of automatic algorithms used for artificial intelligence.

Appendix A.

The procedure of each assessment method in Section 3 is as follows.

• *AASM scoring manual* [16]

1) Tonic REM: On chin EMG records, each 30-second epoch was scored as tonic when sustained muscle activity with an amplitude greater than the minimum amplitude during non-REM sleep was present in at least 50% of the total epoch duration, and the ratio of the tonic REM sleep duration to the total REM sleep duration was calculated.

2) Phasic REM: On chin or 4-limb EMG records, each 3-second mini-epoch having transient muscle activity (0.1–5.0 seconds) with an amplitude $\geq$ 4-fold that of background activity was scored, and the ratio of the phasic REM sleep duration to the total REM sleep duration was calculated.

• *Assessment method described by Montplaisir et al*. [17]

1) Tonic REM: On chin EMG records, each 20-second epoch was scored as tonic when sustained muscle activity with an amplitude $\geq$ 2-fold that of baseline activity (3–7 μV) or $\geq$ 10 μV was present in at least 50% of the total epoch duration, and the ratio of the tonic REM sleep duration to the total REM sleep duration was calculated.

2) Phasic REM: On chin or 4-limb EMG records, each 2-second mini-epoch having muscle activity with an amplitude $\geq$ 4-fold that of background activity was scored, and the ratio of the phasic REM sleep duration to the total REM sleep duration was calculated.

• *SINBAR assessment method* [18]

1) Tonic REM: On chin EMG records, each 30-second epoch was scored as tonic when sustained muscle activity with an amplitude $\geq$ 2-fold that of background activity or $\geq$ 10 μV was present in at least 50% of the total epoch duration, and the ratio of the tonic REM sleep duration to the total REM sleep duration was calculated.