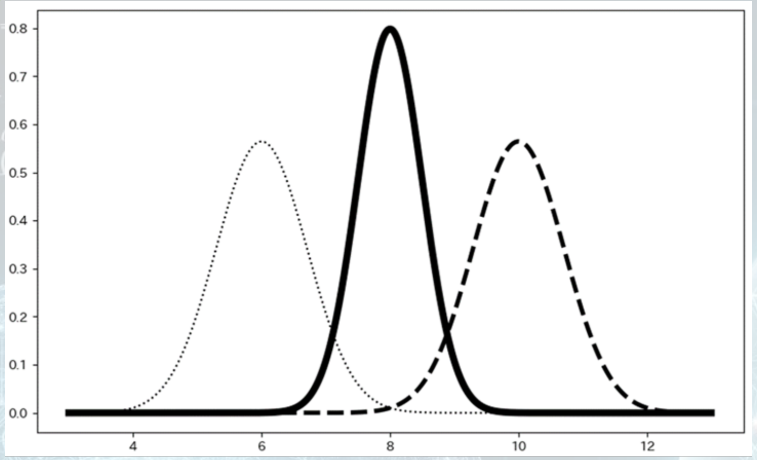
システム神経科学

ベイズ脳仮説と脳内情報処理



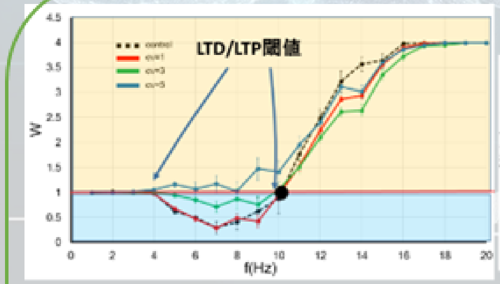
Bayesian integration:

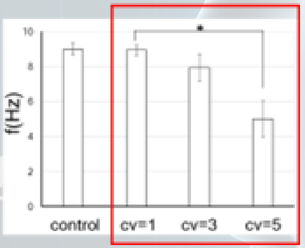
$$\ln P(\vec{pri}|\vec{x}) = \ln P(\vec{x}|\vec{pri}) + \ln P(\vec{pri})$$

$$\hat{\vec{\theta}}_{\mathrm{MAP}} = \arg\max_{\vec{\theta}} \left\{ p(\vec{\theta}|\mathbf{x}) \right\} = \arg\max_{\vec{\theta}} \left\{ p(\mathbf{x}|\vec{\theta}) p(\vec{\theta}) \right\}$$

$$\underset{\hat{q}(\mu)}{\mathrm{argmin}} F[\hat{q}(\mu)] \Leftrightarrow \underset{\hat{q}(\mu)}{\mathrm{argmin}} \left[\int d\mu\, \hat{q}(\mu) \ln \frac{\hat{q}(\mu)}{p(x,\mu)} \right]$$

$$\Leftrightarrow \underset{\hat{\mu}}{\mathrm{argmax}} = \mu_{MAP}$$

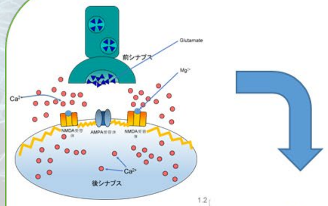




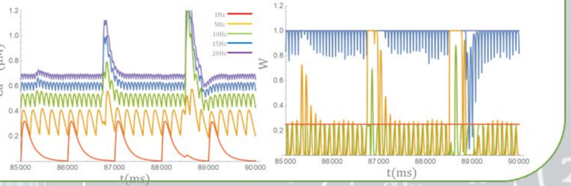
脳内ノイズとシナプス可塑性との関係

Hata, K., Araki, O., Yokoi, O., Kusakabe, T., Yamamoto, Y., Ito, S., and Nikuni, T. ***Sci Rep*** 10(1), 13974 (2020))

Takeda, Y., Hata, K., Yamazaki, T., Kaneko, M., Yokoi, O., Tsai, C., Umemura, K., and Nikuni, T. ***Front Syst Neurosci*** 15, 771661 (2021)



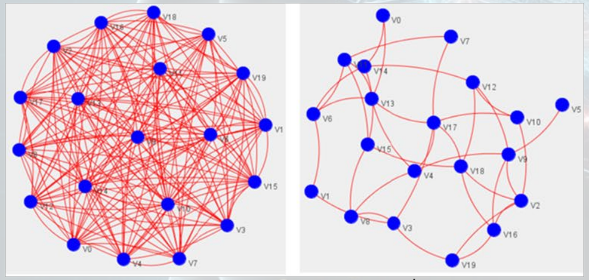
ノイズを含めた多面的な要素によるシナプス可塑性を解析的・数値的に解明



$$\langle Ca_c(f,f_{bg})\rangle = \tau_{Ca} f \left(\zeta_0 + \zeta_1 f + \zeta_2 f_{bg} + \zeta_3 f^2 + \zeta_4 f f_{bg} + \zeta_5 f_{bg}^2\right)$$

$$\sum_{j=f,s} I_j \tau_j \left[1 - \exp\left(-\frac{1}{\tau_j \cdot f}\right)\right]$$

$$\langle W_c(f,f_{bg})\rangle = \int_0^\infty dx \int_0^1 d\epsilon\, \delta(1-x)\Omega\left(Ca_c(f,f_{bg},x,\epsilon|r_{Ca;c},r_{j;c})\right)$$



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