TFO model

Structure — forward/inverse → **TOF curve** — forward → **beating signal** — forward → **SpO2**

Monte Carlo simulation

time setries

TOF curve

(1)
(2)
Intensity
$\Delta\tau$
$\Delta\tau$
t_d
$\Delta\tau$
Maternal information
Maternal and fetal information

Each curve corresponds to a point

$A=\exp[--\mu\_a*(L\_mat)]$

beating signals

systole   diastole
t

peak/valley

information from curve

TOF infomation

$$\Delta A(\lambda) = -\ln(I_{t2}/I_{t1}) = \sum_j \Delta\mu_{a,j}(\lambda) * \langle L_j \rangle$$

$$R = \frac{\Delta A_{\lambda 1}}{\Delta A_{\lambda 2}} = \frac{\ln(I_{sys.,\lambda 1}/I_{dia.,\lambda 1})}{\ln(I_{sys.,\lambda 2}/I_{dia.,\lambda 2})} \approx \frac{(AC/DC)_{\lambda 1}}{(AC/DC)_{\lambda 2}}$$

$$SpO2 = \frac{\epsilon_{Hb,\lambda 1} - R*\epsilon_{Hb,\lambda 2}}{\epsilon_{Hb,\lambda 1} - \epsilon_{HbO_2,\lambda 1} + R*(\epsilon_{HbO_2,\lambda 2} - \epsilon_{Hb,\lambda 2})}$$

Neural network

Neural network

model parameter : Setting ua of each layer(constant)

Layer	μ_a (cm^{-1}) 660 nm/890 nm	μ_s (cm^{-1}) 660 nm/890 nm	g	n
rEpidermis	0.3442/0.3184	121.2/224.7	0.7	1.47
Dermis	0.5453/2459	208.6/116.7	0.7	1.47
Subcutis	0.0001/0.0217	249.7/189.8	0.7	1.47
Vessel Wall	0.8/0.8	230/230	0.9	1.4
Blood	2.026/6.32	75.76/56.18	0.9	1.4

model parameter: $u\_a^m = \varepsilon\_Hb^m \cdot C\_Hb^m + \varepsilon\_HbO2^m \cdot C\_HbO2^m$ / L /W