Based on: T.Davidson, F.Kloosterman, M.Wilson "Hippocampal replay of extended experience", in Neuron, vol. 63, pp. 497-507, 2009

$$
\begin{aligned}
Pr(x|spikes) &= \frac{Pr(spikes|x)Pr(x)}{Pr(spikes)} \\
Pr(spikes|x) &= \prod_{i=1}^{N} Pr(spikes_i|x) = \\
&= \prod_{i=1}^{N} \frac{\Delta t \tau_i(x)^{n_i}}{n_i!} exp(\Delta t \tau_i(x)) \\
log(Pr(spikes|x)) &= \sum_{i=1}^{N} n_i log(\frac{\Delta t \tau_i(x)}{n_i!}) - \Delta t \sum_{i=1}^{N} \tau_i(x)
\end{aligned}
$$

$$
\tau_i(x) = \begin{cases} cos(\frac{2\pi}{2\varphi_{PF}}(x - \varphi_{mPF_i}))\tau_{avg}, & \text{if } x \subset PF \\ 0, & \text{otherwise} \end{cases}
$$

where:
N: #{neurons}= 4000, Δt : length of the time bin, n_i: #{spikes in the bin (from the i-th cell)}, φ_{PF} : length of a place field = $0.628[rad]$, φ_{mPF_i} : middle of the i-th cell's place field, $\tau_{avg} = 20[Hz]$