**Cell Switches Model applying Markov Chain Stochastic Model Check on between two population with regards to** **mRNA and proteins and Neurons both classically and Quantum computationally**

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# ***Abstract***

*Arc, one virus-like gene, crucial for learning and memory, was dis-covered by researchers in neurological disorders fields, Arc mRNA’s single directed path and allowing protein binding regional restric-tively is a potential investigation on helping shuttle toxic proteins responsible for some diseases related to memory deficiency. Mean time to switching (MTS) is calculated explicitly quantifying the switching process in statistical methods combining Hamiltonian Markov Chain(HMC). The model derived from predator and prey with typeII functional response studies the mechanism of normals with intrin-sic rate of increase and the persisters with the instantaneous discovery rate and converting coefficients. During solving the results, since the numeric method is applied for the 2D approximation of Hamiltonion with intrinsic noise induced switching combining geometric minimum action method. In the application of Hamiltonian Markov Chain, the behavior of the convertion (between mRNA and proteins through 6 states from off to on ) is described with probabilistic conditional logic formula and the final concentration is computed with both Continuous and Discret Time Markov Chain(CTMC/DTMC) through Embedding and Switching Diffusion. The MTS, trajectories and Hamiltonian dynamics demonstrate the practical and robust advantages of our model on interpreting the switching process of genes (IGFs, Hax Arcs and etc.) with respects to memory deficiency in aging process which can be useful in further drug efficiency test and disease curing. Coincidentally, the Hamiltonian is also well used in describing quantum mechanics and convenient for computation with time and position information using quantum bits while in the second model we construct, switching between excitatory and inhibitory neurons, similarity of qubit and neuron is an interesting object as well. Especially with the interactions operated with phase gates, the excitation from the ground state to excitation state is a well analogue to the neuron excitation. Not only on theoretical aspect, the experimental methods in neuron switching model is also inspiring to quantum computing. Most basic one is as stimulate hippocampus can be identical to spontaneous neural excitation(|g>|e>), pi-pulse is utilized to drive the ground state to the higher state. There thus exists prosperous potential to study the transfer between states with our switch models both classical and quantum computationally.*

# ***Keywords***

## switching model, mean time to switching, Hamiltonian Markov Chain, geometric minimum action method, firing rate, neuron models, Hopfield network, excitation and inhibition, quantum computation, fast gates, phase estimation, sweep entanglement.

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Received master degree in data engineering and machine learning with physics minor. During Bachelor(Maths bachelor in ECUST, student union technology and entrepreneur department academic division leader,minor in English), did research study in dynamics neuron networks lab, using statistics, data mining basic skills. Minor in English. In currently master program, doing neuroscience research study related to neuro imaging, neuron computation, minoring in Physics.) Main field in Mathematics and programming, with equal interest in other natural science and technology.  
And due to past background in machine learning with disciplinary projects, especially related to biomedical and neuroscience in processing time series, frequency spectrums and Bayes models combining stochastic process, computational modeling with python, matlab, C/C++ and a little bit C#.





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Received the Ph.D. degree in electronic and mechanical engineering from Nagoya University, Nagoya, Japan, in 1998.,He is currently one of the Director of the Institute of Cognitive Neurodynamics, East China University of Science and Technology, Shanghai, China. His research interests are in the areas of cognitive neurodynamics, coding and decoding theory in brain information processing, complexity theory, analysis of biological neural networks, and computational vision and audition.,Dr. Wang serves as the founding Editor-in-Chief of Cognitive Neurodynamics.

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