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SNN Networks for Delta Sleep Control Loops

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Abstract

Burst Mode virtual neurons are simulated in an SNN with a control loop with drosophila neural circuits for delta sleep induction, as a pest control technology. Added biometric loops make a programmable targeted control loop for sleep induction in identified entomological pests. The biometric loop can be used to distinguish from useful insects. This design is targeted towards space applications.

Keywords: NREM sleep, delta sleep neurons, drosophila, SNN networks, single chip IoT boards, sensor fusion.

1. INTRODUCTION

NREM sleep as delta sleep is induced in drosophila by either chemical induction or electromagnetic induction. In this paper a newer control loop of SNN and natural neurons in the fruit fly is introduced using off the shelf delta sleep technology using PEMF coils and directed EMI circuitry. Hardware consists of off the shelf IoT boards with camera and microphone integration for a biometric loop and directed PEMF circuitry for the control loop using the GPIO with SPI or I2C for connectivity..

2. MATERIALS AND METHODS

The hardware schematic is shown in figure 1, and the software uses a ready to off the shelf .SNN software, for keras translation, SNN Tool Box, many other frameworks like nenego.ai can readily be used .

The control loop developed is not an animal model and applies only to entomological neural circuitry, aimed only at excessive pests in gardens and agricultural applications.

A small population of pests always exists and is useful even in the creation and application of this technology, the technology being non lethal restores a balance and sustainability to agro practices, reversibly sleeping excess pests.

3. NEURAL NETWORK DECOMPOSITION.

The SNN synthesizes burst neuron modes from a transfer function applied to spike trains. if [s,t] is the spike train, we define an operator S operating on the spike train.

$$f=S([s,t]) \quad (1)$$

A control loop with biometric and transduction components is directional with a scale of one square centimeter or less as defined by the biometric size parameter.

4. BIOMETRIC LOOP

Seamless segmentation technology for 1D and images are used for object identification and insect motion segmentation, with location information, using Mapillary's seamless segmentation FPN classifier and Amazon Research on wake work localization and recognition. The output of these programs are the alphabet [a] defined of insect biometrics and segmented objects of insects [size, species], this forms the biometric loop.

5. WAVEFORM CAPTURE AND REGRESSION.

Delta sleep in drosophila

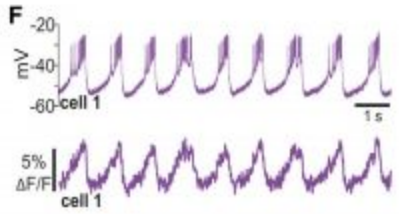

FIGURE 1: R5 DELTA WAVE OSCILLATIONS[4]

[4] presents R5 sleep transition circuitry, in delta oscillation waveforms, that can be converted to a SNN model as described in (2) using evolutionary computing.

[5] is a graph OCR software, on converting the image in figure 1 to data, and plotting on [7], we obtain figure 2.

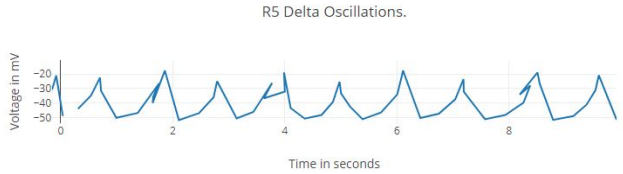

FIGURE 2: R5 DELTA WAVE OSCILLATIONS[4]

The 1D data is reverse transcribed to a machine genome using the model in equation 1, using Wolfram. The architecture depicted by equation (1), is a product of a transformation S on a spike train [s,t] , with parameters to be reverse engineered from the 1D data, using a variety of search algorithms. In [1], the author applies evolutionary algorithms to model based waveform capture, a similar approach can be used using the Wolfram functions for evolutionary programming.[2].

6. DISCUSSION AND FUTURE WORK.

Several commercially available, PEMF[3] based delta sleep devices exist for insomnia, but none are biometrically activated. Future work would consist of SNN neurons for N1, N2 and N3 phase deep sleep neuronal oscillations and spindle capture for NREM,[6] deep delta sleep with biometric control loops, in addition to sleep control loops for effective monitoring of deep sleep and waking states. This would herald a new generation of wearables and stationary mounted insomnia therapies for medical use.

We have thus used evolutionary programming in the design of SNN based neurons, in a PEMF induced control loop structure for sleep induction in drosophila, usable in pest population mitigation in several scenarios, scalable to sleep patterns for insomnia in both medical and veterinary practice.

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