Shankar and Venugopal *BMC Neuroscience* 2015, **16**(Suppl 1):P277
http://www.biomedcentral.com/1471-2202/16/S1/P277

BMC Neuroscience

POSTER PRESENTATION Open Access

A self-organizing neural network for neuromuscular control

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From 24th Annual Computational Neuroscience Meeting: CNS*2015
Prague, Czech Republic. 18-23 July 2015

Adaptive technology holds great promise for sensorimotor rehabilitation in people suffering from spinal cord injury, neuromuscular disease and stroke. With a long-term goal of developing adaptive technology for diagnosis and rehabilitation of neuromuscular dysfunction, we begin the development of a self-organizing neural network (SNN) that compensates for reduced neural drive. We suggest that the self-organizing architecture that adds or deletes nodes online to generate suitable compensatory muscle excitation (Figure 1A) is an apt mechanism to emulate the motor pool behavior of recruitment and de-recruitment of motor units during muscle force generation. Using a virtual muscle [1] resembling the human biceps brachii, we demonstrate the augmentation of neural excitation by the SNN to compensate for abnormal muscle force due to change in the number of motor units.

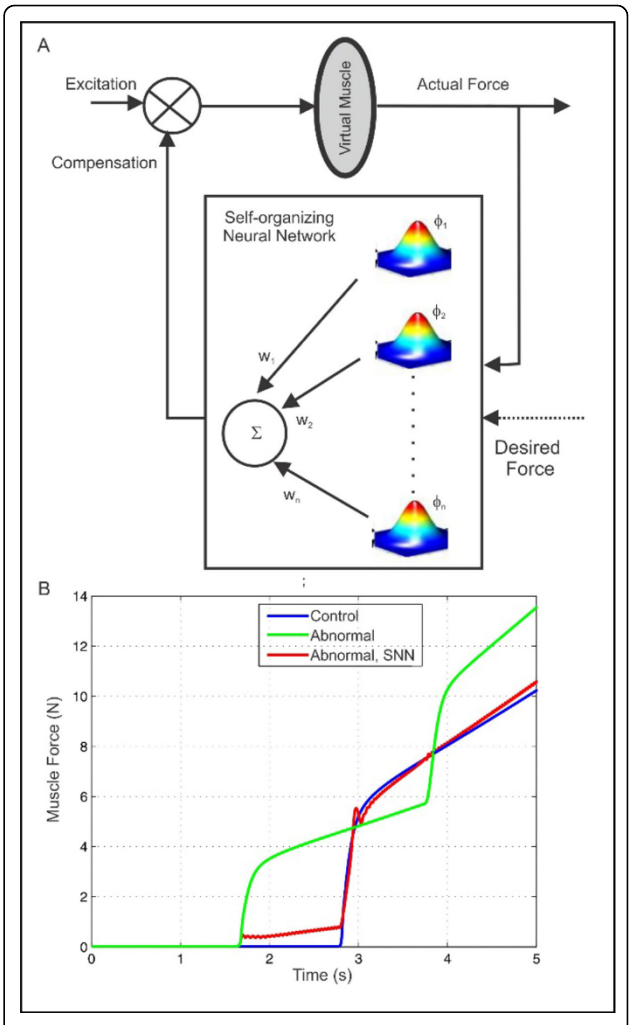

Figure 1 A. Schematic showing the virtual muscle-SNN system; Φ_1, Φ_2, .. Φ_n are radial basis functions and w_1, w_2, ..w_n are weights for summation. **B**. Simulation of normal (Slow-Fast motor unit ratio - 2:4), abnormal (Slow-Fast motor unit ratio - 3:3) muscle force and, compensation by SNN.

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Published: 18 December 2015

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doi:10.1186/1471-2202-16-S1-P277
Cite this article as: Shankar and Venugopal: **A self-organizing neural network for neuromuscular control.** *BMC Neuroscience* 2015 **16**(Suppl 1): P277.

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