Particle Swarm Optimization for Programming Neuromodulation Systems

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Optimizes Deep Brain Stimulation Therapy

An algorithm using particle swarm optimization (PSO) in programming electrodes in deep brain stimulation arrays (DBSAs) provides clinicians with an intuitive, semi-automated approach for programming multi-electrode neuromodulation systems. The system and methods optimize deep brain stimulation (DBS) therapy by producing a range of optimal electrode configuration solutions that can achieve a number of objectives, such as maximizing neural activation of a region of interest, minimizing activation in a region where stimulation is not desired, minimizing battery power consumption, and maximizing the closeness to sources of sensed functional data. The computed solutions are presented visually to clinicians via Pareto front visualization, enabling them to intuitively select a stimulation setting that matches desired activation outcomes and programming goals for each specific patient.

Identifies Range of Multiple-Electrode DBS Lead Options

One of the biggest clinical challenges associated with multiple-electrode DBS leads is the countless possible combinations of electrode configurations as well as inefficient and time-consuming trial-and-error methods entailed in optimizing multiple objectives. Particle Swarm Optimization (PSO) is a well-known occurrence in biology, in which complex collective behaviors emerge out of swarms of individual organisms. This technology's algorithm uses PSO to identify electrode configurations and stimulation settings optimized for a variety of objectives. By identifying a range of optimal settings, the clinician has a starting point with which to increase or decrease the overall amount of current delivered to the patient. This new approach is particularly robust when axonal activation could reasonably occur along multiple points along a given axon and is robust to variation of maximum electrode currents on each site.

BENEFITS AND FEATURES:

- Algorithm using particle swarm optimization (PSO)
- Maximizes neural activation of a region of interest

- Minimizes activation in a region where stimulation is not desired
- Minimizes battery power consumption
- Maximizes the closeness to sources of sensed functional data
- Pareto front visualization
- Intuitive, semi-automated approach for programming multi-electrode neuromodulation systems
- Better optimize and individualize DBS treatment

APPLICATIONS:

- DBS therapies
- Deep brain stimulation arrays (DBSAs)
- Systems with multiple electrodes that require spatial optimization
- Cardiac rhythm management, peripheral nervous system, and spinal cord system

Phase of Development - Pilot scale demonstration

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Publications
[Particle swarm optimization for programming deep brain stimulation arrays](#)
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