SYSTEM FOR HANDLING REHABILITATION STRATEGY TRAINING FOR SUBJECT

IITM Technology Available for Licensing

Problem Statement

- **Stroke, leading to upper extremity dysfunction, causes motor impairments** such as hemiparesis, making everyday tasks like reaching and grasping difficult for patients.
- Existing rehabilitation approaches, including **CIMT and bimanual training, have conflicting strategies**, making it difficult to determine the best treatment for individual stroke patients.
- **Recovery depends on factors like initial severity and brain reorganization,** with some patients showing progress years after the stroke, complicating the prognosis.
- There is need for a more **effective rehabilitation method that addresses the contradictions** in current treatments and improves patient outcomes.

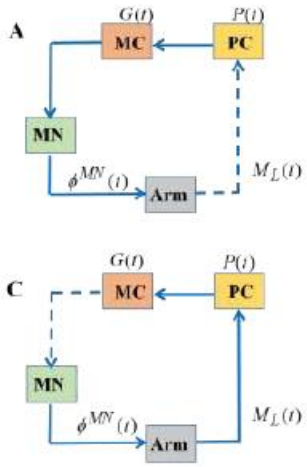

Figure: Illustration of the training schema in a cortico-basal ganglia model

Intellectual Property

- IITM IDF Ref 1745
- **IN 507924 Patent Granted**

TRL (Technology Readiness Level)

TRL 2 Technology Concept Formulated

Technology Category/ Market

Category- Assistive, Test Equipment & Design Manufacturing/ Others

Industry Classification:

Medical Devices, Rehabilitation Technology, Assistive Technology, Physical Therapy, and Healthcare Solutions

Applications:

Rehabilitation Strategy for Stroke Patients- targeting recovery in both normal and stroke conditions; specific tasks such as congruent aiming, incongruent aiming, and equidistant aiming tasks

Market report:

The global stroke rehabilitation market was valued at USD 144.9 Billion in 2023, and projected to grow to USD 376 Billion by 2033 with a CAGR of 9.2%

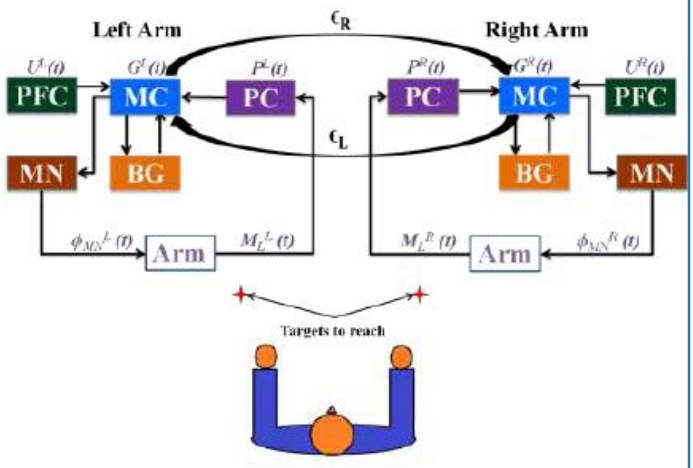

Figure: An illustration of the cortico-basal ganglia model for bimanual reaching

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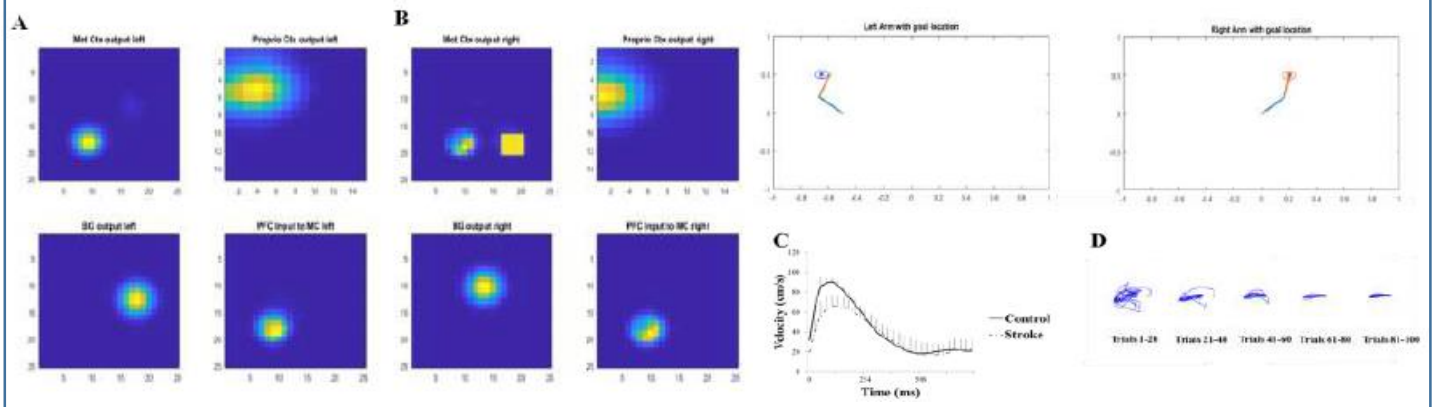

Figure: Illustrates the reaching behavior in stroke . In order to test changes in the kinematics of the arm after introducing lesion, the method can be used to estimate the velocity profile of the affected arm while it was performing a reaching task. The network is trained to reach a single target followed by introduction of lesion in the corresponding MC. It can be noticed from notation "C" of the FIG. 6 that there is a significant decrease in the velocity of the affected arm when compared to its normal counterpart.

Technology

- The invention employs two semi-independent systems with interconnected motor-cortical and cortico-basal ganglia loops to facilitate customized rehabilitation strategies for upper extremity hemiparesis..
- Utilizes Self-Organizing Maps (SOM) and Continuous Attractor Neural Networks (CANN) for dynamic motor cortex representation and integration of multiple sensory and feedback inputs.
- Supports unimanual, bimanual, and Constraint-Induced Movement Therapy (CIMT) for rehabilitation, optimized based on stroke severity and lesion size.
- Evaluates rehabilitation efficacy using metrics like Peak Resultant Velocity (PRV) and reaching error under varying lesion conditions and task complexities
- Simulates real-world reaching tasks and recovery processes through a two-link arm model controlled by neural feedback, enabling insights into stroke recovery and therapy optimization

Key Features / Value Proposition

- Simulates human motor control more realistically with detailed cortico-basal ganglia interactions than existing models.
- Adapts strategies to lesion size and task complexity, unlike rigid conventional rehabilitation systems.
- Tracks metrics like PRV and reaching error, offering objective evaluations instead of subjective observations.
- Addresses both immediate and delayed stroke rehabilitation, supporting comprehensive therapy plans.
- Focuses on complex bimanual tasks, enabling effective rehabilitation for everyday functional movements.

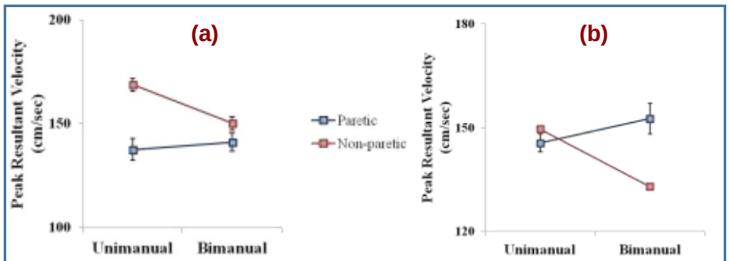

Figure: Model performance in (a) congruent aiming procedure and (b) incongruent aiming procedure.

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