Development of Machine Learning Integrated Dexterity Model for Neurodegenerative Disease

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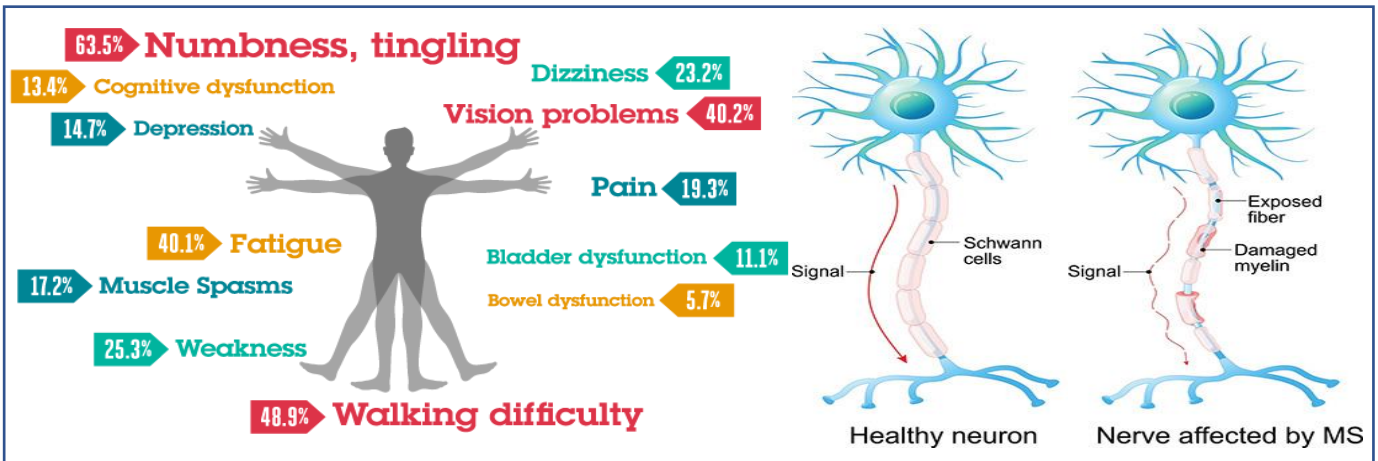
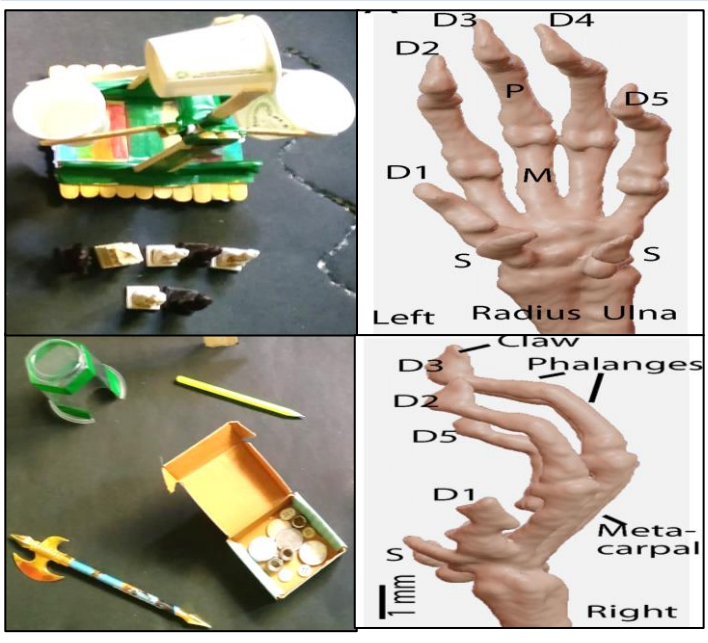
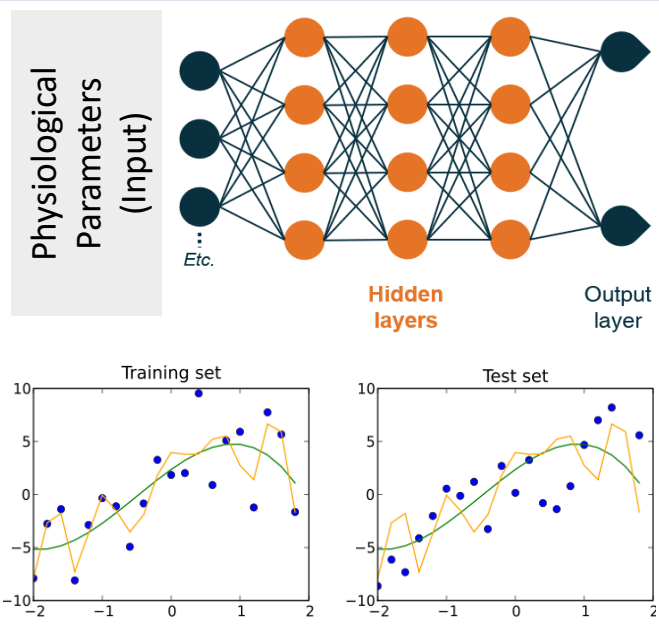


Background Dexterity implies to the capability to utilize the fingers, hands, and arms to execute a task. The quality of performance in daily living skills, and activities is ascertained largely by the function of hand and manual dexterity. Importantly, neurodegenerative diseases such as multiple sclerosis (MS) has been found to involve neurological deficits including ataxia, and sensory deficits, leading impaired dexterity. The standard method to measure manual dexterity is Nine-Hole Peg Test (NHPT), which is commonly utilized in clinics. However, the NHPT and other dexterity evaluation methods including Action Research Arm Test and Box and Block Test, typically not performed in the daily routine by health care providers owing to the requirements of special material and a table, making them time-exhausting and burdensome. Additionally, these tests partially encompass a variety of dexterity as they measure primarily the functionality of arm and hand rather than evaluation of fine motor dexterity via in-hand manipulation of objects. Therefore, there is a demand for the development of a novel and better dexterity model to facilitate the early prediction of neurodegenerative disease. ***Objective*** To develop a **non-invasive Machine Learning Integrated Dexterity Model (MLIDM) for the early prediction of probability of occurrence of neurodegeneration**.





Methods A Ferris wheel integrated with coin dropping was utilized for developing a dexterity model. In brief, a low-cost and effective dexterity model was developed, followed by examining the behavior pattern, and training the machine learning algorithms such as support vector machine, random forest, and deep learning, and testing the prediction efficiency of MLIDM.

Results The prototype of MLIDM has been designed and developed and the preliminary results demonstrated the effective evaluation of manual dexterity. ***Conclusion*** MLIDM is promising approach for the early prediction of neurodegenerative disease, which can also be extended to other neurological diseases depending on the degree of dexterity.

References

Banerjee, Kumar, Gaurav, Thakur *et al*. ***AAAMC***. 2021, Berrett J M *et al*. ***Plos One***. 2020
Filippi M *et al*. ***Nature Rev Dis Prim***. 2018