Linkoids and Periodic Tangloids in Neural Pathways: A Knot-Theoretical Approach to Brain Recovery & Regression

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This poster presents a mathematical framework based on knot theory, specifically *linkoids* and *periodic tangloids* (Fig.1), which could offer new insights into modeling the dynamic processes of neural pathways in the context of *brain recovery and regression*. While the topological study of entangled closed curves is well-established, we explore its extension to open-ended structures and their potential applications in describing the dynamic reorganization or degradation of neural connections. Linkoids, modeling partially restored or fragmented pathways, may provide a useful tool for capturing the structural flexibility of nervous systems as they adapt to injury or degeneration. Periodic tangloids, on the other hand, may represent cyclic neural activity patterns, offering a new way to examine how repetitive brain functions could either recover or degrade.

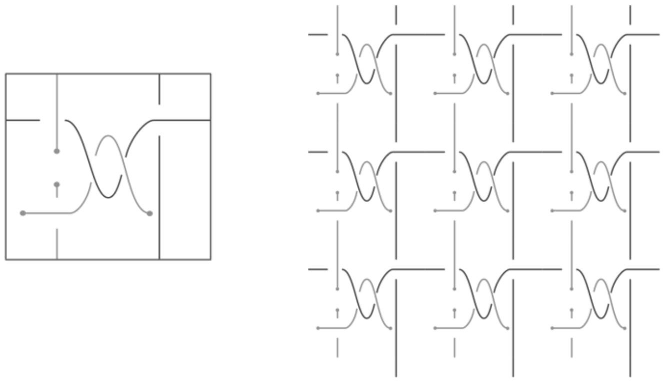

Figure 1. On the left a multi-linkoid and on the right a doubly periodic tangloid

Local transformations in neural networks, analogous to *Reidemeister moves* (Fig.2) in knot theory, could lead to global changes in brain function, similar to how small local modifications affect the structure of knots. Additionally, *topological invariants* such as the *Jones polynomial* might offer a method to classify neural pathways and evaluate their resilience or vulnerability to cellular damage. Through this mathematical lens, we aim to foster interdisciplinary collaborations with medical researchers to explore the potential applications of these concepts in understanding and supporting both brain recovery and the progression of degenerative conditions.

Figure 2. The three classical Reidemeister moves