NeuroField MS Notes

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Introduction

1. Modeling
    a. neuron approaches – limitations and advantages
    b. field approaches – complementary – advantages and disadvantages
    c. perhaps mention hybrids (Robinson and Kim)
2. Simulation codes
    a. single neuron – many codes; give examples
    b. fields – few codes – Virtual Brain, any others? Features, limitations.
    c. This paper: our approach – has had the most physiological applications in around 150 papers to me: we wish to provide the code so others can use and extend the work. Naturally this also has limitations, but is also being progressively extended.
3. Structure: II. Neural field theory. III. Code structure and algorithms. IV. Demonstrations. V. Pitfalls and troubleshooting. VI. Summary and ongoing developments.

NFT

1. General
2. Populations
3. Dendrites
4. firing rate response (sigmoid)
5. axons – fields; patchy connections

Code Structure and Algorithms

In each section introduce the relevant quantities and described the algorithms, as required. It should also explain particular alternatives and "switches" that control different variants of the model.

1. Dendrites
2. Sigmoid
3. Axonal fields, including patchy propagation.
4. Inputs – could perhaps be at the beginning of this section: specify populations, grids, output types and frequencies, time step. Input files.
5. outputs: parameter file, time histories, restart dumps, arrays, error estimates
6. diagnostics: internal, external

+ Rennie
+ Drysdale

Demonstrations

Provide appropriate test examples, including explanation of how to use the diagnostics, internal and external, and the resulting figures.

Pitfalls, Limitations, and Troubleshooting

Some of this could perhaps come under the section on code structure and algorithms, where we might point out things like the Courant condition, etc. So a separate section may not be necessary. However it is important to explain somewhere, and remind in the final section, that such a code cannot be used blindly. We should also explain how to check the robustness of results by, for example, reducing the time step (or increasing it) to check stability and convergence.

Summary and Ongoing Developments/Future Directions

A brief summary, followed by an outline of ongoing improvements to the range of features and diagnostics included in the code – e.g., patchy connections, realistic cortical geometry, etc. Online manual and executables. Do we distribute source code?