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NETWORK MODEL

Motivated by anisotropic characteristics in connectivity in local cortical circuits found in the rat's brain, a network model with anisotropic tissue geometry is developed. Employing both a graph theoretic definition and a numerical implementation, distance-dependent connectivity present in the model is exposed. The introduction of a rewiring algorithm and quantitative anisotropy measure lays the foundation for the analysis of structural aspects of the anisotropic network model in Chapter **??**.

1.1 OVERVIEW

This chapter introduces the central object of this study, the *anisotropic network model*. Reviewing connectivity in local cortical circuits in Section **??**, we identify anisotropy in connectivity in layer V pyramidal cells, inferred by their specific neuronal anatomy. Reducing the complex neuron morphology to characteristic axonal and dendritic profiles, we introduce the anisotropic network model in Section **??**. While a graph theoretic definition allows for analytical considerations, a numerical implementation enables us not only to support the analytical observations but also gives access to results that go beyond. To fully harness this implementation we argue for the choice of a specific parameter set in Section **??**, allowing us to generate a set of "sample graphs" to which we will refer through this study.

Using the analytical and numerical approach in conjunction, in our analysis of anisotropic networks we are most interested in identifying structural aspects that are due to the network's anisotropy in connectivity and do not occur in similar, isotropic networks. To be able to make this distinction, in Section **??** we extract the distance-dependent connectivity of anisotropic networks, as it is imposed by the specific geometric relations present in the network. We then go on to introduce "rewiring" in Section **??**, a method that allows us to manipulate the anisotropic networks to eventually display isotropy in connectivity. Finally then, Section **??** ties together the previous concepts by providing a measure for anisotropy and showing how rewiring is, in fact, providing the transition from anisotropic networks to networks with isotropy in connectivity.