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STRUCTURAL ASPECTS

In this chapter we analyze the strucarl. The term motif referes to... . Studies of Song et al. (2005) and Perin et al. (2011) show stuff. Pernice2011, Sporns , Zhao2011.

Three-neuron patterns

Here we investigate the occurrence of three-neuron patterns in the anisotropic networks. Song et al. (2005) reported a characteristic, highly non-random motif distribution in rat's visual cortex (layer 5), that was later confirmed by Perin et al. (2011) in the rat's somatosensory cortex (layer 5).

There are 12 three-neuron motifs that represent connected simple directed graphs, here labeled 4 to 16 to stay consistent with the reports of Song et al. By analyzing connectivity in the different sample graphs, three-neuron motif occurrences were recorded and compared relative from Section **??**

In anisotropic networks we found two-neuron pair probabilities of occurrence of

$$\begin{aligned} p_u &= 0.791336 && \text{for unconnected pairs,} \\ p_s &= 0.184151 && \text{for single connections and} \\ p_r &= 0.024513 && \text{for reciprocal connections.} \end{aligned}$$

Pattern 8, for example, has a probability of occurrence of

$$\mathbf{P}(X = 8) = 6\, p_u p_s p_r,$$

where X maps the motif the corresponding number as shown in . The full probabilities are

$$\begin{aligned} &\mathbf{P}(X=4) = 3p_s^2 p_u && \mathbf{P}(X=\ \ 9) = 3p_r^2 p_u && \mathbf{P}(X=13) = 6p_s^2 p_r \\ &\mathbf{P}(X=5) = 3p_s^2 p_u && \mathbf{P}(X=10) = 6p_s^3 && \mathbf{P}(X=14) = 3p_s^2 p_r \\ &\mathbf{P}(X=6) = 6p_s^2 p_u && \mathbf{P}(X=11) = 2p_s^3 && \mathbf{P}(X=15) = 6p_s p_r^2 \\ &\mathbf{P}(X=7) = 6p_s p_u p_r && \mathbf{P}(X=12) = 3p_s^2 p_r && \mathbf{P}(X=16) = p_r^3. \end{aligned}$$

Taking the probabilities of occurrence as computed from the two-neuron connections as the expect, we identify overrepresentation.

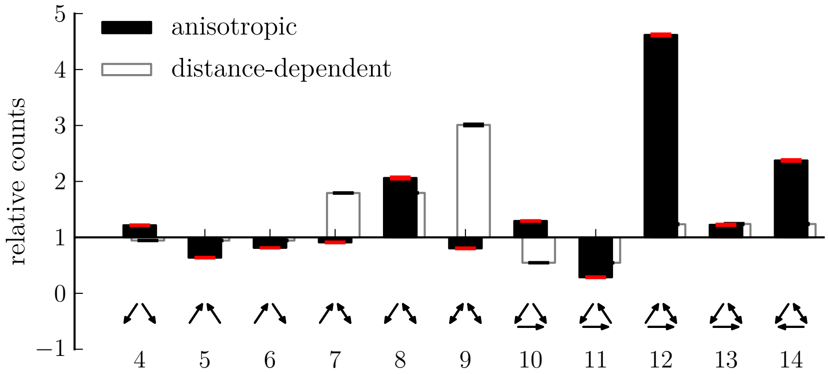

Figure 1.1: Relative occurrence of three-neuron patterns Extracting the counts of three-node motifs in anisotropic (filled bars) and distance-dependent networks (unfilled bars), the quotient of the obtained count with the number of occurrences expected from the two-neuron connection probabilities in the networks (cf. Section **??**) shows the over- and underrepresentation of specific motifs in the network (red and black errorbars are SEM). In anisotropic networks pattern 12, for example, appears around five times more often than we would expect from the occurrence two-neuron connections. The relative counts for anisotropic networks resemble the findings of Song et al. (2005) and differ significantly from the counts in distance-dependent networks, implying that anisotropy has a strong influence on the relative occurrence of three-neuron patterns. (`4839ce41`)

Interestingly, full do not appear (mean =) in tuned anisotropic, given evidence towards the incompleteness of the model.

To fully we ex. The results from give good evidence, however we find that

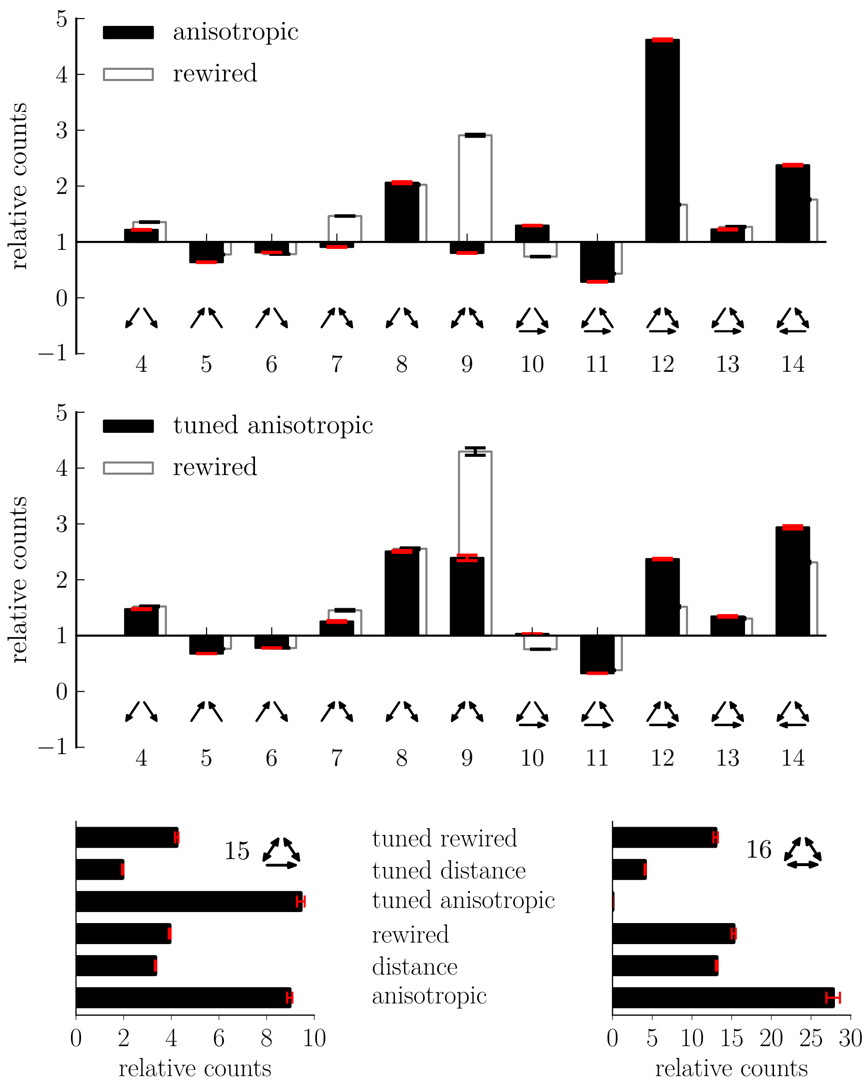

Figure 1.2: Relative occurrence of three-neuron patterns Extracting the counts of three-node motifs in anisotropic (filled bars) and distance-dependent networks (unfilled bars), the quotient of the obtained count with the number of occurrences expected from the two-neuron connection probabilities in the networks (cf. Section **??**) shows the over- and underrepresentation of specific motifs in the network (red and black errorbars are SEM). In anisotropic networks pattern 12, for example, appears around five times more often than we would expect from the occurrence two-neuron connections. The relative counts for anisotropic networks resemble the findings of Song et al. (2005) and differ significantly from the counts in distance-dependent networks, implying that anisotropy has a strong influence on the relative occurrence of three-neuron patterns. (`4839ce41`)

Anisotropy in connectivity can for motifs 10, 12 and 14, however not in motif 4. Additionally, anisotropy in connectivity causes for large in motifs . Motif 9 is significantly underrepresented in anisotropic networks, also reflecting the findings of Song et al.

Edge counts in neuron clusters