Dynamic Neural Field

1. Growing Activity

In the growing activity regime, the entire dynamic field becomes active despite the removal of the external input. This phenomenon is achieved by adjusting the parameters of the neural field simulation. One of the parameters is sigma, which controls the spatial influence between neurons. By increasing the sigma to around 1.0, the activation can spread across a wider area, allowing for the desired growing activity. Another parameter is A, which determines the strength of the excitatory connections between neurons. Setting A to approximately 1.0 ensures sufficient excitation to promote the spreading of activity. In contrast, the parameter C represents the level of inhibition in the neural field. To enable growing activity, it is necessary to minimize the inhibitory influence. By choosing a value of around 0.5 for C, the inhibitory component is relatively weak, allowing the activation to propagate freely throughout the field. Together, these parameter settings create the conditions for the entire dynamic field to become active in the growing activity regime.

Hence, we set the values of the parameters to:
Sigma = 1.0, A = 1.0, C = 0.5

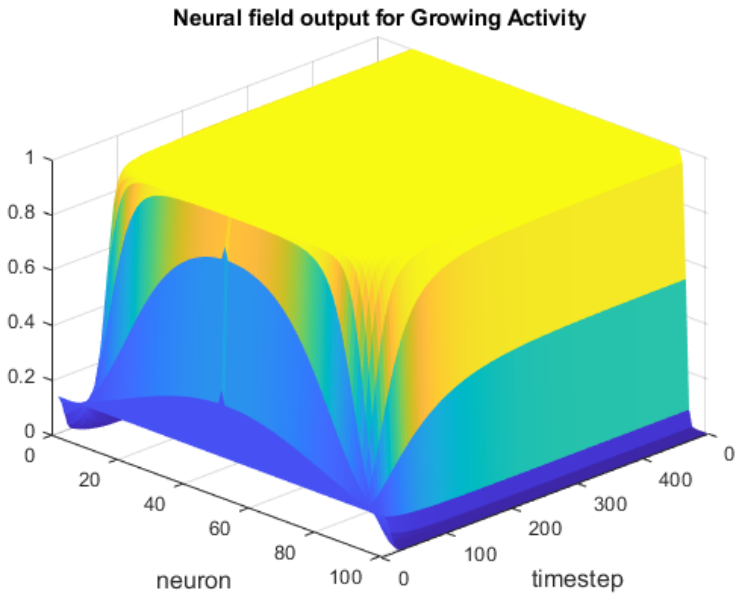

Fig 1: Plot for Growing Activity

2. Decaying Activity

In the decaying activity regime, the activity in the neural field gradually fades away after the removal of the external input. This behavior is achieved through careful selection of the parameter values. Sigma determines the spatial influence between neurons so to confine the activation to a smaller region, a smaller sigma value of approximately 0.7 is chosen. This restricts the spread of activity and leads to a more localized effect. A controls the strength of the excitatory connections between neurons. In the context of the decaying activity, a value of around 1.0 is selected to maintain a moderate level of excitation initially. This ensures that the activity sustains itself for a period before gradually diminishing. Parameter C represents the level of inhibition in the neural field so to achieve decaying activity, a relatively stronger inhibitory influence is introduced by setting C to approximately 1.5. This inhibition gradually suppresses the activity over time, causing it to decay. By carefully adjusting these parameters, the neural field simulation exhibits the desired behavior of the decaying activity.

Hence, we set the values of the parameters to:
Sigma = 0.7, A = 1.0, C = 1.5

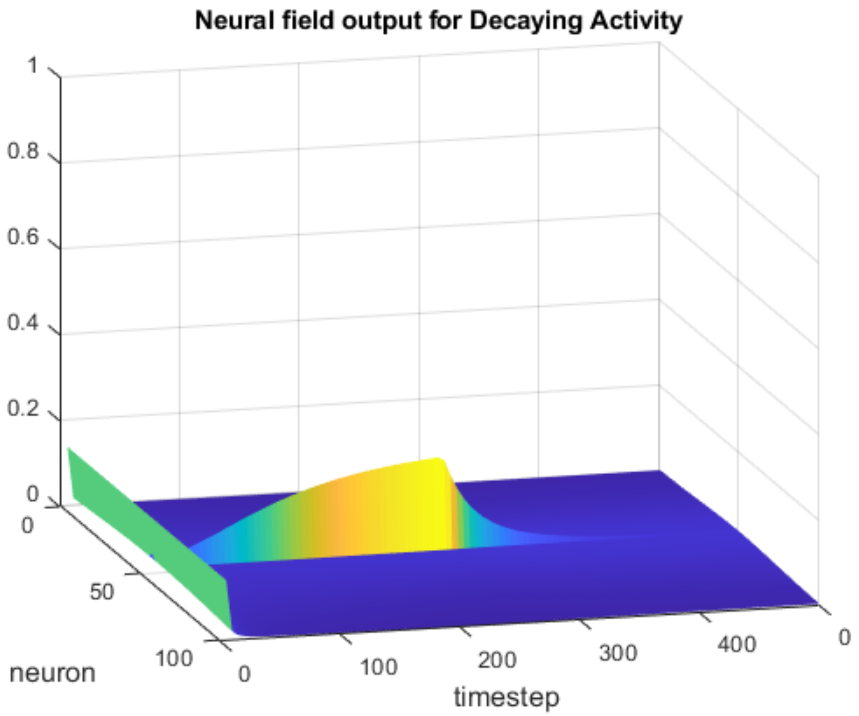

Fig 2: Plot for Decaying Activity

3. Memory Activity

In the memory activity regime, the active area in the neural field remains active even after the external input is removed. This behavior is accomplished by adjusting the parameter values appropriately. First, the parameter sigma is set to around 0.7. This ensures moderate spatial confinement of the active area, similar to the decaying activity regime. By keeping sigma at this level, the activated region is contained within a specific area of the field. Next, the parameter A is increased to approximately 2.0. This stronger excitation allows the neural activity to persist even in the absence of external input. By intensifying the excitatory connections, the active area can sustain its activation over time, resulting in memory-like behavior. Finally, the inhibitory parameter C is set to around 1.0 to maintain a balanced level of inhibition. By minimizing the inhibitory influence, the active area in the neural field is allowed to persist and retain its activity even after the removal of the external input. By carefully adjusting these parameter values, the neural field simulation exhibits the desired behavior of memory activity.

Hence, we set the values of the parameters to:
Sigma = 0.7, A = 2.0, C = 1.0

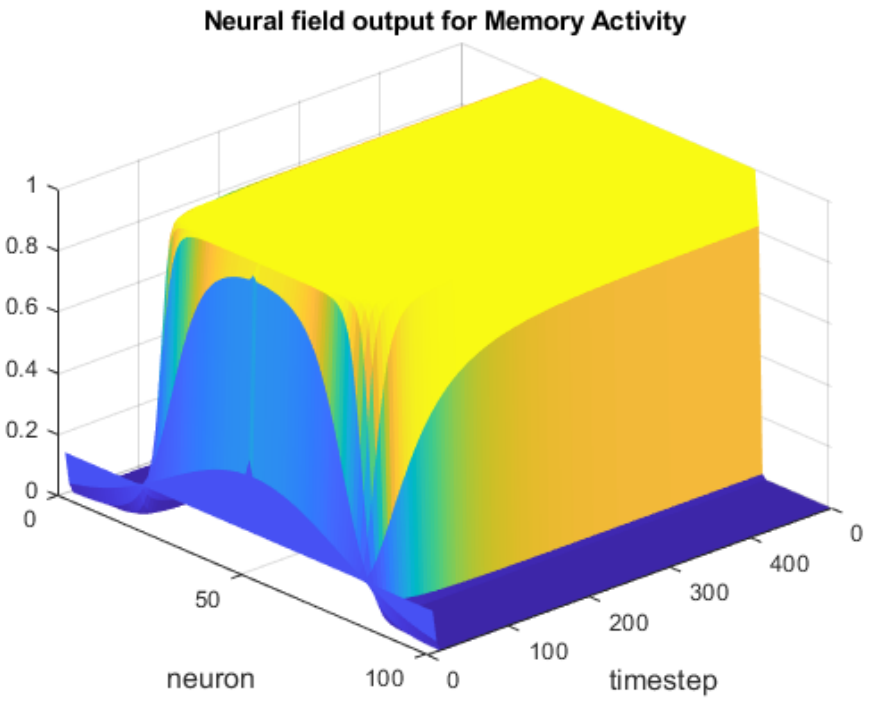

Fig 3: Plot for Memory Activity