Assignment 2

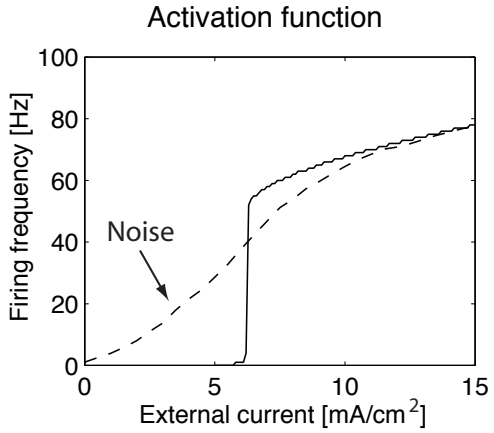
for NeuroComputing/ Theoretical Neuroscience 2014

1. Explain briefly, within one paragraph, how an action potential (spike) is generated with the help of different ion channels. Please identify the minimal set of ion channels for this process (3 points).

2. A membrane has capacitance 1000 μF and a voltage-gated and time-dependent ion channel. This channel has a reversal potential of -1 mV and supports an inward current of positive ions with conductance g1 = 1S in its base state. When the membrane potential exceeds 0.5 mV, this channel opens for an additional inward current of negative ions with conductance g2= 5S for a time window of Δt = 1 ms. Write a simulation program that shows the time course of the membrane potential for 10ms. (3 points)

   Hint: `Positive in' means voltage goes up (drives it towards spike). The program is similar to the EPSP.m program with the addition of a time counter to code for the time dependence of the channel.

3. Use the Hodgkin–Huxley program to plot the current-response (activation) function as shown in Figure below (Fig. 2.11 in the textbook). (4 points)



Send your answers to prof6508@cs.dal.ca with subject line A2. Please write your answer for question 1 in the email and attach the Matlab program for question 2 and a figure for question 3. This assignment must be received on Thursday, Jan 30 before 4pm.