University of Washington
Computer Science and Engineering
Winter 2007

CSE 490 I: Design in Neurobotics

Problem Set 1 Due: before lecture on 1/9/2007

This problem set is intended for you to get exposed to the neurobotics concept and learn some terminologies used in the field. Don't be discouraged if these papers are hard for you to read. It is expected. The following exercises are intended to allow you to appreciate the papers.

Problem 1 (60%):
Read "Real-time control of a robot arm using simultaneously recorded neurons in the motor cortex," Chapin et al, Nature Neuroscience, 2 (7): 664 – 670, 1999. This was one of the first work in controlling a "robotic" device using brain signals. Notice that this field is very young!

(a) Identify 20 words/phrases in this paper that you do not know about. Mark where you found the word/phrase in the paper and write down the meaning of this word/phrase (you can use the internet). If the word/phrase appears more than once, site only one location where you first ran into this word. Rather than simply writing down the strict definition, write down the meaning that is relevant to this paper. (Example: primary motor (M1) cortex (p.674, second paragraph): primary motor cortex is an area of the brain that is closest to being the movement related signal output port. There are neurons in there that directly map onto specific muscles by long wires (axons) through the spinal cord.) Don't be afraid to list what may appear to be simple. If you don't know it, it is good to fully understand those words no matter how simple those words may appear.

(b) Write down a one paragraph summary (~200 words) of this paper using your own words.

(c) Write down three findings/interpretations that you liked most about the paper.

(d) Write down three findings/interpretations that you questioned the most about.

(e) In this paper, they cite a classic work done in the 70's about how the neurons in the primary motor cortex could be dissociated from movement by conditioning. This is truly the first reported work that used the brain signals to control an external device. Identify the main author of this original work and find out

   a. Where he works,
   b. What was the original work like, and
   c. What does he do now?

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Problem 2 (40%):
Read "Remapping hand movements in a novel geometrical environment," Mosier, et al., Journal of Neurophysiology, 94:4362 – 4372, 2005. This is a neuroscience investigation to understand what kind of neural representation may exist in the brain through neurobotics setup. This setup is similar to what you will use in the lab (and the project) and the topic of the paper may stimulate some ideas for the class project. Note: this type of investigation is also considered to be part of the neurobotics.

(a) Identify 10 words/phrases in this paper that you do not know about and go through the same exercise you went through for the previous paper.

(b) Write down a one paragraph summary (~200 words) of this paper using your own words.

(c) Write down three findings/interpretations that you liked most about the paper.

(d) Write down three findings/interpretations that you questioned the most about.