VII SIMPOSI DE NEUROBIOLOGIA EXPERIMENTAL

Secció de Neurobiologia Experimental de la SCB

INSTITUT D´ESTUDIS CATALANS

Carrer del Carme, 47

Barcelona

28 i 29 d'octubre de 2008

(P-9) PREDICTION OF RAT'S LOCATION BY POSITION RECONSTRUCTION FROM PLACE CELLS FIRING

Guger C[1], Gener T[2], Schaffelhofer S[1,3], Brotons-Mas JR[2,4], Edlinger G[1], Sanchez-Vives MV[2,5]

[1]g.tec medical engineering GmbH, Graz, Austria; [2]IDIBAPS (Institut d'Investigacios Biomediques August Pi i Sunyer), Barcelona [3] University of Applied Sciences Upper Austria, Linz, Austria; [4] Instituto de Neurociencias de Alicante, Universidad Miguel Hernández-CSIC [5] ICREA, Barcelona

The hippocampal complex is critically involved in spatial navigation. Place cells are neurons that fire when the animal is located in a specific area of the environment, what is called the "firing field" for that neuron (O'Keefe and Dostrovsky, Brain Res 34: 171,1971). These firing fields are supposed to be the building blocks of the cognitive map of the external space. When a rat (or a human) navigate in the space, different place cells fire coding for the different locations. Here we wanted to explore the possibility of reconstructing the trajectory of the navigation by off line analysis of the place cells' firing.

In a total of 6 rats, four tetrodes (twisted quadruple electrodes) were chronically implanted in order to measure spike activity of single neurons. Additionally, the running path of the animals was investigated with a video tracking system. Both the spike activity and the tracking information were used to train different algorithms (encoding phase) to find a relationship between the neural activity and the xy position of the rat (decoding phase). Three position reconstruction algorithms (Zhang et al. J Neurophys 79: 1017, 1998) have been implemented and were applied to the data: (i)Template matching, (ii)Probabilistic / Bayesian method (1-step), (iii) Probabilistic / Bayesian method with continuity constraint (2-step). In a second step the position of the animal in xy-coordinates was reconstructed just by investigating the spike activity.

The reconstruction was tested for CA1 and subiculum neurons.This study shows that the position can be predicted with a deviation of only 10 cm in an area of different size just by single cells activity in the best case. Reconstruction accuracy gradually increases with the number of place cells use to encode the algorithms. Recordings from hippocampal CA1 regions yield better reconstruction accuracy than recordings from subicular units.

Supported for EU projects PRESENCCIA and Synthetic Forager (SF).