

Homework 2 – due W 02/14/07

1. [50 points]

- a) An $m \times n$ matrix, p , of pixel values, $p(i,j)$, with $1 \leq i \leq m$, $1 \leq j \leq n$, is desired to be set into a column vector, P , of $m \times n$ entries, $P(k)$, by concatenating the pixel values of one row after another starting with the first. Give a formula for the position of the k th entry in $P(k)$ of the (i,j) pixel.
- b) Knowing that P came from p , give a formula to return to p from P .

2. [50 points]

Use the result of problem 1 above to specify pixels in a 5×5 array. Use `newff` to design a three layer feedforward network with 25 inputs and 25 outputs with the output activation functions being `hardlim(.)` and all other activation functions being `tansig(.)`. The inputs are to be taken as wrapped (like on a sphere) so that the top and bottom edges align as do the other two sides in order to give edges neighbors. Assuming the pixels to be gray scale with values between 0 and 1, the outputs are desired to be 1 if (and only if) the corresponding input pixel value and those its North, South, East, and West neighbors sum to at least two.

Discuss your network as to its design, training set, actual training, and behavior on non-trained pixel arrays.

Not for credit but of interest: Look into the use of the Matlab call `gridtop(m,n)` for grid topology of neurons and `mandist(.)` for Manhattan distance. If you set `loc=gridtop(m,n)` and `plotsom(loc)` a plot should result.