

RBF neural networks

The main command creating the network:

```
net = newrb(inp, out, err, spread, n_max, disp)
```

inp – matrix of the input data

out – vector of the given output data

err – mean square error of the model that we want to achieve, default = 0.0

spread – spread of the RBF function, default = 1.0

n_max – maximum number of RBF neurons

disp – number of neurons to add between displays, default = 25

For example:

```
net = newrb(inp, out, 0.01, 1, 100, 1);
```

net = newrbe(inp, out, spread) – command creates the RBF network with number of RBF neurons equal to number of samples

Example for 1-input data:

```
inp = load('data_sin1a_i.txt'); inp = inp';
out = load('data_sin1a_o.txt'); out = out';

er = 0.01;
spread = 1;

net = newrb(inp, out, er, spread, 100, 1);
neurons_no = length(net.IW{1,1})

inp1 = linspace(min(inp), max(inp), 1000);
out1 = sim(net, inp1);
figure(2); plot(inp1, out1, '-', inp, out, '.');

out2 = sim(net, inp);
error = abs(out - out2);
figure(3); plot(error);
```

Example for 2-input data:

```
inp = load('data3d_i.txt'); inp = inp';
out = load('data3d_o.txt'); out = out';

er = 0.01;
spread = 1;

net = newrb(inp, out, er, spread, 200, 1);
neurons_no = length(net.IW{1,1})

x_lin = linspace(min(inp(1,:)), max(inp(1,:)), 50);
y_lin = linspace(min(inp(2,:)), max(inp(2,:)), 50);
[X,Y] = meshgrid(x_lin, y_lin);
Z = griddata(inp(1,:), inp(2,:), out, X, Y, 'cubic');

figure(1); mesh(X,Y,Z); axis tight; hold on;
plot3(inp(1,:), inp(2,:), out, '.'); title('Surface for data');

out2 = sim(net, inp);
error = abs(out - out2);
figure(2); plot(error); title('Error of the network');
```

```

Z1 = griddata(inp(1,:), inp(2,:), out2, X, Y, 'cubic');
figure(3); mesh(X,Y,Z1); axis tight; hold on;
plot3(inp(1,:), inp(2,:), out, '.'); title('Surface for the network');

```

Task to do:

1. For chosen data files:
 - a. look at the data,
 - b. select the most advantageous RBF neurons spread,
 - c. create networks with **newrb** command and compare the quality of results.
2. Repeat all experiments for **newrbe** command.

Prepare the report with the description of all realised experiments.

Description of data files:

Plik(i)	Ilość wejść	Ilość wyjść	Opis
data_sin1 data_sin2 data_sin3	1	1	Sine function sampled with different density.
data_sin1a data_sin2a data_sin3a	1	1	Noisy sine function sampled with different density.
data3d	2	1	Function: $z = \sin(x) \cdot \cos(y) / (x^2 + y^2 + 1)$
percep dane a	2	1	Data separable with one simple perceptron neuron
parity	5	1	Output = 1 if the sum of inputs is even, 0 if not.
transac	6	1	Inputs: amount, company index, hour, type of person realising the transaction, day of week, type of day (free or not) Output: the credibility of transaction in %
captain	3	1	Output: assessment of the degree of danger of the ship made by captain-expert (0, 0.5, 1) Inputs: speeds of the ship
diabet	8	1	Inputs: patients data Output: risk of diabetes