EPART winter 2019/2020
Test #2 (max. = 33)

1	2	3	4	5	6	7	Σ

21.01.2020

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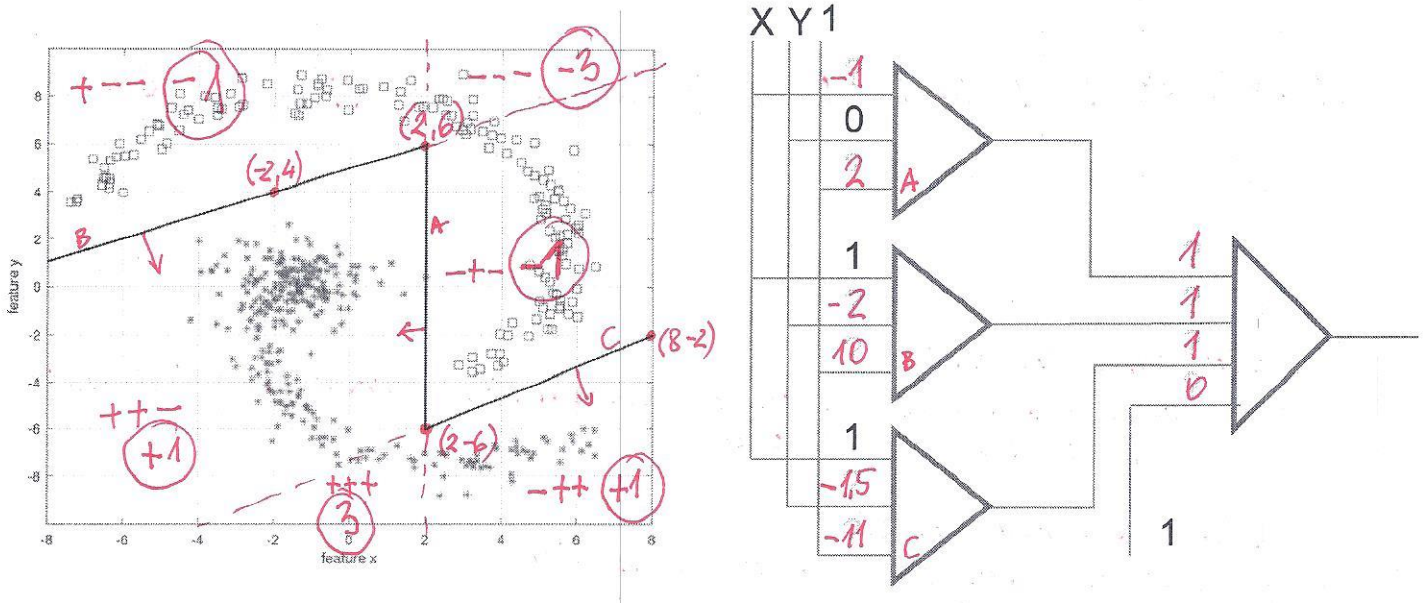
1. (8 pts) The neural network is supposed to give boundary decision between classes depicted in the diagram below. Please fill in missing neuron's weights in the net schema at the bottom of the page. The network should produce 1 for '*' class. Neurons have binary bipolar activation function (i.e. their output is -1 or 1).



2. (2 pts) How many weights has a standard (fully connected) network, which in the only hidden layer has H=40 neurons, classifies C=7 objects' classes represented by F=30 features?

W_{cnt} = $(30+1)\times 40 + (40+1)\times 7 = 1527$

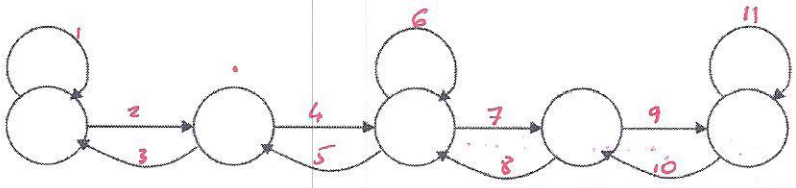
3. (4 pts) The input for the convolutional layer is a 64x64 pixel RGB image. In this layer 7 square filters of size 5 are used, with the stride of 1, and with padding = 2. How many weights (or filter parameters) are in such a layer?

W_{cnt} = $(3\times 5\times 5+1)\times 7 = 532$ or $3\times 5\times 5\times 7 = 525$

How many elements are the output of a layer?

$\frac{64-5+2\cdot 2}{1}+1 = 64$ O_{cnt} = $64\times 64\times 7 = 28\,k$

4. (3 pts) The diagram below shows possible transitions between N=5 states in a Markov process. Assuming that there are K=4 different observations, how many probabilities should be computed in Baum-Welsh procedure?



P_{cnt} = $11 + 5\times 4\,(+5) = 31\,(36)$

↑ Π

5. (5 pts) Fill in the suffix array for the following text buffer:

F	R	E	Q	U	E	N	Z	M	O	D	U	L	I	E	R	T	E	N	$
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Suffix array:

11	18	6	3	15	1	14	13	9	19	7	10	4	2	16	17	5	12	8	X
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

6. (8 pts) We are given N classifiers with the task to select only K classifiers to prepare the voting ensemble. Propose a method of selecting classifiers to such an ensemble.

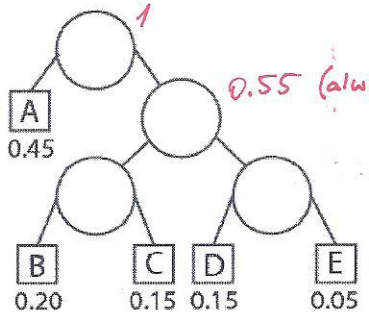
For small K & N:
check exhaustively all K assemblies error coefficients;
select the best one

For moderate K&N
start with the best classifier
for k = 2,, K
check k-classfier ensembles error coefficients (N-k+1 ensembles)
select the best one (i.e. individual classifier best fit to already selected)

For large K&N
check genetic algorithm selection:
gen size - enough bits to code classifier number (K genes in entity)
crossover - selection of unused classifier
population size : few tens

select K best classifiers

7. (3 pts) Compute the average number of tests performed during the classification with the decision tree depicted below. A priori probabilities are given below leaf nodes.



0.55 (always 2 tests)

$T_{avg} = 1 + 2 \times 0.55 = 2.1$