A comparison of the SVM and Neural Networks in signal and image classification

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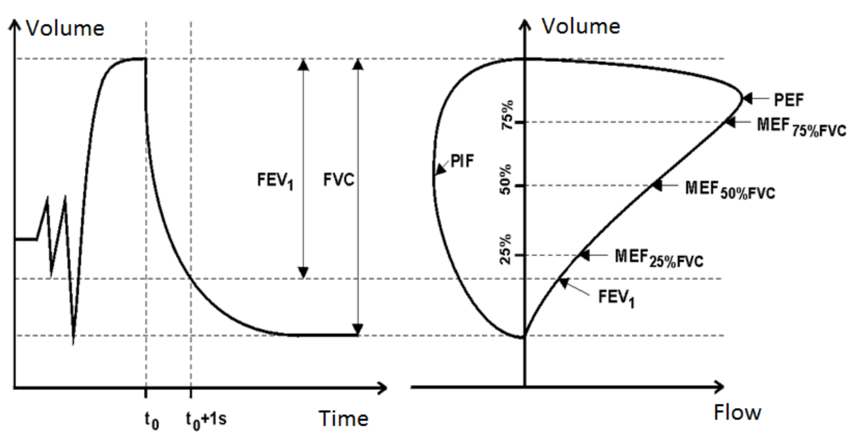
Problem and Motivation

A comparison of classification of the SVM and Neural Networks adapting datasets of four different kinds: spirometric test results, prediction of survival in ovarian cancer, IRIS flower recognition and segmentation of crucial objects from the background.

Classification of spirometric test results

Joanna GRABSKA-CHRZĄSTOWSKA, Wiesław LIBUSZOWSKI, Waldemar Tomalak, "Input parameters influence on results classification of respiratory system diagnosy with neural network"

Spirometry test based on measurement of volumes and flows in respiratory system is the most frequent examination run after suspition of any form of change in respiratory system due to disease process. Interpretation of a test result is based on comparison with norms, which is a guide to malfunction identification. Performance of neural network with backpropagation algorithm were examined using 1803 spirometry test results received in Respiratory System Physiopathology Department, Tuberculosis and Lung Diseases Institute in Rabka



		NEURAL NETWORK* 7->7->1 LINEAR->LOG->LINEAR	
		HEALTHY	SICK
EXPERT	HEALTHY	590	37
	SICK	49	346

* Quality of classification: 91.6%., Sensitivity 87.6%, Specificity 94.1%

		SUPPORT VECTOR MACHINE 1* RBF, C=10,000, epsilon=0.4, gamma=0.12	
		HEALTHY	SICK
Certain Data	HEALTHY	581	46
Certain Data	SICK	72	323

* Quality of classification 88.5%., Sensitivity 81.7%, Specificity 92.6%

Processing of medical images

USG image containing human liver with a kidney (on the left) [8], and the segmented regions.

		NEURAL NETWORK* 9->10->1 LINEAR->TANH->LOG	
		BELONGS	DOESN'T BELONG
Certain Data	BELONGS	754	246
Certain Data	DOESN'T BELONG	206	794

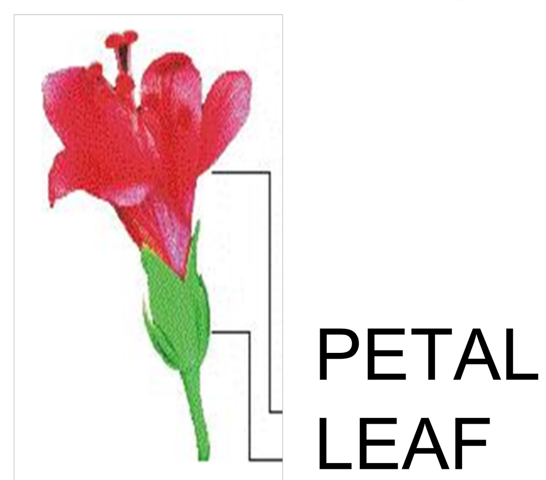
* Quality of classification: 77.4%., Sensitivity 79.4%, Specificity 75.4%

		NEURAL NETWORK* 9->10->1 LINEAR->TANH->LOG	
		BELONGS	DOESN'T BELONG
Certain Data	BELONGS	754	246
Certain Data	DOESN'T BELONG	206	794

* Quality of classification: 77.4%., Sensitivity 79.4%, Specificity 75.4%

IRIS Flower Problem

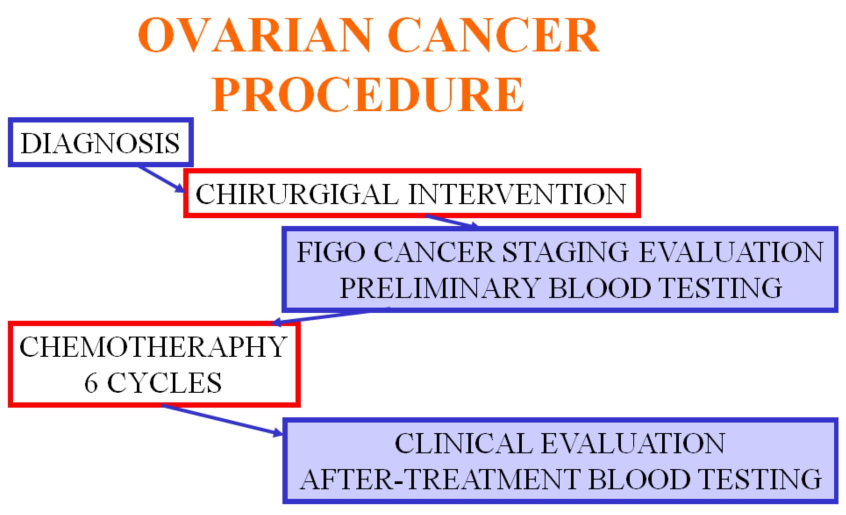
In this problem both methods proved to be equal, both reaching 98.6% proper classification with just two flowers misclassified.



Prediction of survival in ovarian cancer

Joanna GRABSKA-CHRZĄSTOWSKA, Jan Kulpa, Urszula Rychlik, "Neural network implementation to survival prediction in ovarian carcinoma"

Data of 156 female patients of Krakow Centre of Oncology



		NEURAL NETWORK* 5->3->1 LINEAR->EXP->TANH	
		SURVIVAL > 24 MONTH	SURVIVAL < 24 MONTH
Certain Data	SURVIVAL > 24 MONTH	77	11
Certain Data	SURVIVAL < 24 MONTH	15	53

* Quality prediction: 83.3%., Sensitivity 78%, Specificity 87%

		SUPPORT VECTOR MACHINE 1* RBF, C=10,000, epsilon=0.4, gamma=0.12	
		SURVIVAL > 24 MONTH	SURVIVAL < 24 MONTH
Certain Data	SURVIVAL > 24 MONTH	79	9
Certain Data	SURVIVAL < 24 MONTH	25	43

* Quality prediction 78.2%., Sensitivity 63.2%, Specificity 89.8%

The results of the two methods

METHODS	NN			SVM		
PROBLEMS	Correct results [%]	Sensitivity [%]	Specificity [%]	Correct results [%]	Sensitivity [%]	Specificity [%]
SPIROMETRIC TESTS (Healthy/Sick) 1022 boys	91.6	87.6	94.1	88.5	81.7	92.6
PREDICTION OF SURVIVAL IN OVARIAN CANCER (12 month) 156 women	83.3	78 %	87 %	78.2	63.2	89.8
IRISES (3 classes) 150 flowers	98.7	-	-	98.7	-	-
USG IMAGE (part of the image belongs /doesn't belong to the kidney)	77.4	79.4	75.4	65.9	70.6	61,2

Conclusions

The quality of classification for three of the four methods firmly promotes neural networks. The differences for the two first methods are not very big (2%-3%), but for the wide problem of segmentation the difference reaches almost 12%. No advantages of the SVM methods like: a short time of calculations, independence from the size of the problem or not falling into local minima can compensate for such a defeat. Summing up, one must clearly state that having such a strong tool like neural networks there is no sense promoting the methods based on a very similar ground but less developed and behaving unstably as well.