diagnostic model, so as to realize the fault diagnosis of marine diesel generator.

V . Fault diagnosis experiments

The main work of training stage is to select appropriate category parameters based on the sample set, where the parameters include the kernel function parameters and the penalty factor C . First, choose Gaussian function $K(x,x^{'}) = \exp(-\frac{\left\|x-x^{'}\right\|}{2\sigma^2})$ as mapping kernel function, when testing, the training samples being regarded as testing samples, the accuracy rate can obtain more than 95%. The categories are not wrong, then classify the test samples, the accuracy rate can obtain more than 85%. Using the data acquisition and recording in front, after preprocessing, regard them as normal operating condition's sample data of the marine diesel generator. According to the regression theory, select $\sigma^2 = \frac{1}{2}, C = 200\ \varepsilon = 0.001.$

Take cylinder exhausts temperature T_r , sweep gas tank pressure P_s , maximum explosion pressure $P_{\max}$, turbocharger rotational speed n_{tc} , sweep gas tank temperature and compressor output temperature T_c as the input variables of SVM, take filter net pressure loss coefficient, air-cooled pressure loss coefficient, waste heat boiler pressure loss coefficient as component feature parameters, diagnose directly.

The severity of the fault can be divided into three grade, namely, fault grade I, fault grade II and no-fault (normal conditions). According to the output vector of SVM, the results of treatment are as follows:

if $0.75 < F < 1.50$, it is grade I (major fault)

if $0.25 < F < 0.75$, it is grade II (moderate fault)

if $F < 0.25$ or $F > 1.5$, it is normal (no fault)

Thus can get diagnosis results.

For data comparison, the SVM and BP neural network simulation results are compared, current ly BP neural network has more applications in fault diagnosis [5]. The experiment results are shown in Table 1.

Table 1 simulation and prediction results comparison of SVM and BP neural network

error		SVM		BP neural network	
		fitting data	prediction data	fitting data	prediction data
absolute error	maximum	0.860	0.235	0.782	0.513
	minimum	0.001	0.004	0.015	0.012
	average	0.264	0.108	0.183	0.210
relative error	maximum	1.65	0.43	1.5	0.7
	minimum	0	0.01	0	0.1
	average	0.56	0.21	0.42	0.38

The results of SVM and BP neural network are analyzed and compared. SVM method can not only make the error as small as possible but also make the regression function as smooth as possible, thus improve its generalization (forecasting) capabilities. At the same time the structure of artificial neural network is optimal structure that being get by a large number of test, its training time is very long, it takes about 38 minutes to get predictable results; while SVM method requires only small samples to calculate, it takes about 4s to get an acceptable predictive value. So in terms of computing speed or generalization ability, SVM methods have shown a good performance.

VI . Conclusion

SVM being used in the turbocharger system modeling of marine diesel generator, simulation results show the learning efficiency of SVM and its ability in solving over-fitting are perfect. SVM is based on small sample statistical theory, and it has rigorous theoretical system, so there will certainly be very broad application prospects in the field of non-linear modeling.

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