

APPENDIX –A

1. Coding code for SVM in R for kinear kernel

```
Library(kernlab)
```

```
#import data from csv file for train data
```

```
mydata <- read.csv('train7.csv')
```

```
#import data from csv file for test data
```

```
mydata2 <- read.csv('test7.csv')
```

```
#assign data to temp
```

```
temp<- mydata[1:105, 3,]
```

```
#append data
```

```
temp<-cbind(temp,temp)
```

```
#train the data
```

```
bestmodel<-ksvm (temp,ytrain,type="C-svc", kernel='vanilladot', cross=5)
```

2. Coding code for SVM in R.

```
Library(kernlab)
```

```
#import data from csv file for train data
```

```
mydata <- read.csv('train7.csv')
```

```
#import data from csv file for test data
```

```
mydata2 <- read.csv('test7.csv')
```

```
#assign data to xtrain and read from 3rd column ubtil 13th column
```

```
xtrain <- mydata[1:105, 3:13]
```

```
#assign data to ytrain and read from 2nd column
```

```
ytrain <- mydata[1:105, 2:2]
```

```
#assign data to xtest and read from 3rd column ubtil 13th column
```

```
xtest <- mydata2[1:45, 2:2]
```

```
#assign data to ytest and read from 2nd column
```

```
ytest <- mydata2[1:45, 3:13]
```

```
#assign label to data
```

```
ytrain <- factor(ytrain, levels = c ("High","Medium","Low"),labels=c("H", "M", "L"))
```

```
ytest <- factor(ytest, levels = c ("High","Medium","Low"),labels=c("H", "M", "L"))
```

```

clist <- c(1:20)

clist <- clist /10

sigmalist <- clist

#Find optimal cross validation error rate RBF kernel function
cv_err <- matrix(0,nrow=length(clist),ncol=length(sigmalist))

for (i in seq(length(clist))) {
  C <- clist[i]
  for (j in seq(length(sigmalist))) {
    model<-ksvm(ytrain~.,data=xtrain,type="C-svc", kernel='rbf',
kpar=list(sigma=sigmalist[j]), C=clist[i],cross=5)

    cv_err[i,j] <- cross(model)
  }
}

#train the data

bestmodel<-ksvm (ytrain~.,data=xtrain,type="C-svc", kernel='rbf', kpar=list(sigma=0.3),
C=2.3,cross=5)

#prediction of dissolved oxygen class

pred.ksvm <- predict( bestmodel, xtest)

error.ksvm <- mean( pred.ksvm!=ytest)

```

```
#compute the table for prediction and  
table( pred.ksvm, ytest  
  
#accuracy of prediction  
sum(pred.ksvm==ytest)/length(ytest)
```

APPENDIX –B

Data records-Training

D.O	D.O	Temp.	pH	BOD	Sal	E. coli	NH3N	Cond	T.Phosphorus	COD	T.Nitrogen	Chlorophyll-a
2.14	Low	30.21	6.56	2	0.04	120	0.32	85	0.03	16	1	3.1
2.28	Low	29.61	6.96	2	0.04	30	0.21	97	0.07	22	1	1.6
2.4	Low	28.73	7.19	2	0.03	440	0.27	72	0.05	21	1	6.8
2.68	Low	28.86	6.61	2	0.05	60	0.61	116	0.07	17	1	2.7
2.96	Low	30.04	7.47	2	0.06	70	0.33	122	0.06	15	5.09	1.9
2.98	Low	29.45	7.11	1	0.05	180	0.05	105	0.01	8	1	0.6
3.17	Low	27.87	6.49	2	0.03	170	0.17	66	0.05	20	2	1.5
3.23	Low	29.21	6.85	6	0.04	300	0.25	93	0.12	19	3	2.1
3.31	Low	29.18	6.53	2	0.04	1000	0.64	92	0.04	12	1	4.7
3.31	Low	30.54	7.14	4	0.08	100	1.25	177	0.04	17	3	3
3.38	Low	30.76	6.98	3	0.05	190	0.49	116	0.01	28	1	1.9
3.41	Low	31.93	6.79	3	0.06	220	0.43	141	0.03	13	1	2.5
3.42	Low	29.08	6.68	1	0.05	400	1.04	107	0.09	16	2	13.4
3.44	Low	29.17	7.14	1	0.05	130	0.01	102	0.01	10	1	1.1
3.45	Low	30.66	7.61	2	0.05	80	0.36	110	0.01	11	1	1
3.47	Low	31.17	7.23	1	0.05	70	0.02	117	0.01	19	1	0.5
3.61	Low	29.78	6.98	2	0.05	170	2.04	107	0.06	13	1	2.9
3.68	Low	29.53	6.8	2	0.04	210	0.61	84	0.06	17	1	4.4
3.69	Low	30.27	6.75	10	0.07	44	1.8	143	0.05	26	1	6.9
3.74	Low	29.22	7.13	1	0.04	370	0.01	80	0.01	8	1	0.2
3.81	Low	27.9	6.39	3	0.05	690	0.53	104	0	28	1	6.3
3.87	Low	29.52	7.05	1	0.04	280	0.65	98	0.11	16	1	7.7

3.97	Low	30	7.04	3	0.05	260	0.27	1063	0.06	11	1	4.5
4.09	Low	29.7	7.07	2	0.03	690	0.01	74	0.02	7	1	1.5
4.11	Low	26.11	7.24	2	0.04	290	0.05	98	0.08	14	1	4.1
4.17	Low	29.09	7.31	4	0.04	160	0.23	91	0.08	21	1	16.8
4.18	Low	31.1	7.35	1	0.04	220	0	86	0	21	0	0
4.18	Low	30.44	7.01	1	0.07	60	0.74	160	0.05	4	2	2.5
4.2	Low	30.89	7.05	3	0.04	590	0.4	80	0.01	13	1	1.2
4.25	Low	30	7.16	1	0.07	60	0.13	145	0.01	11	1	1.5
4.3	Low	31.32	6.7	2	0.04	70	0.19	89	0.01	26	4	7.1
4.32	Low	30.71	7.17	1	0.03	352	0.12	69	0.02	5	0	2.9
4.4	Low	31.26	6.85	5	0.03	124	0.01	68	0	17	1	3.2
4.47	Low	29.42	6.8	1	0.06	490	0.02	129	0.03	16	1	0.8
4.52	Low	29	6.79	2	0.06	210	0.3	131	0.04	29	1	18.8
6.4	Medium	31.56	7.43	1	0.02	610	0.11	45	0	8	0	0.9
6.87	Medium	31.58	7.34	1	0.03	60	0.16	69	0	3	0	4.1
6.88	Medium	31.9	7.22	1	0.03	12	0.13	75	0.03	12	0	2.9
6.48	Medium	32.15	6.68	2	0.02	610	0.12	55	0.02	13	0	4.1
6.84	Medium	32.2	7.26	1	0.03	16	0.11	75	0.02	17	0	3.7
5.99	Medium	29.58	8.21	3	0.04	30	0.01	82	0.04	21	1	1.1
5.45	Medium	29.59	6.5	2	0.02	400	0.15	52	0.09	8	1	2.1
6.18	Medium	29.63	6.52	2	0.04	800	0.75	81	0.06	12	1	17.8
6.07	Medium	29.65	7.14	2	0.04	200	0.16	88	0.03	18	1	2
5.8	Medium	29.68	7.49	1	0.02	280	0.05	56	0.01	9	1	1
6.69	Medium	30.06	7.2	2	0.04	236	0.1	88	0.03	21	1	2.1
6.41	Medium	30.1	7.17	3	0.07	200	0.09	157	0.03	12	1	11.5
6.63	Medium	30.1	7.46	1	0.04	40	0.08	93	0.01	8	1	4.7
6.71	Medium	30.1	7.14	2	0.04	70	0.01	88	0.04	27	1	0.5
6.77	Medium	30.11	7.36	1	0.04	160	0.1	92	0.01	13	1	2.1

6.6	Medium	30.27	7.14	2	0.03	380	0.23	74	0.03	21	1	2.6
5.77	Medium	30.28	7.64	1	0.02	10	0.01	50	0.02	17	1	2.7
6.97	Medium	30.28	7.23	2	0.04	228	0.1	92	0.03	21	1	4.5
6.74	Medium	30.3	6.87	1	0.03	400	0.15	58	0.03	5	1	4.9
5.79	Medium	30.31	6.78	1	0.02	300	0.03	56	0.01	14	1	1.9
6.48	Medium	30.57	7.06	2	0.05	100	0.25	100	0.03	8	1	0
6.67	Medium	30.59	7.44	1	0.05	150	0.07	108	0.01	9	1	0.1
6.94	Medium	30.6	7.35	2	0.03	124	0.2	77	0.05	14	1	10.1
6.74	Medium	30.66	6.89	2	0.03	160	0.07	76	0.02	17	1	7.7
6.86	Medium	30.66	7.62	1	0.04	10	0.01	89	0.01	13	1	6
6.95	Medium	30.86	7.53	1	0.04	30	0.01	87	0.01	14	1	3.6
5.61	Medium	30.88	6.49	2	0.03	260	0.11	58	0.04	15	1	4.3
6.44	Medium	30.88	7.05	1	0.03	240	0.44	75	0.01	7	1	4.3
6.72	Medium	30.88	7.19	1	0.03	8	0.06	69	0	10	1	4.3
6.83	Medium	30.89	7.28	2	0.02	190	0.04	50	0.01	17	1	0.9
6.14	Medium	31.23	7.83	1	0.04	464	0.03	90	0	6	1	7.7
6.22	Medium	31.23	7.44	1	0.04	10	0.01	84	0.01	13	1	1.6
6.95	Medium	31.24	7.31	2	0.05	810	0.76	111	0.01	23	1	4.7
6.14	Medium	31.25	7.15	1	0.03	390	0.12	65	0.01	13	1	2.8
6.37	Medium	31.25	7.52	1	0.04	260	0.07	98	0.01	9	1	0.5
7.38	High	31.2	7.83	2	0.04	8	0	92	0.02	9	0	12.9
7.36	High	30.89	7.42	1	0.03	12	0.03	74	0.02	8	0	13.1
7.05	High	31.01	7.39	2	0.04	32	0.03	82	0	14	0	13.2
7.61	High	29.92	7.46	2	0.1	120	0.01	205	0	5	0	15.7
8.16	High	32.24	7.86	5	0.04	20	0.03	92	0	56	0	16.6
7.21	High	30.7	7.16	1	0.03	4	0.04	63	0	11	1	0.6
7.34	High	29.33	7.69	1	0.04	92	0.26	79	0.04	12	1	0.6
7.38	High	30.55	7.43	1	0.03	110	0.03	67	0.01	8	1	0.7

7.26	High	31.23	7.46	1	0.03	120	0.06	60	0.01	10	1	0.8
7.55	High	31.27	7.54	1	0.03	10	0.01	74	0.01	12	1	0.8
7.09	High	32.97	7.26	1	0.03	44	0.05	76	0.03	9	1	1.4
7.09	High	29.76	7.57	1	0.03	30	0.17	65	0.01	14	1	1.4
7.16	High	31.82	7.44	1	0.03	200	0.04	72	0.01	14	1	1.4
7.26	High	31.97	7.52	1	0.04	45	0.03	79	0.01	10	1	1.4
7.03	High	32.43	7.46	1	0.03	25	0.06	74	0.01	9	1	1.5
7.19	High	30.01	8.08	1	0.03	12	0.04	72	0.09	15	1	2.1
7.23	High	28.96	7.46	1	0.04	10	0.11	92	0.01	13	1	2.1
7.26	High	31.7	7.57	1	0.04	88	0.06	82	0.01	11	1	2.1
7.32	High	30.98	7.31	3	0.02	50	0.01	52	0.01	10	1	2.1
7.68	High	29.68	7.48	1	0.04	100	0.08	87	0.01	12	1	2.1
9.29	High	29.95	8.33	1	0.03	12	0.08	66	0.02	19	1	2.9
7.01	High	29.81	7.29	1	0.04	8	0.15	81	0.01	15	1	3
7.2	High	31.42	8.02	1	0.03	20	0.36	71	0.01	9	1	3
7.26	High	30.46	7.17	1	0.03	220	0.05	61	0	14	1	3
7.28	High	32.03	7.02	1	0.03	24	0.01	71	0	8	1	3
7.21	High	29.85	7.3	1	0.04	1304	0.31	83	0.03	16	1	3.8
7.26	High	31.84	7.49	1	0.03	76	0.08	78	0.01	10	1	3.8
7.38	High	32.15	7.72	1	0.05	290	0.07	104	0.03	17	1	3.8
7.92	High	28.93	7.71	1	0.04	30	0.16	95	0.01	18	1	3.8
8.05	High	30.48	7.53	1	0.04	36	0.08	90	0.01	15	1	3.8
7.9	High	32.29	8.17	2	0.04	6	0.05	94	0.01	15	1	4.3
8.08	High	30.64	7.62	1	0.03	168	0.09	77	0.04	9	1	4.3
8.34	High	31.04	7.61	2	0.03	48	0.06	78	0.02	23	1	4.3
8.61	High	30.19	8.25	1	0.04	12	0.01	81	0.02	14	1	4.3
7.1	High	30.08	7.84	1	0.04	100	0.07	93	0.03	11	1	4.4

Data records-Testing

D.O	D.O	Temp.	pH	BOD	Sal	E. coli	NH3N	Cond	T.Phosphorus	COD	T.Nitrogen	Chlorophyll-a
4.73	Low	29.57	6.27	1	0.03	7100	0.18	68	0.03	5	1	3.3
4.74	Low	31.9	7.1	3	0.05	460	0.3	105	0.05	14	1	4
4.76	Low	27.34	6.87	2	0.04	400	0.02	85	0.1	7	1	3.8
4.76	Low	30.75	7.83	4	0.05	130	0.59	100	0.04	20	1	3.9
4.79	Low	26.77	7.07	2	0.04	310	0.06	89	0.05	17	1	4.8
4.81	Low	30.48	6.43	1	0.02	1040	0.08	54	0	7	1	2.1
4.83	Low	28.76	7.1	2	0.03	2000	0.06	73	0	6	1	8.8
4.83	Low	30.19	7.68	1	0.03	250	0.22	65	0.01	10	1	0.7
4.86	Low	29.78	7.18	2	0.06	970	0.07	124	0.01	31	3	10.8
4.88	Low	30.48	7.38	3	0.03	210	0.31	77	0.01	20	1	5.4
4.53	Low	28.54	7.11	3	0.02	520	0.12	47	0.05	22	1	8.7
4.58	Low	32.2	7.14	5	0.06	80	0.58	139	0	15	1	4.3
4.59	Low	32.05	7.15	1	0.06	70	0.79	124	0.06	10	1	2.4
4.62	Low	28.17	7	2	0.04	2300	0.03	79	0	8	1	7.9
4.67	Low	29.48	7.42	3	0.05	150	0.09	115	0.06	13	1	10.6
6.99	Medium	30.8	7.19	1	0.03	120	0.14	72	0	7	3	1.5
5.63	Medium	30.81	7.08	4	0.04	310	0.22	99	0.01	20	3	8.7
6.13	Medium	31.94	6.95	1	0.07	472	1.83	158	0.08	4	3	9
6.93	Medium	31.18	7.12	1	0.03	150	0.42	73	0	7	4	1.7
5.04	Medium	30.96	6.95	5	0.08	100	2.65	179	0.12	15	5	20.4
6.33	Medium	29.31	7.09	1	0.03	90	0.01	67	0.01	12	1	0.5
5.12	Medium	30.14	6.9	1	0.02	210	0.22	56	0.01	9	1	0.5

6.7	Medium	30.16	7.09	1	0.04	180	0.09	89	0.01	9	1	1	0.5
5.98	Medium	30.76	7.14	1	0.05	140	0.31	100	0.01	7	1	1	0.5
6.66	Medium	30.88	7.39	1	0.04	120	0.01	85	0.01	11	2	2	1.8
6.06	Medium	29.86	7.21	1	0.04	240	0.05	94	0.01	9	1	1	1.9
6.34	Medium	30.18	7.06	1	0.02	20	0.04	49	0.01	9	1	1	2
6.56	Medium	31.29	6.67	1	0.02	270	0.08	51	0.01	6	1	1	2
5.65	Medium	31.54	6.53	6	0.07	56	2.21	147	0.13	20	1	1	8.3
5.18	Medium	28.44	6.9	6	0.05	220	0.27	110	0.16	37	2	2	12.4
8.2	High	31.99	8.49	3	0.03	4	0.01	73	0.09	6	1	1	17.2
7.57	High	29.52	7.37	1	0.04	130	0.07	81	0.01	13	1	1	18.6
8.02	High	31.59	7.2	1	0.03	4	0.11	78	0.09	7	1	1	18.6
8.22	High	32.1	8.35	2	0.03	12	0.01	72	0.06	26	1	1	19.7
7.92	High	31.4	7.53	2	0.03	30	0.06	77	0	18	1	1	21.8
8.18	High	30.65	7.89	1	0.03	48	0.06	76	0.01	9	1	1	23
8.36	High	31.67	8	3	0.03	10	0.04	73	0.04	18	1	1	28.6
7.66	High	30.74	7.33	3	0.07	104	0.07	158	0.03	9	1	1	30.3
7.06	High	29.3	7.4	3	0.03	870	0.02	60	0	21	1	1	39.4
8.89	High	30.96	7.71	1	0.05	50	0.02	109	0.02	5	3.14	3.14	1.3
7.51	High	29.45	7.47	1	0.04	60	0.23	88	0.01	19	1	1	4.6
7.6	High	30.71	6.89	1	0.02	1300	0.01	47	0	8	1	1	4.6
7.8	High	32.17	7.67	2	0.03	24	0.01	76	0	7	1	1	4.6
9.92	High	29.94	7.88	1	0.04	52	0.06	84	0.02	10	1	1	4.6
7.06	High	30.44	7.21	1	0.03	80	0.11	69	0.01	6	1	1	4.7