

ICML-HW2 Report

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Usage

```
$ python3 svm.py [-h]
```

optional Options	Description
-h, --help	show this help message and exit
-s SCALING	svm kernel,default=rbf
-k KERNEL	PCA n_components,default=2
-n N_COMPONENTS	input the size of batch
-c PENALTY_C	SVC penalty parameter C of the error term,default=1
-cv CV	cross_validate,default=10
-pp PP	print progress,default = true

1. Extract features to describe the hand gesture and apply SVM to classify the “CSL” dataset. (50%)

- **Brief description of development environment**

DISTRIB_ID=Ubuntu
DISTRIB_RELEASE=18.04
DISTRIB_CODENAME=bionic
DISTRIB_DESCRIPTION="Ubuntu 18.04.1 LTS"

- **Description of your features**

input為 CSL dataset的圖片pixel，大小為(227,227,3)，先將圖片pixel攤平為(154587,)，後使用PCA，將inputs做降維為n_components，再將降維後的結果輸入SVM模型。

- **Comparison of**

- the effect of scaling the feature values

Parameters	Description
n_components	2
penalty C	1.0
cross_validate	10

- kernel : linear

- scaling:False

Result	Description
accuracy	0.6792307692307692
precision	0.6374671360898836
recall	0.6792307692307692

- scaling:True

Result	Description
accuracy	0.7923076923076923
precision	0.8047775397312039
recall	0.7923076923076923

- kernel : rbf

- scaling:False

Result	Description
accuracy	0.9353846153846154
precision	0.9527517007958797
recall	0.9353846153846153

- scaling:True

Result	Description
accuracy	0.9507692307692308
precision	0.952222243054072
recall	0.9507692307692307

從結果可以觀察到，有使用scaling的結果都比沒有使用scaling的結果來得更好，無論是accuracy、precision還是recall，結果均有提升。

- **The cross validation results**

- the precision/recall of each validation iteration
- the average precision/recall of all validation iterations

scaling: True

kernel: linear

n_components: 1

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.4966	0.4634	0.4961	0.5007	0.4643	0.5016
cv1	0.5482	0.4774	0.5477	0.5440	0.4803	0.5433
cv2	0.5531	0.4859	0.5524	0.5455	0.4883	0.5439
cv3	0.5162	0.4674	0.5158	0.5114	0.4421	0.5106
cv4	0.5066	0.4583	0.5061	0.5213	0.4816	0.5205
cv5	0.5406	0.5211	0.5398	0.5306	0.4937	0.5294
cv6	0.5442	0.4662	0.5427	0.5349	0.4464	0.5335
cv7	0.5165	0.4284	0.5151	0.5143	0.4105	0.5135
cv8	0.4682	0.4208	0.4670	0.4814	0.4297	0.4805
cv9	0.5125	0.4490	0.5107	0.5165	0.4333	0.5160
avg	0.5203	0.4638	0.5193	0.5200	0.4570	0.5193

testing:

accuracy: 0.49153846153846154

precision: 0.4191348417218478

recall: 0.49153846153846154

scaling: True
 kernel: linear
 n_components: 2
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.8287	0.8484	0.8274	0.8193	0.8447	0.8184
cv1	0.8292	0.8350	0.8286	0.8295	0.8363	0.8286
cv2	0.8206	0.8346	0.8199	0.8168	0.8338	0.8154
cv3	0.8212	0.8047	0.8205	0.8040	0.7857	0.8028
cv4	0.8248	0.8479	0.8235	0.8125	0.8444	0.8109
cv5	0.8594	0.8658	0.8585	0.8549	0.8650	0.8542
cv6	0.8507	0.8838	0.8499	0.8691	0.8698	0.8683
cv7	0.8300	0.8322	0.8285	0.8357	0.8343	0.8340
cv8	0.8177	0.8347	0.8170	0.8143	0.8314	0.8137
cv9	0.8395	0.8521	0.8387	0.8298	0.8472	0.8290
avg	0.8322	0.8439	0.8312	0.8286	0.8393	0.8275

testing:

accuracy: 0.8092307692307692

precision: 0.81243419978542

recall: 0.8092307692307692

scaling: True
 kernel: linear
 n_components: 3
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9960	0.9962	0.9960	0.9959	0.9960	0.9959
cv1	0.9951	0.9953	0.9951	0.9957	0.9958	0.9957
cv2	0.9957	0.9960	0.9957	0.9929	0.9929	0.9929
cv3	0.9961	0.9962	0.9961	0.9943	0.9950	0.9943
cv4	0.9959	0.9960	0.9959	0.9943	0.9946	0.9943
cv5	0.9961	0.9962	0.9961	0.9915	0.9926	0.9915
cv6	0.9953	0.9955	0.9953	0.9957	0.9962	0.9957
cv7	0.9964	0.9965	0.9964	0.9943	0.9946	0.9943
cv8	0.9959	0.9960	0.9959	0.9971	0.9973	0.9972
cv9	0.9956	0.9957	0.9956	0.9957	0.9960	0.9957
avg	0.9958	0.9960	0.9958	0.9947	0.9951	0.9947

testing:

accuracy: 0.9938461538461538

precision: 0.9942702722114487

recall: 0.9938461538461538

scaling: True

kernel: linear

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.8272	0.8248	0.8259	0.8110	0.8065	0.8102
cv1	0.8336	0.8538	0.8327	0.8537	0.8811	0.8528
cv2	0.8278	0.8260	0.8268	0.8466	0.8450	0.8453
cv3	0.8404	0.8528	0.8397	0.8196	0.8368	0.8185
cv4	0.8242	0.8603	0.8229	0.8224	0.8584	0.8210
cv5	0.8466	0.8607	0.8455	0.8521	0.8654	0.8512
cv6	0.8466	0.8738	0.8452	0.8606	0.8839	0.8594
cv7	0.8022	0.8187	0.8015	0.8043	0.8160	0.8036
cv8	0.7824	0.7951	0.7811	0.7814	0.7950	0.7800
cv9	0.8451	0.8578	0.8438	0.8340	0.8468	0.8329
avg	0.8276	0.8424	0.8265	0.8286	0.8435	0.8275

testing:

accuracy: 0.8053846153846154

precision: 0.8266956464654729

recall: 0.8053846153846153

scaling: True

kernel: linear

n_components: 2

penalty C: 0.8

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.8435	0.8720	0.8427	0.8276	0.8366	0.8276
cv1	0.8709	0.8794	0.8701	0.8920	0.9042	0.8912
cv2	0.8595	0.8660	0.8589	0.8636	0.8736	0.8624
cv3	0.8207	0.8367	0.8195	0.7912	0.8184	0.7897
cv4	0.8507	0.8601	0.8496	0.8423	0.8519	0.8411
cv5	0.8381	0.8792	0.8373	0.8364	0.8777	0.8358
cv6	0.8649	0.8842	0.8635	0.8706	0.8902	0.8693
cv7	0.8404	0.8513	0.8391	0.8529	0.8682	0.8516
cv8	0.8541	0.8530	0.8533	0.8700	0.8637	0.8690
cv9	0.8355	0.8370	0.8348	0.8369	0.8440	0.8361
avg	0.8478	0.8619	0.8469	0.8484	0.8628	0.8474

testing:

accuracy: 0.8138461538461539

precision: 0.8617681466089079

recall: 0.8138461538461539

scaling: True

kernel: linear

n_components: 2

penalty C: 1.2

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.8562	0.8666	0.8549	0.8455	0.8501	0.8445
cv1	0.8371	0.8425	0.8356	0.8665	0.8723	0.8652
cv2	0.8122	0.7977	0.8109	0.8409	0.8256	0.8396
cv3	0.8125	0.8295	0.8117	0.7912	0.8134	0.7901
cv4	0.8368	0.8394	0.8355	0.8324	0.8338	0.8310
cv5	0.8025	0.8038	0.8005	0.7937	0.8011	0.7920
cv6	0.8365	0.8474	0.8353	0.8193	0.8296	0.8182
cv7	0.8007	0.8410	0.7998	0.8086	0.8613	0.8076
cv8	0.8419	0.8366	0.8409	0.8529	0.8411	0.8517
cv9	0.8631	0.8702	0.8622	0.8512	0.8640	0.8503
avg	0.8300	0.8375	0.8287	0.8302	0.8392	0.8290

testing:

accuracy: 0.813076923076923

precision: 0.824983230132455

recall: 0.8130769230769231

scaling: True

kernel: poly

n_components: 1

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.3873	0.3569	0.3903	0.3779	0.3396	0.3807
cv1	0.4470	0.4030	0.4491	0.4688	0.4341	0.4714
cv2	0.4018	0.3625	0.3987	0.4006	0.3470	0.3981
cv3	0.4699	0.4269	0.4697	0.4702	0.3910	0.4702
cv4	0.4219	0.3909	0.4211	0.4389	0.4094	0.4375
cv5	0.3781	0.3028	0.3761	0.3798	0.2901	0.3776
cv6	0.3440	0.2983	0.3408	0.3400	0.3077	0.3371
cv7	0.3678	0.2854	0.3709	0.3814	0.2841	0.3852
cv8	0.4824	0.3862	0.4817	0.4929	0.3928	0.4921
cv9	0.4571	0.4644	0.4603	0.4721	0.4848	0.4745
avg	0.4157	0.3677	0.4159	0.4223	0.3680	0.4225

testing:

accuracy: 0.38

precision: 0.3484426358424545

recall: 0.38

scaling: True

kernel: poly

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.8008	0.8134	0.8008	0.8138	0.8255	0.8140
cv1	0.7904	0.8159	0.7917	0.8011	0.8347	0.8031
cv2	0.8363	0.8358	0.8364	0.8068	0.8090	0.8063
cv3	0.8138	0.8348	0.8140	0.8040	0.8192	0.8038
cv4	0.8076	0.8068	0.8071	0.8054	0.8073	0.8048
cv5	0.8345	0.8490	0.8353	0.8435	0.8592	0.8453
cv6	0.8092	0.8415	0.8093	0.8009	0.8391	0.8015
cv7	0.8312	0.8392	0.8317	0.8214	0.8376	0.8226
cv8	0.7868	0.8040	0.7872	0.7714	0.7792	0.7721
cv9	0.8018	0.8095	0.8021	0.8155	0.8202	0.8153
avg	0.8113	0.8250	0.8116	0.8084	0.8231	0.8089

testing:

accuracy: 0.8115384615384615

precision: 0.7997635825399532

recall: 0.8115384615384615

scaling: True
 kernel: poly
 n_components: 3
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9967	0.9968	0.9967	0.9972	0.9974	0.9973
cv1	0.9847	0.9860	0.9847	0.9901	0.9910	0.9900
cv2	0.9976	0.9976	0.9976	0.9915	0.9914	0.9915
cv3	0.9992	0.9992	0.9992	0.9972	0.9973	0.9972
cv4	0.9926	0.9929	0.9926	0.9886	0.9892	0.9886
cv5	0.9972	0.9972	0.9972	0.9929	0.9931	0.9929
cv6	0.9877	0.9883	0.9877	0.9829	0.9863	0.9829
cv7	0.9961	0.9961	0.9961	0.9986	0.9986	0.9986
cv8	0.9991	0.9991	0.9991	0.9986	0.9986	0.9986
cv9	0.9817	0.9846	0.9817	0.9800	0.9818	0.9801
avg	0.9933	0.9938	0.9933	0.9918	0.9925	0.9917

testing:

accuracy: 0.9961538461538462
 precision: 0.9961689291101055
 recall: 0.9961538461538461

scaling: True
 kernel: poly
 n_components: 2
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.7992	0.8098	0.7996	0.8041	0.8152	0.8049
cv1	0.8103	0.8159	0.8105	0.8153	0.8238	0.8159
cv2	0.8359	0.8387	0.8351	0.8267	0.8325	0.8254
cv3	0.8300	0.8345	0.8305	0.8111	0.8177	0.8116
cv4	0.8079	0.8184	0.8076	0.8026	0.8047	0.8020
cv5	0.8135	0.8064	0.8133	0.8037	0.7910	0.8036
cv6	0.7821	0.8033	0.7822	0.7980	0.8284	0.7989
cv7	0.8229	0.8190	0.8230	0.8343	0.8343	0.8351
cv8	0.8073	0.7959	0.8062	0.7957	0.7860	0.7945
cv9	0.8412	0.8444	0.8413	0.8512	0.8589	0.8509
avg	0.8150	0.8186	0.8149	0.8143	0.8193	0.8143

testing:

accuracy: 0.8415384615384616
 precision: 0.8507869947737253

recall: 0.8415384615384615

scaling: True
kernel: poly
n_components: 2
penalty C: 0.8
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.8075	0.8098	0.8080	0.8138	0.8169	0.8144
cv1	0.8007	0.8095	0.8011	0.8097	0.8285	0.8100
cv2	0.8223	0.8264	0.8225	0.8153	0.8229	0.8148
cv3	0.8078	0.8112	0.8085	0.7841	0.7875	0.7846
cv4	0.8360	0.8422	0.8361	0.8338	0.8326	0.8335
cv5	0.8053	0.8166	0.8045	0.8080	0.8251	0.8080
cv6	0.8127	0.8123	0.8125	0.8250	0.8292	0.8251
cv7	0.7740	0.7816	0.7771	0.7843	0.7936	0.7886
cv8	0.8626	0.8586	0.8625	0.8457	0.8306	0.8456
cv9	0.8358	0.8418	0.8359	0.8426	0.8462	0.8421
avg	0.8165	0.8210	0.8169	0.8162	0.8213	0.8167

testing:

accuracy: 0.8061538461538461
precision: 0.8041601924013182
recall: 0.8061538461538463

scaling: True
kernel: poly
n_components: 2
penalty C: 1.2
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.8408	0.8493	0.8411	0.8414	0.8524	0.8418
cv1	0.8348	0.8417	0.8349	0.8452	0.8578	0.8454
cv2	0.7983	0.8014	0.7986	0.8011	0.8101	0.8014
cv3	0.7826	0.7911	0.7831	0.7727	0.7827	0.7726
cv4	0.8207	0.8256	0.8204	0.8210	0.8141	0.8202
cv5	0.8211	0.8324	0.8216	0.8137	0.8248	0.8140
cv6	0.7859	0.7929	0.7856	0.7909	0.7962	0.7908
cv7	0.8164	0.8322	0.8176	0.8300	0.8523	0.8317
cv8	0.8166	0.8238	0.8153	0.8186	0.8214	0.8173
cv9	0.8399	0.8443	0.8399	0.8512	0.8623	0.8507
avg	0.8157	0.8235	0.8158	0.8186	0.8274	0.8186

testing:

accuracy: 0.833076923076923

precision: 0.8579800876584142

recall: 0.833076923076923

scaling: True

kernel: rbf

n_components: 1

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.6308	0.6394	0.6296	0.6386	0.6584	0.6384
cv1	0.6302	0.6383	0.6292	0.6335	0.6585	0.6318
cv2	0.6370	0.6491	0.6362	0.6193	0.6312	0.6169
cv3	0.6339	0.6458	0.6329	0.6222	0.5992	0.6213
cv4	0.6277	0.6338	0.6268	0.6491	0.6664	0.6479
cv5	0.6346	0.6449	0.6335	0.6074	0.6207	0.6064
cv6	0.6355	0.6434	0.6345	0.6202	0.6308	0.6194
cv7	0.6332	0.6441	0.6323	0.6386	0.6502	0.6382
cv8	0.6303	0.6371	0.6295	0.6386	0.6495	0.6374
cv9	0.6299	0.6337	0.6289	0.6223	0.6524	0.6226
avg	0.6323	0.6410	0.6313	0.6290	0.6417	0.6280

testing:

accuracy: 0.62

precision: 0.6215675599657847

recall: 0.6199999999999999

scaling: True

kernel: rbf

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9612	0.9615	0.9607	0.9531	0.9533	0.9526
cv1	0.9603	0.9603	0.9597	0.9574	0.9584	0.9569
cv2	0.9607	0.9610	0.9602	0.9545	0.9571	0.9539
cv3	0.9626	0.9625	0.9622	0.9489	0.9518	0.9481
cv4	0.9618	0.9619	0.9613	0.9531	0.9540	0.9526
cv5	0.9617	0.9619	0.9612	0.9559	0.9575	0.9556
cv6	0.9607	0.9608	0.9602	0.9545	0.9556	0.9540
cv7	0.9609	0.9614	0.9604	0.9500	0.9545	0.9500
cv8	0.9614	0.9614	0.9609	0.9529	0.9541	0.9520
cv9	0.9612	0.9614	0.9607	0.9628	0.9675	0.9622
avg	0.9613	0.9614	0.9608	0.9543	0.9564	0.9538

testing:

accuracy: 0.9507692307692308

precision: 0.952222243054072

recall: 0.9507692307692307

scaling: True

kernel: rbf

n_components: 3

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9965	0.9966	0.9965	0.9945	0.9946	0.9945
cv1	0.9968	0.9970	0.9968	0.9986	0.9986	0.9986
cv2	0.9970	0.9971	0.9970	0.9943	0.9948	0.9943
cv3	0.9968	0.9970	0.9968	0.9915	0.9930	0.9915
cv4	0.9962	0.9964	0.9962	1.0000	1.0000	1.0000
cv5	0.9970	0.9971	0.9970	0.9943	0.9948	0.9943
cv6	0.9965	0.9967	0.9965	0.9972	0.9973	0.9972
cv7	0.9965	0.9967	0.9965	0.9943	0.9945	0.9943
cv8	0.9967	0.9968	0.9967	0.9957	0.9960	0.9957
cv9	0.9962	0.9964	0.9962	0.9986	0.9986	0.9986
avg	0.9966	0.9968	0.9966	0.9959	0.9962	0.9959

testing:

accuracy: 0.9984615384615385

precision: 0.9985207100591715

recall: 0.9984615384615385

scaling: True

kernel: rbf

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9612	0.9615	0.9607	0.9531	0.9533	0.9526
cv1	0.9603	0.9603	0.9597	0.9574	0.9584	0.9569
cv2	0.9607	0.9610	0.9602	0.9545	0.9571	0.9539
cv3	0.9626	0.9625	0.9622	0.9489	0.9518	0.9481
cv4	0.9618	0.9619	0.9613	0.9531	0.9540	0.9526
cv5	0.9617	0.9619	0.9612	0.9559	0.9575	0.9556
cv6	0.9607	0.9608	0.9602	0.9545	0.9556	0.9540
cv7	0.9609	0.9614	0.9604	0.9500	0.9545	0.9500
cv8	0.9614	0.9614	0.9609	0.9529	0.9541	0.9520
cv9	0.9612	0.9614	0.9607	0.9628	0.9675	0.9622
avg	0.9613	0.9614	0.9608	0.9543	0.9564	0.9538

testing:

accuracy: 0.9507692307692308

precision: 0.952222243054072

recall: 0.9507692307692307

scaling: True

kernel: rbf

n_components: 2

penalty C: 0.8

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9611	0.9612	0.9606	0.9559	0.9563	0.9554
cv1	0.9595	0.9596	0.9590	0.9588	0.9598	0.9584
cv2	0.9603	0.9604	0.9598	0.9560	0.9589	0.9553
cv3	0.9615	0.9615	0.9611	0.9489	0.9518	0.9481
cv4	0.9604	0.9606	0.9599	0.9531	0.9540	0.9526
cv5	0.9609	0.9611	0.9604	0.9559	0.9575	0.9556
cv6	0.9595	0.9596	0.9590	0.9516	0.9525	0.9512
cv7	0.9593	0.9597	0.9588	0.9514	0.9556	0.9515
cv8	0.9601	0.9602	0.9597	0.9543	0.9556	0.9534
cv9	0.9600	0.9601	0.9595	0.9628	0.9675	0.9622
avg	0.9603	0.9604	0.9598	0.9549	0.9569	0.9544

testing:

accuracy: 0.9507692307692308

precision: 0.9518646123339944

recall: 0.9507692307692307

scaling: True
 kernel: rbf
 n_components: 2
 penalty C: 1.2
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9633	0.9636	0.9628	0.9545	0.9549	0.9539
cv1	0.9615	0.9617	0.9610	0.9574	0.9584	0.9569
cv2	0.9615	0.9619	0.9610	0.9545	0.9571	0.9539
cv3	0.9636	0.9635	0.9631	0.9474	0.9497	0.9467
cv4	0.9628	0.9629	0.9623	0.9531	0.9540	0.9526
cv5	0.9626	0.9629	0.9621	0.9573	0.9587	0.9570
cv6	0.9618	0.9619	0.9613	0.9559	0.9568	0.9555
cv7	0.9623	0.9628	0.9618	0.9529	0.9574	0.9529
cv8	0.9622	0.9622	0.9618	0.9514	0.9529	0.9506
cv9	0.9623	0.9626	0.9618	0.9642	0.9689	0.9636
avg	0.9624	0.9626	0.9619	0.9549	0.9569	0.9544

testing:

accuracy: 0.9492307692307692
 precision: 0.9509033212283261
 recall: 0.9492307692307692

scaling: True
 kernel: sigmoid
 n_components: 1
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.0426	0.0047	0.0385	0.0414	0.0046	0.0385
cv1	0.0426	0.0048	0.0386	0.0426	0.0047	0.0385
cv2	0.0426	0.0048	0.0386	0.0426	0.0047	0.0385
cv3	0.0426	0.0048	0.0386	0.0426	0.0047	0.0385
cv4	0.0424	0.0047	0.0385	0.0426	0.0047	0.0385
cv5	0.0424	0.0047	0.0385	0.0427	0.0047	0.0385
cv6	0.0426	0.0048	0.0386	0.0427	0.0047	0.0385
cv7	0.0427	0.0304	0.0388	0.0429	0.0048	0.0385
cv8	0.0425	0.0048	0.0386	0.0429	0.0048	0.0385
cv9	0.0427	0.0432	0.0386	0.0415	0.0046	0.0385
avg	0.0426	0.0112	0.0386	0.0424	0.0047	0.0385

testing:

accuracy: 0.038461538461538464
 precision: 0.004273504273504273

recall: 0.038461538461538464

scaling: True
kernel: sigmoid
n_components: 2
penalty C: 1.0
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.0960	0.0201	0.0906	0.1034	0.0224	0.0993
cv1	0.1009	0.0212	0.0955	0.1051	0.0224	0.0990
cv2	0.1093	0.0198	0.1034	0.1094	0.0191	0.1026
cv3	0.1162	0.0154	0.1103	0.1165	0.0155	0.1097
cv4	0.1096	0.0198	0.1037	0.1051	0.0186	0.0983
cv5	0.1023	0.0220	0.0967	0.0982	0.0206	0.0929
cv6	0.1089	0.0205	0.1030	0.1067	0.0201	0.1011
cv7	0.1016	0.0210	0.0963	0.1043	0.0221	0.0986
cv8	0.0949	0.0191	0.0897	0.0900	0.0183	0.0848
cv9	0.0958	0.0203	0.0905	0.0944	0.0187	0.0901
avg	0.1036	0.0199	0.0980	0.1033	0.0198	0.0976

testing:

accuracy: 0.09923076923076923
precision: 0.020424189568041526
recall: 0.09923076923076923

scaling: True
kernel: sigmoid
n_components: 3
penalty C: 1.0
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.1156	0.0160	0.1101	0.1159	0.0160	0.1115
cv1	0.1110	0.0537	0.1061	0.1080	0.0531	0.1027
cv2	0.1104	0.0152	0.1055	0.1151	0.0161	0.1090
cv3	0.1102	0.0176	0.1054	0.1122	0.0153	0.1064
cv4	0.1124	0.0540	0.1074	0.1165	0.0542	0.1104
cv5	0.1113	0.0538	0.1063	0.1053	0.0145	0.1013
cv6	0.1115	0.0538	0.1064	0.1095	0.0151	0.1051
cv7	0.1109	0.0153	0.1059	0.1157	0.0162	0.1103
cv8	0.1120	0.0156	0.1069	0.1114	0.0156	0.1064
cv9	0.1215	0.0163	0.1154	0.1202	0.0161	0.1154
avg	0.1127	0.0311	0.1075	0.1130	0.0232	0.1078

testing:

accuracy: 0.10307692307692308

precision: 0.014329310509224159

recall: 0.10307692307692308

scaling: True

kernel: sigmoid

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.0960	0.0201	0.0906	0.1034	0.0224	0.0993
cv1	0.1009	0.0212	0.0955	0.1051	0.0224	0.0990
cv2	0.1093	0.0198	0.1034	0.1094	0.0191	0.1026
cv3	0.1162	0.0154	0.1103	0.1165	0.0155	0.1097
cv4	0.1096	0.0198	0.1037	0.1051	0.0186	0.0983
cv5	0.1023	0.0220	0.0967	0.0982	0.0206	0.0929
cv6	0.1089	0.0205	0.1030	0.1067	0.0201	0.1011
cv7	0.1016	0.0210	0.0963	0.1043	0.0221	0.0986
cv8	0.0949	0.0191	0.0897	0.0900	0.0183	0.0848
cv9	0.0958	0.0203	0.0905	0.0944	0.0187	0.0901
avg	0.1036	0.0199	0.0980	0.1033	0.0198	0.0976

testing:

accuracy: 0.09923076923076923

precision: 0.020424189568041526

recall: 0.09923076923076923

scaling: True

kernel: sigmoid

n_components: 2

penalty C: 0.8

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.1106	0.0226	0.1045	0.1145	0.0238	0.1099
cv1	0.1104	0.0190	0.1045	0.1165	0.0206	0.1097
cv2	0.1090	0.0194	0.1031	0.1094	0.0188	0.1026
cv3	0.0962	0.0285	0.0903	0.0952	0.0283	0.0883
cv4	0.1097	0.0221	0.1039	0.1051	0.0210	0.0983
cv5	0.1110	0.0223	0.1050	0.1067	0.0213	0.1012
cv6	0.0966	0.0194	0.0913	0.0910	0.0188	0.0861
cv7	0.0983	0.0209	0.0931	0.1029	0.0220	0.0973
cv8	0.0974	0.0204	0.0921	0.0929	0.0190	0.0876
cv9	0.0991	0.0220	0.0938	0.0959	0.0197	0.0915
avg	0.1038	0.0217	0.0982	0.1030	0.0213	0.0972

testing:

accuracy: 0.10692307692307693

precision: 0.020953886971408955

recall: 0.10692307692307693

scaling: True

kernel: sigmoid

n_components: 2

penalty C: 1.2

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.1000	0.0206	0.0943	0.1034	0.0221	0.0993
cv1	0.0995	0.0209	0.0941	0.1037	0.0224	0.0976
cv2	0.1094	0.0200	0.1036	0.1094	0.0191	0.1026
cv3	0.1096	0.0188	0.1037	0.1122	0.0202	0.1054
cv4	0.1094	0.0199	0.1036	0.1051	0.0188	0.0983
cv5	0.1007	0.0218	0.0952	0.0953	0.0202	0.0902
cv6	0.1009	0.0198	0.0953	0.0939	0.0187	0.0888
cv7	0.1012	0.0209	0.0958	0.1043	0.0222	0.0986
cv8	0.0974	0.0197	0.0920	0.0943	0.0191	0.0888
cv9	0.0963	0.0206	0.0909	0.0987	0.0195	0.0942
avg	0.1024	0.0203	0.0969	0.1020	0.0202	0.0964

testing:

accuracy: 0.10615384615384615

precision: 0.01908017926044964

recall: 0.10615384615384614

scaling: False

kernel: linear

n_components: 1

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.3303	0.3052	0.3309	0.3352	0.2908	0.3354
cv1	0.3579	0.3090	0.3562	0.3580	0.2946	0.3566
cv2	0.4029	0.3364	0.4033	0.4034	0.3350	0.4040
cv3	0.3638	0.2866	0.3642	0.3551	0.2513	0.3564
cv4	0.3297	0.3268	0.3308	0.3196	0.3197	0.3205
cv5	0.3448	0.2597	0.3453	0.3556	0.2703	0.3562
cv6	0.3500	0.2978	0.3499	0.3627	0.3001	0.3625
cv7	0.3785	0.2921	0.3805	0.3686	0.2825	0.3700
cv8	0.2899	0.2657	0.2900	0.3143	0.2844	0.3147
cv9	0.3783	0.3099	0.3793	0.3734	0.2907	0.3741
avg	0.3526	0.2989	0.3530	0.3546	0.2919	0.3550

testing:

accuracy: 0.35846153846153844

precision: 0.3074284892923398

recall: 0.3584615384615384

scaling: False

kernel: linear

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.7067	0.6867	0.7043	0.7062	0.6880	0.7037
cv1	0.6578	0.6503	0.6579	0.6605	0.6402	0.6607
cv2	0.6170	0.5636	0.6184	0.6151	0.5743	0.6171
cv3	0.6946	0.6635	0.6936	0.6960	0.6660	0.6948
cv4	0.6563	0.6368	0.6571	0.6619	0.6184	0.6633
cv5	0.6819	0.6580	0.6812	0.6899	0.6734	0.6886
cv6	0.7030	0.6704	0.7019	0.6956	0.6543	0.6948
cv7	0.6562	0.6313	0.6568	0.6600	0.6309	0.6610
cv8	0.6510	0.6266	0.6515	0.6400	0.5883	0.6411
cv9	0.7180	0.7209	0.7179	0.7425	0.7392	0.7429
avg	0.6742	0.6508	0.6740	0.6768	0.6473	0.6768

testing:

accuracy: 0.6361538461538462

precision: 0.5591189403584431

recall: 0.6361538461538461

scaling: False
 kernel: linear
 n_components: 3
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9964	0.9965	0.9964	0.9959	0.9960	0.9959
cv1	0.9965	0.9967	0.9965	0.9957	0.9960	0.9957
cv2	0.9989	0.9989	0.9989	0.9957	0.9957	0.9957
cv3	0.9972	0.9973	0.9972	0.9957	0.9959	0.9957
cv4	0.9964	0.9966	0.9964	0.9972	0.9973	0.9972
cv5	0.9968	0.9970	0.9968	0.9943	0.9950	0.9943
cv6	0.9968	0.9970	0.9968	1.0000	1.0000	1.0000
cv7	0.9989	0.9989	0.9989	0.9957	0.9962	0.9957
cv8	0.9991	0.9991	0.9991	1.0000	1.0000	1.0000
cv9	0.9992	0.9992	0.9992	0.9986	0.9986	0.9986
avg	0.9976	0.9977	0.9976	0.9969	0.9971	0.9969

testing:

accuracy: 0.9930769230769231
 precision: 0.9932556332556334
 recall: 0.9930769230769231

scaling: False
 kernel: linear
 n_components: 2
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.7249	0.7163	0.7237	0.7159	0.7283	0.7145
cv1	0.6236	0.6300	0.6239	0.6250	0.5807	0.6253
cv2	0.7220	0.6964	0.7214	0.7244	0.7110	0.7241
cv3	0.6878	0.6780	0.6872	0.6619	0.5906	0.6607
cv4	0.6616	0.6594	0.6593	0.6577	0.6707	0.6556
cv5	0.7180	0.6953	0.7174	0.7183	0.6968	0.7187
cv6	0.7036	0.6980	0.7035	0.7127	0.6943	0.7127
cv7	0.6492	0.6281	0.6468	0.6443	0.6100	0.6415
cv8	0.6640	0.6548	0.6642	0.6643	0.6491	0.6647
cv9	0.7262	0.7305	0.7246	0.7396	0.7569	0.7383
avg	0.6881	0.6787	0.6872	0.6864	0.6688	0.6856

testing:

accuracy: 0.6684615384615384
 precision: 0.6318713814408081

recall: 0.6684615384615384

scaling: False
kernel: linear
n_components: 2
penalty C: 0.8
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.6673	0.6420	0.6671	0.6786	0.6479	0.6787
cv1	0.6980	0.6983	0.6980	0.7145	0.7169	0.7146
cv2	0.6588	0.6140	0.6596	0.6520	0.6125	0.6530
cv3	0.6411	0.6262	0.6413	0.6378	0.6065	0.6375
cv4	0.7274	0.6980	0.7263	0.7344	0.7140	0.7336
cv5	0.6615	0.6345	0.6613	0.6686	0.6361	0.6678
cv6	0.6658	0.6073	0.6639	0.6814	0.6173	0.6796
cv7	0.6235	0.6216	0.6249	0.6286	0.6047	0.6309
cv8	0.7093	0.6857	0.7084	0.7143	0.6749	0.7131
cv9	0.6609	0.6594	0.6618	0.6567	0.6635	0.6580
avg	0.6714	0.6487	0.6713	0.6767	0.6494	0.6767

testing:

accuracy: 0.6761538461538461

precision: 0.6460647174174807

recall: 0.6761538461538461

scaling: False
kernel: linear
n_components: 2
penalty C: 1.2
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.6662	0.6474	0.6659	0.6676	0.6521	0.6672
cv1	0.6807	0.6543	0.6800	0.6776	0.6490	0.6763
cv2	0.6820	0.6159	0.6822	0.6690	0.6058	0.6697
cv3	0.6984	0.6704	0.6983	0.6989	0.6764	0.6988
cv4	0.6835	0.6822	0.6829	0.6832	0.6665	0.6821
cv5	0.7121	0.6895	0.7118	0.7169	0.6943	0.7178
cv6	0.6837	0.6554	0.6828	0.7141	0.6768	0.7132
cv7	0.6555	0.6570	0.6548	0.6614	0.6568	0.6615
cv8	0.6956	0.6691	0.6945	0.6800	0.6512	0.6790
cv9	0.7151	0.7035	0.7143	0.7253	0.7193	0.7244
avg	0.6873	0.6645	0.6868	0.6894	0.6648	0.6890

testing:

accuracy: 0.713076923076923

precision: 0.6905633792753321

recall: 0.7130769230769229

scaling: False

kernel: poly

n_components: 1

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.2411	0.1975	0.2433	0.2483	0.2046	0.2507
cv1	0.3061	0.2727	0.3063	0.3182	0.2891	0.3191
cv2	0.3781	0.3029	0.3792	0.3935	0.3206	0.3952
cv3	0.2832	0.2085	0.2824	0.2656	0.1913	0.2653
cv4	0.3253	0.2563	0.3252	0.3054	0.2550	0.3047
cv5	0.2915	0.2824	0.2902	0.2859	0.2405	0.2854
cv6	0.2359	0.1736	0.2343	0.2347	0.1644	0.2330
cv7	0.2918	0.2394	0.2919	0.2986	0.2609	0.2980
cv8	0.2914	0.2850	0.2920	0.2943	0.2845	0.2948
cv9	0.4033	0.3253	0.4055	0.4177	0.3150	0.4207
avg	0.3048	0.2544	0.3050	0.3062	0.2526	0.3067

testing:

accuracy: 0.3384615384615385

precision: 0.29170432283461795

recall: 0.3384615384615384

scaling: False

kernel: poly

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.6531	0.6892	0.6522	0.6372	0.6483	0.6349
cv1	0.7274	0.7422	0.7264	0.7230	0.7382	0.7228
cv2	0.7376	0.7669	0.7382	0.7372	0.7710	0.7384
cv3	0.6856	0.7160	0.6831	0.6932	0.6851	0.6910
cv4	0.7114	0.7148	0.7118	0.7216	0.7169	0.7232
cv5	0.6945	0.6956	0.6937	0.6885	0.6824	0.6893
cv6	0.7135	0.7057	0.7124	0.6927	0.6847	0.6923
cv7	0.7452	0.7597	0.7439	0.7300	0.7466	0.7282
cv8	0.7290	0.7400	0.7287	0.7243	0.7383	0.7248
cv9	0.6868	0.7019	0.6866	0.6881	0.7047	0.6862
avg	0.7084	0.7232	0.7077	0.7036	0.7116	0.7031

testing:

accuracy: 0.7515384615384615

precision: 0.7651508745453987

recall: 0.7515384615384615

scaling: False

kernel: poly

n_components: 3

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9903	0.9920	0.9903	0.9945	0.9949	0.9945
cv1	0.9976	0.9978	0.9976	0.9957	0.9960	0.9957
cv2	0.9950	0.9955	0.9950	0.9901	0.9913	0.9900
cv3	0.9844	0.9871	0.9844	0.9844	0.9882	0.9843
cv4	0.9910	0.9924	0.9910	0.9872	0.9904	0.9872
cv5	0.9850	0.9882	0.9850	0.9815	0.9831	0.9815
cv6	0.9904	0.9920	0.9904	0.9929	0.9937	0.9929
cv7	0.9932	0.9942	0.9932	0.9914	0.9930	0.9915
cv8	0.9904	0.9920	0.9904	0.9900	0.9913	0.9900
cv9	0.9924	0.9937	0.9924	0.9943	0.9950	0.9943
avg	0.9910	0.9925	0.9910	0.9902	0.9917	0.9902

testing:

accuracy: 0.9776923076923076

precision: 0.9809743771423035

recall: 0.9776923076923077

scaling: False

kernel: poly

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.7042	0.7139	0.7029	0.6952	0.7077	0.6936
cv1	0.7460	0.7608	0.7453	0.7259	0.7469	0.7256
cv2	0.7179	0.7313	0.7169	0.7216	0.7317	0.7213
cv3	0.7148	0.7185	0.7134	0.7216	0.7392	0.7213
cv4	0.7307	0.7178	0.7309	0.7202	0.7013	0.7203
cv5	0.7407	0.7427	0.7405	0.7639	0.7688	0.7630
cv6	0.7224	0.7428	0.7226	0.6970	0.6796	0.6976
cv7	0.6294	0.6336	0.6287	0.6371	0.6466	0.6369
cv8	0.6861	0.7107	0.6858	0.7000	0.7036	0.7000
cv9	0.7151	0.7196	0.7163	0.6953	0.7128	0.6960
avg	0.7107	0.7192	0.7103	0.7078	0.7138	0.7076

testing:

accuracy: 0.7369230769230769

precision: 0.7334572416109674

recall: 0.7369230769230769

scaling: False

kernel: poly

n_components: 2

penalty C: 0.8

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.6893	0.7043	0.6882	0.6690	0.6763	0.6676
cv1	0.6610	0.6871	0.6606	0.6491	0.6320	0.6503
cv2	0.6790	0.7235	0.6784	0.6989	0.7203	0.7002
cv3	0.6955	0.7121	0.6962	0.6932	0.7314	0.6946
cv4	0.7146	0.7231	0.7159	0.7145	0.7288	0.7173
cv5	0.7173	0.7227	0.7159	0.7283	0.7333	0.7277
cv6	0.7454	0.7731	0.7441	0.7340	0.7615	0.7334
cv7	0.7499	0.7688	0.7484	0.7614	0.7922	0.7592
cv8	0.7223	0.7099	0.7221	0.7200	0.7222	0.7192
cv9	0.7452	0.7666	0.7452	0.7382	0.7615	0.7370
avg	0.7120	0.7291	0.7115	0.7107	0.7260	0.7107

testing:

accuracy: 0.7330769230769231

precision: 0.743602848408252

recall: 0.7330769230769231

scaling: False
 kernel: poly
 n_components: 2
 penalty C: 1.2
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.6714	0.6570	0.6719	0.6510	0.6143	0.6507
cv1	0.6939	0.7253	0.6924	0.7017	0.7017	0.7010
cv2	0.7485	0.7601	0.7495	0.7599	0.7742	0.7628
cv3	0.7039	0.6943	0.7024	0.6960	0.6918	0.6948
cv4	0.7458	0.7594	0.7467	0.7301	0.7312	0.7320
cv5	0.7473	0.7566	0.7466	0.7568	0.7692	0.7567
cv6	0.6981	0.7228	0.6966	0.7141	0.7290	0.7134
cv7	0.7509	0.7417	0.7502	0.7429	0.7387	0.7411
cv8	0.7414	0.7405	0.7422	0.7443	0.7443	0.7456
cv9	0.6769	0.6781	0.6746	0.6667	0.6553	0.6638
avg	0.7178	0.7236	0.7173	0.7163	0.7150	0.7162

testing:

accuracy: 0.6984615384615385
 precision: 0.7196540498668464
 recall: 0.6984615384615385

scaling: False
 kernel: rbf
 n_components: 1
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.6292	0.6362	0.6283	0.6014	0.6010	0.6006
cv1	0.6276	0.6353	0.6269	0.5994	0.5962	0.5986
cv2	0.6260	0.6345	0.6257	0.5980	0.6245	0.5984
cv3	0.6285	0.6350	0.6278	0.5795	0.6010	0.5785
cv4	0.6249	0.6344	0.6244	0.6293	0.6450	0.6289
cv5	0.6300	0.6363	0.6292	0.5804	0.5899	0.5799
cv6	0.6287	0.6341	0.6279	0.5889	0.5777	0.5885
cv7	0.6254	0.6324	0.6245	0.6000	0.5931	0.5983
cv8	0.6269	0.6359	0.6260	0.6157	0.6123	0.6141
cv9	0.6249	0.6323	0.6243	0.6037	0.6109	0.6038
avg	0.6272	0.6347	0.6265	0.5996	0.6052	0.5990

testing:

accuracy: 0.6053846153846154
 precision: 0.6120207538017818

recall: 0.6053846153846153

scaling: False
kernel: rbf
n_components: 2
penalty C: 1.0
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9820	0.9825	0.9823	0.9462	0.9569	0.9462
cv1	0.9828	0.9833	0.9831	0.9290	0.9506	0.9289
cv2	0.9841	0.9846	0.9844	0.9247	0.9433	0.9254
cv3	0.9817	0.9822	0.9820	0.9460	0.9631	0.9465
cv4	0.9817	0.9825	0.9821	0.9361	0.9504	0.9367
cv5	0.9834	0.9840	0.9837	0.9289	0.9477	0.9289
cv6	0.9828	0.9834	0.9831	0.9275	0.9424	0.9279
cv7	0.9838	0.9843	0.9840	0.9400	0.9510	0.9402
cv8	0.9822	0.9827	0.9825	0.9371	0.9555	0.9370
cv9	0.9822	0.9827	0.9824	0.9270	0.9492	0.9274
avg	0.9827	0.9832	0.9830	0.9343	0.9510	0.9345

testing:

accuracy: 0.9353846153846154
precision: 0.9527517007958797
recall: 0.9353846153846153

scaling: False
kernel: rbf
n_components: 3
penalty C: 1.0
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	1.0000	1.0000	1.0000	0.9393	0.9765	0.9389
cv1	1.0000	1.0000	1.0000	0.9361	0.9760	0.9358
cv2	1.0000	1.0000	1.0000	0.9375	0.9762	0.9374
cv3	1.0000	1.0000	1.0000	0.9403	0.9766	0.9404
cv4	1.0000	1.0000	1.0000	0.9446	0.9773	0.9448
cv5	1.0000	1.0000	1.0000	0.9474	0.9778	0.9471
cv6	1.0000	1.0000	1.0000	0.9388	0.9749	0.9387
cv7	1.0000	1.0000	1.0000	0.9386	0.9764	0.9388
cv8	1.0000	1.0000	1.0000	0.9214	0.9742	0.9205
cv9	1.0000	1.0000	1.0000	0.9328	0.9756	0.9325
avg	1.0000	1.0000	1.0000	0.9377	0.9761	0.9375

testing:

accuracy: 0.9261538461538461

precision: 0.9740469131949863

recall: 0.9261538461538462

scaling: False

kernel: rbf

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9820	0.9825	0.9823	0.9462	0.9569	0.9462
cv1	0.9828	0.9833	0.9831	0.9290	0.9506	0.9289
cv2	0.9841	0.9846	0.9844	0.9247	0.9433	0.9254
cv3	0.9817	0.9822	0.9820	0.9460	0.9631	0.9465
cv4	0.9817	0.9825	0.9821	0.9361	0.9504	0.9367
cv5	0.9834	0.9840	0.9837	0.9289	0.9477	0.9289
cv6	0.9828	0.9834	0.9831	0.9275	0.9424	0.9279
cv7	0.9838	0.9843	0.9840	0.9400	0.9510	0.9402
cv8	0.9822	0.9827	0.9825	0.9371	0.9555	0.9370
cv9	0.9822	0.9827	0.9824	0.9270	0.9492	0.9274
avg	0.9827	0.9832	0.9830	0.9343	0.9510	0.9345

testing:

accuracy: 0.9353846153846154

precision: 0.9527517007958797

recall: 0.9353846153846153

scaling: False

kernel: rbf

n_components: 2

penalty C: 0.8

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9813	0.9818	0.9817	0.9352	0.9515	0.9351
cv1	0.9819	0.9824	0.9821	0.9290	0.9503	0.9289
cv2	0.9833	0.9839	0.9835	0.9176	0.9392	0.9183
cv3	0.9811	0.9816	0.9814	0.9389	0.9607	0.9392
cv4	0.9816	0.9823	0.9819	0.9332	0.9493	0.9338
cv5	0.9825	0.9831	0.9827	0.9203	0.9468	0.9203
cv6	0.9825	0.9831	0.9828	0.9246	0.9415	0.9251
cv7	0.9833	0.9838	0.9836	0.9414	0.9527	0.9417
cv8	0.9817	0.9822	0.9820	0.9371	0.9555	0.9370
cv9	0.9822	0.9827	0.9824	0.9199	0.9474	0.9201
avg	0.9821	0.9827	0.9824	0.9297	0.9495	0.9299

testing:

accuracy: 0.9315384615384615

precision: 0.9533694691318334

recall: 0.9315384615384613

scaling: False

kernel: rbf

n_components: 2

penalty C: 1.2

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.9823	0.9828	0.9826	0.9517	0.9597	0.9517
cv1	0.9830	0.9835	0.9833	0.9276	0.9486	0.9275
cv2	0.9839	0.9844	0.9842	0.9276	0.9441	0.9282
cv3	0.9820	0.9825	0.9823	0.9517	0.9669	0.9522
cv4	0.9823	0.9831	0.9827	0.9361	0.9497	0.9367
cv5	0.9841	0.9847	0.9843	0.9331	0.9477	0.9332
cv6	0.9836	0.9842	0.9839	0.9289	0.9437	0.9294
cv7	0.9836	0.9842	0.9839	0.9443	0.9521	0.9447
cv8	0.9828	0.9833	0.9831	0.9386	0.9552	0.9382
cv9	0.9835	0.9840	0.9837	0.9313	0.9503	0.9316
avg	0.9831	0.9837	0.9834	0.9371	0.9518	0.9373

testing:

accuracy: 0.9353846153846154

precision: 0.9522207835832579

recall: 0.9353846153846153

scaling: False

kernel: sigmoid

n_components: 1

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.1016	0.0144	0.0965	0.0979	0.0129	0.0942
cv1	0.0904	0.0186	0.0859	0.0895	0.0201	0.0849
cv2	0.0995	0.0124	0.0947	0.0994	0.0129	0.0942
cv3	0.0974	0.0206	0.0927	0.0923	0.0189	0.0875
cv4	0.0730	0.0061	0.0676	0.0724	0.0060	0.0663
cv5	0.0993	0.0125	0.0944	0.1024	0.0130	0.0975
cv6	0.1022	0.0131	0.0971	0.0967	0.0118	0.0920
cv7	0.1004	0.0126	0.0955	0.1057	0.0135	0.1003
cv8	0.0990	0.0154	0.0941	0.0971	0.0149	0.0920
cv9	0.0896	0.0177	0.0852	0.0959	0.0229	0.0920
avg	0.0952	0.0143	0.0904	0.0949	0.0147	0.0901

testing:

accuracy: 0.09153846153846154

precision: 0.011873743937078919

recall: 0.09153846153846154

scaling: False

kernel: sigmoid

n_components: 2

penalty C: 1.0

cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.1213	0.0216	0.1152	0.1214	0.0221	0.1168
cv1	0.1197	0.0237	0.1138	0.1222	0.0183	0.1154
cv2	0.1208	0.0209	0.1149	0.1264	0.0284	0.1197
cv3	0.1198	0.0230	0.1140	0.1207	0.0226	0.1140
cv4	0.1214	0.0225	0.1155	0.1207	0.0179	0.1140
cv5	0.1216	0.0223	0.1155	0.1195	0.0154	0.1140
cv6	0.1206	0.0234	0.1146	0.1138	0.0181	0.1083
cv7	0.1231	0.0234	0.1171	0.1343	0.0279	0.1282
cv8	0.1201	0.0228	0.1141	0.1200	0.0194	0.1140
cv9	0.1043	0.0127	0.0982	0.1116	0.0200	0.1068
avg	0.1193	0.0216	0.1133	0.1211	0.0210	0.1151

testing:

accuracy: 0.11538461538461539

precision: 0.02337879758376726

recall: 0.11538461538461539

scaling: False
 kernel: sigmoid
 n_components: 3
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.0691	0.0449	0.0639	0.0690	0.0441	0.0652
cv1	0.0740	0.0442	0.0687	0.0781	0.0430	0.0719
cv2	0.0691	0.0452	0.0641	0.0696	0.0310	0.0640
cv3	0.0842	0.0442	0.0785	0.0824	0.0410	0.0759
cv4	0.0684	0.0436	0.0634	0.0753	0.0530	0.0695
cv5	0.0694	0.0444	0.0643	0.0669	0.0518	0.0619
cv6	0.0681	0.0417	0.0630	0.0626	0.0510	0.0577
cv7	0.0695	0.0444	0.0644	0.0657	0.0507	0.0606
cv8	0.0673	0.0400	0.0622	0.0629	0.0310	0.0577
cv9	0.0785	0.0669	0.0728	0.0730	0.0717	0.0688
avg	0.0717	0.0460	0.0665	0.0705	0.0468	0.0653

testing:

accuracy: 0.06384615384615384
 precision: 0.051095458758109356
 recall: 0.06384615384615386

scaling: False
 kernel: sigmoid
 n_components: 2
 penalty C: 1.0
 cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.1213	0.0216	0.1152	0.1214	0.0221	0.1168
cv1	0.1197	0.0237	0.1138	0.1222	0.0183	0.1154
cv2	0.1208	0.0209	0.1149	0.1264	0.0284	0.1197
cv3	0.1198	0.0230	0.1140	0.1207	0.0226	0.1140
cv4	0.1214	0.0225	0.1155	0.1207	0.0179	0.1140
cv5	0.1216	0.0223	0.1155	0.1195	0.0154	0.1140
cv6	0.1206	0.0234	0.1146	0.1138	0.0181	0.1083
cv7	0.1231	0.0234	0.1171	0.1343	0.0279	0.1282
cv8	0.1201	0.0228	0.1141	0.1200	0.0194	0.1140
cv9	0.1043	0.0127	0.0982	0.1116	0.0200	0.1068
avg	0.1193	0.0216	0.1133	0.1211	0.0210	0.1151

testing:

accuracy: 0.11538461538461539
 precision: 0.02337879758376726

recall: 0.11538461538461539

scaling: False
kernel: sigmoid
n_components: 2
penalty C: 0.8
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.1196	0.0226	0.1135	0.1228	0.0224	0.1181
cv1	0.1211	0.0210	0.1152	0.1222	0.0189	0.1154
cv2	0.1213	0.0155	0.1154	0.1222	0.0153	0.1154
cv3	0.1198	0.0230	0.1140	0.1207	0.0226	0.1140
cv4	0.1246	0.0243	0.1187	0.1179	0.0185	0.1111
cv5	0.1216	0.0223	0.1155	0.1195	0.0154	0.1140
cv6	0.1204	0.0219	0.1144	0.1138	0.0180	0.1083
cv7	0.1231	0.0234	0.1171	0.1343	0.0279	0.1282
cv8	0.1199	0.0212	0.1140	0.1200	0.0193	0.1140
cv9	0.1043	0.0127	0.0982	0.1116	0.0200	0.1068
avg	0.1196	0.0208	0.1136	0.1205	0.0198	0.1145

testing:

accuracy: 0.11846153846153847
precision: 0.020683483814309005
recall: 0.11846153846153847

scaling: False
kernel: sigmoid
n_components: 2
penalty C: 1.2
cross_validate: 10

cross validation result:

CV No.	Accuracy	Percision	Recall	Accuracy	Percision	Recall
Type	Train	Train	Train	Test	Test	Test
cv0	0.1213	0.0216	0.1152	0.1214	0.0221	0.1168
cv1	0.1198	0.0232	0.1140	0.1222	0.0180	0.1154
cv2	0.1194	0.0223	0.1135	0.1250	0.0279	0.1182
cv3	0.1198	0.0230	0.1140	0.1207	0.0226	0.1140
cv4	0.1206	0.0236	0.1148	0.1136	0.0162	0.1068
cv5	0.1216	0.0224	0.1155	0.1195	0.0154	0.1140
cv6	0.1206	0.0235	0.1146	0.1138	0.0179	0.1083
cv7	0.1242	0.0239	0.1182	0.1343	0.0267	0.1282
cv8	0.1201	0.0228	0.1141	0.1200	0.0194	0.1140
cv9	0.1043	0.0127	0.0982	0.1116	0.0200	0.1068
avg	0.1192	0.0219	0.1132	0.1202	0.0206	0.1142

testing:

accuracy: 0.11538461538461539

precision: 0.02338656740317801

recall: 0.11538461538461539

- Description of your observations

由上述眾多結果中可以觀察到，kernel若使用rbf則效果最好，poly及linear次之，而sigmoid的效果最差，而在n_components的參數上，分別以1、2、3下去跑，結果可以看到n_components越高，則效果越好，penalty C的參數則沒有較明顯的趨勢，須依據不同模型選擇不同的參數值，若有做scaling，結果也會較沒有scaling的來得更好。

2. Proof the jointly optimization result (20%):

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3. $\frac{\partial L_D}{\partial \alpha_2} = -s + 1 + sk_{11}(r - s\alpha_2) - k_{22}\alpha_2 + k_{12}\alpha_2 - sk_{12}(r - s\alpha_2) + y^{(2)}(v - v_2) = 0$

$$\Rightarrow \alpha_2(-s^2k_{11} - k_{22} + k_{12} + s^2k_{12}) = s - 1 - y^{(2)}(v_1 - v_2) + sk_{11}r - sk_{12}r$$
$$\Rightarrow \alpha_2 \stackrel{(new)}{=} \underline{\alpha_2} \stackrel{(old)}{=} \underline{\alpha_2}$$
$$E_1 - E_2 = (w \cdot x_1 + b) - y_1 - w \cdot x_2 - b + y_2$$
$$= w \cdot (x_1 - x_2) - y_1 + y_2 = \sum_{i=1}^n \alpha_i y_i x_i (x_1 - x_2) - y_1 + y_2$$
$$= \sum_{i=1}^n \alpha_i y_i k_{i1} - \sum_{i=1}^n x_i y_i k_{i2} - y_1 + y_2$$
$$= \alpha_1 y_1 k_{11} + \alpha_2 y_2 k_{22} + v_1 - \alpha_1 y_1 k_{12} - \alpha_2 y_2 k_{21} - v_2 - y_1 + y_2$$
$$= y_1 k_{11} (r - s\alpha_2) - (r - s\alpha_2) y_1 k_{12} + \alpha_2 y_2 k_{12} - \alpha_2 y_2 k_{22} + v_1 - v_2 - y_1 + y_2 \quad \text{--- ②}$$
$$\textcircled{2} \times y_2 \Rightarrow y_2(E_1 - E_2) = sk_{11}(r - s\alpha_2) - sk_{12}(r - s\alpha_2) + \alpha_2 k_{12} - \alpha_2 k_{22} + y_2(v_1 - v_2) - s + 1$$
$$\Rightarrow y_2(E_1 - E_2) = \frac{\partial L_D}{\partial \alpha_2} = y \alpha_2^{(old)}$$
$$\Rightarrow \underline{\alpha_2} = y \alpha_2^{(old)} - y_2(E_1 - E_2)$$
$$\alpha_2^{(new)} \cdot y = y \alpha_2^{(old)} - y_2(E_1 - E_2) \Rightarrow \alpha_2^{(new)} = \underline{\alpha_2} - \frac{y_2(E_1 - E_2)}{y}$$