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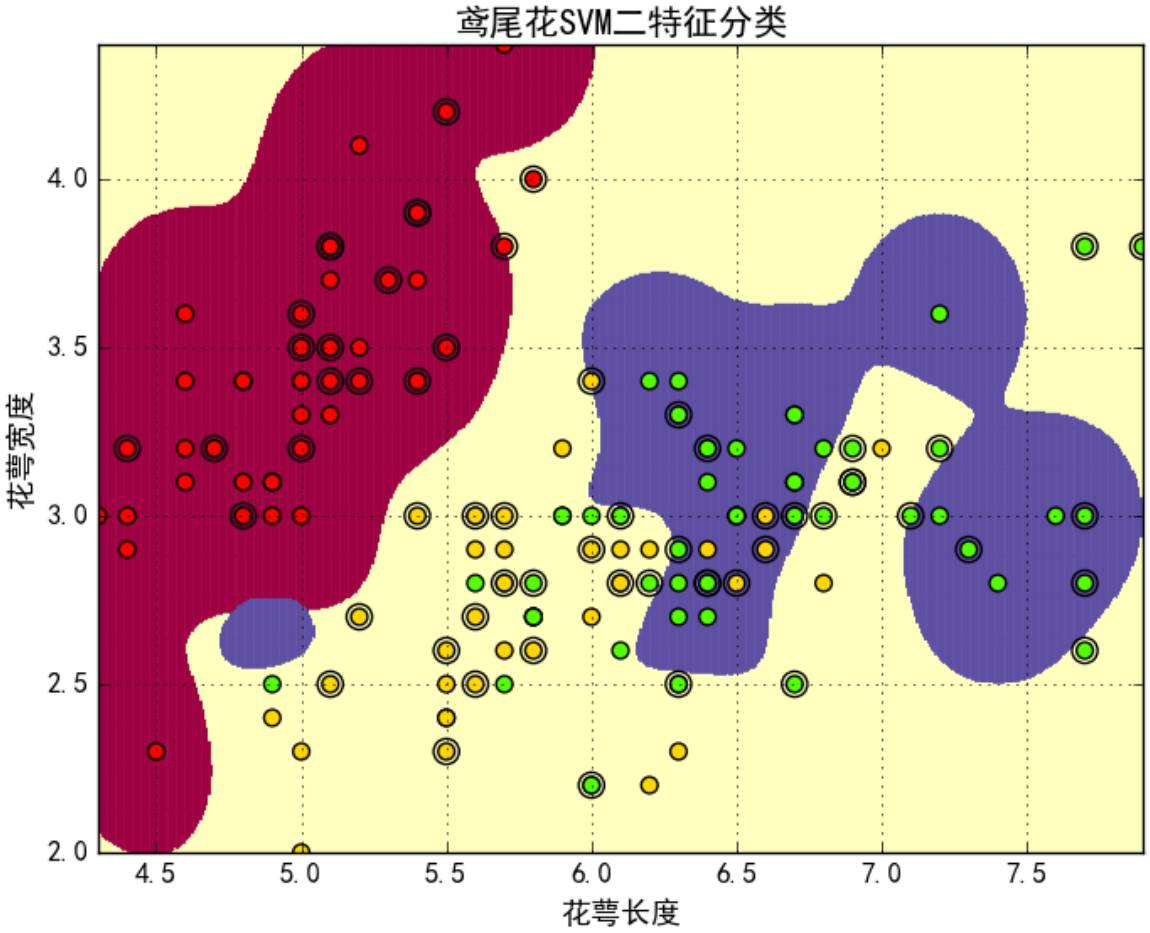
支持向量机实践

邹博

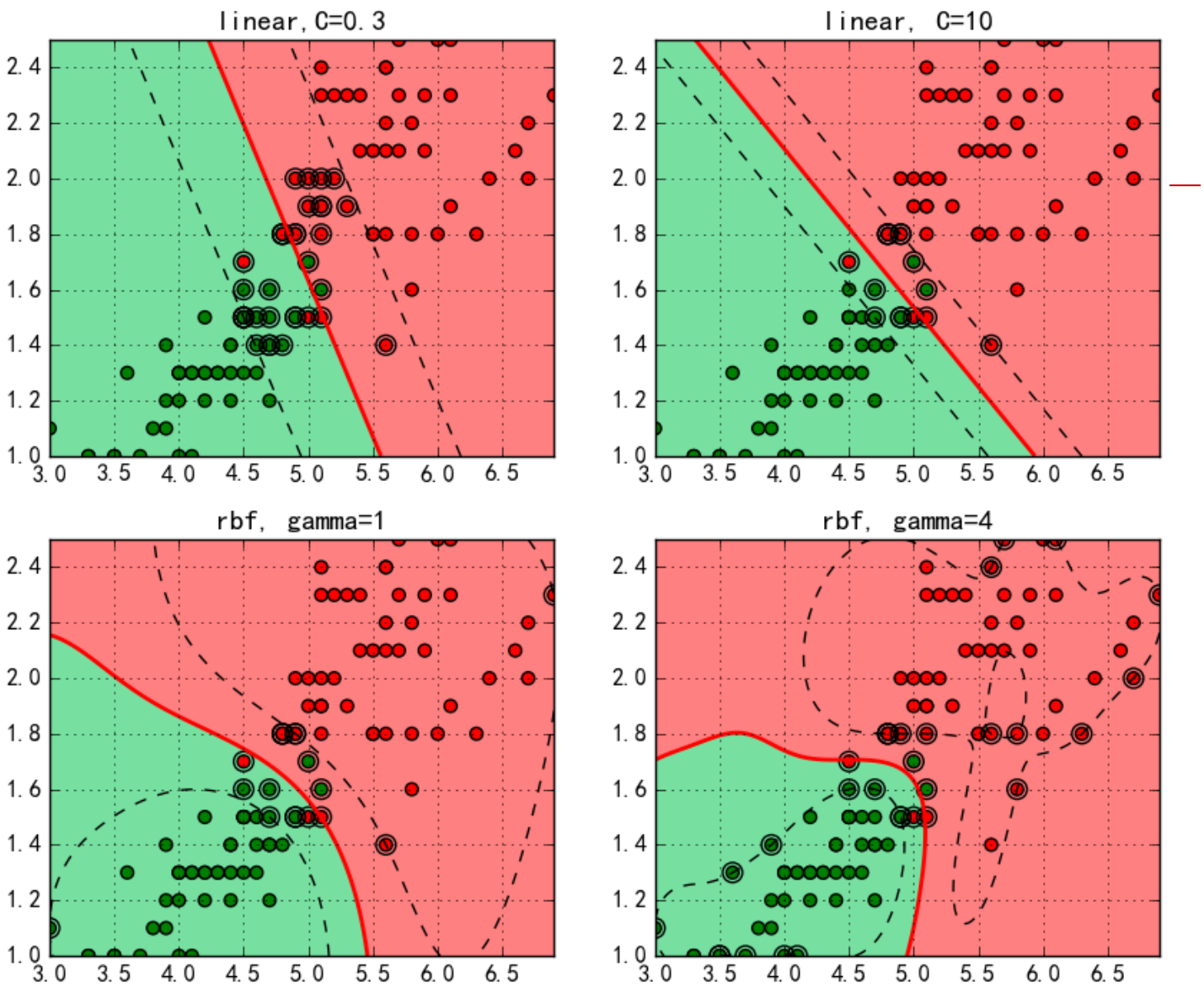
主要内容

- SVM包的使用
- SVM的调参
- 不平衡数据的处理
- SVM用于手写体数字分类
- 支持向量回归：SVR

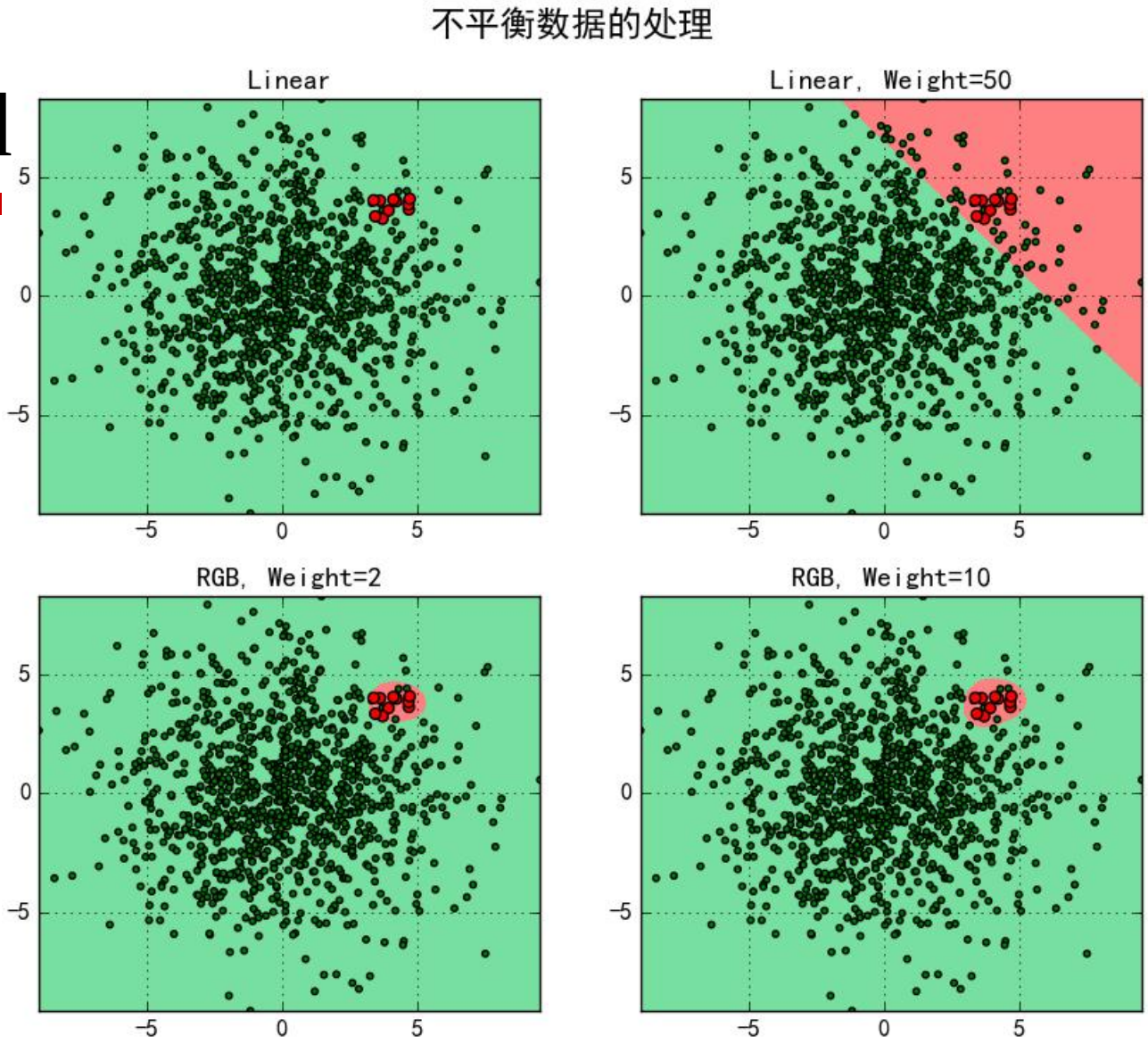
SVM分类



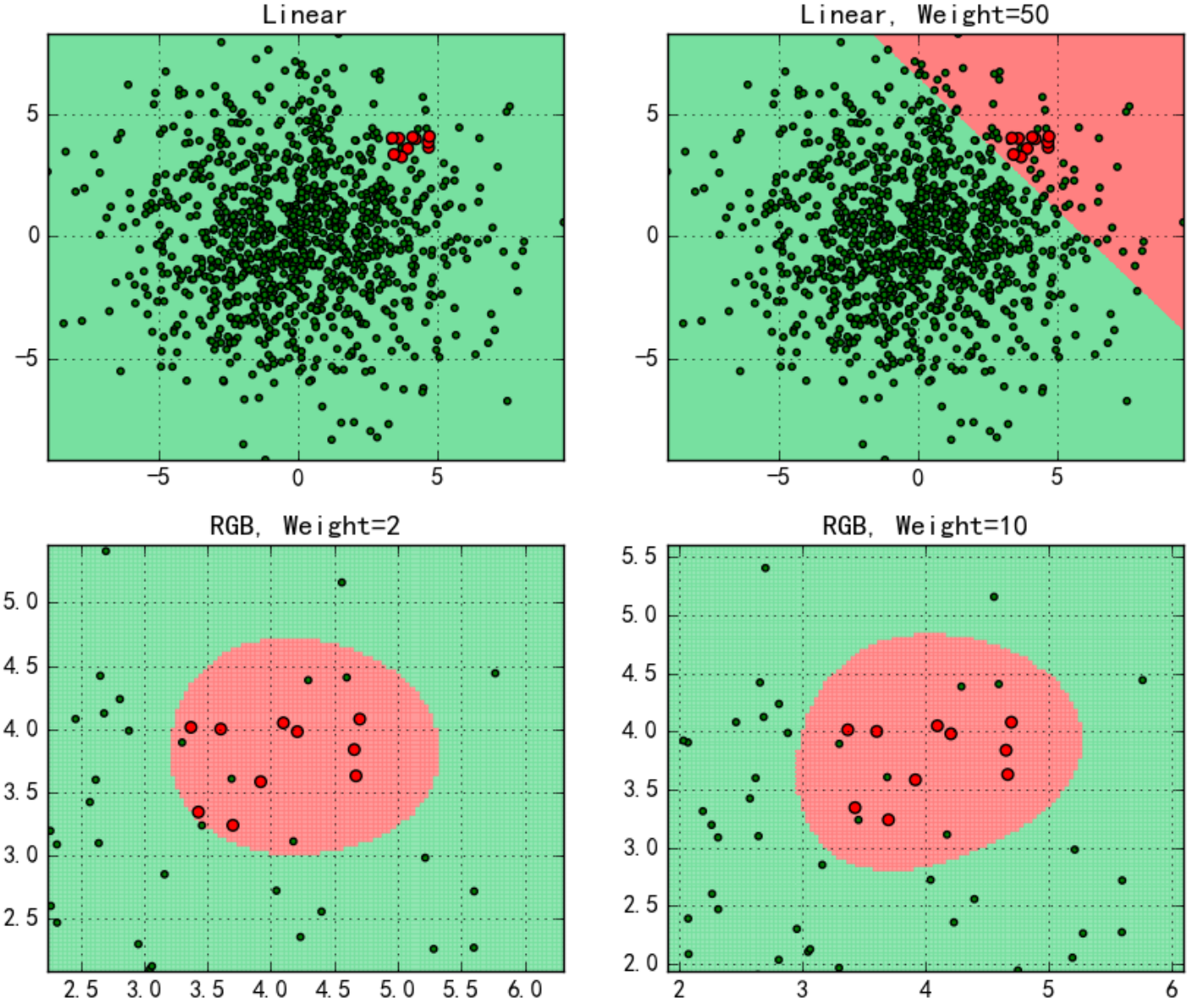
调参



Unbalanced


不平衡数据的处理
Linear
Linear, Weight=50
RGB, Weight=2
RGB, Weight=10
5
0
−5
−5
0
5

放大

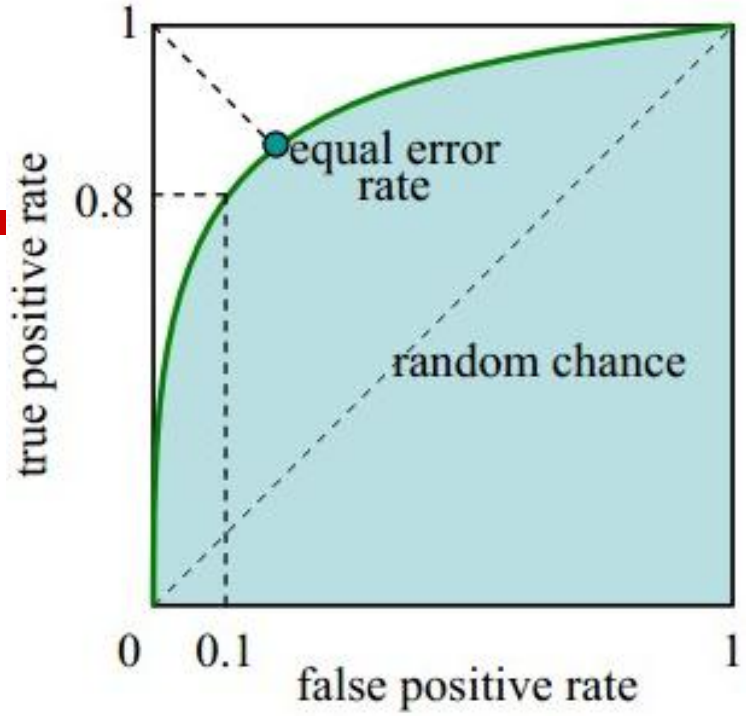


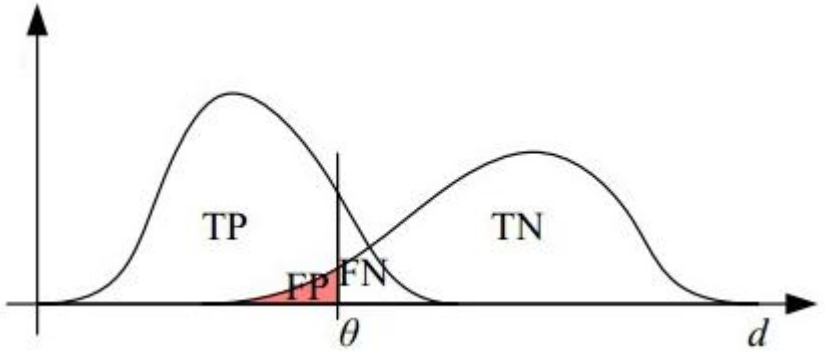
复习：AUC

实际值 \ 预测值	Positive	Negtive
正	TP	FN
负	FP	TN

$$TPR = \frac{TP}{TP + FN}$$

$$FPR = \frac{FP}{FP + TN}$$





Receiver Operating Characteristic

Area Under Curve

分类器指标

$$accuracy = \frac{TP + TN}{TP + TN + FN + FP}$$

$$precision = \frac{TP}{TP + FP}$$

$$recall = \frac{TP}{TP + FN}$$

$$F_1 = \frac{2 \cdot precision \cdot recall}{precision + recall}$$

$$F_\beta = \frac{(1 + \beta^2) \cdot precision \cdot recall}{\beta^2 \cdot precision + recall}$$

预测值 / 实际值	Positive	Negtive
正	TP	FN
负	FP	TN

计算

$$accuracy = \frac{TP + TN}{TP + TN + FN + FP}$$

$$precision = \frac{TP}{TP + FP}$$

$$recall = \frac{TP}{TP + FN}$$

$$F_1 = \frac{2 \cdot precision \cdot recall}{precision + recall}$$

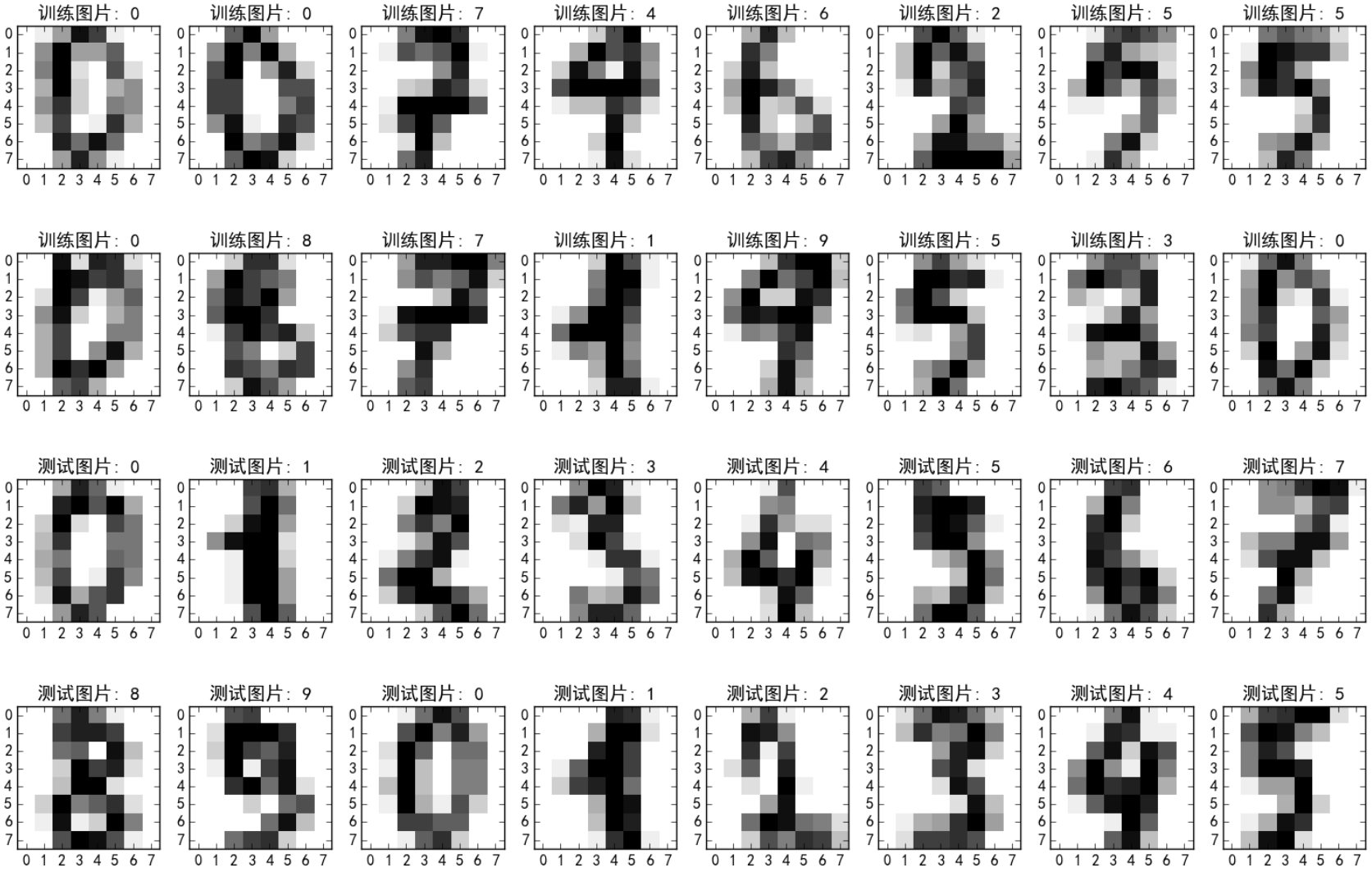
$$F_\beta = \frac{(1 + \beta^2) \cdot precision \cdot recall}{\beta^2 \cdot precision + recall}$$

```
y_true = np.array([1, 1, 1, 1, 0, 0])
y_hat  = np.array([1, 0, 1, 1, 1, 1])
```

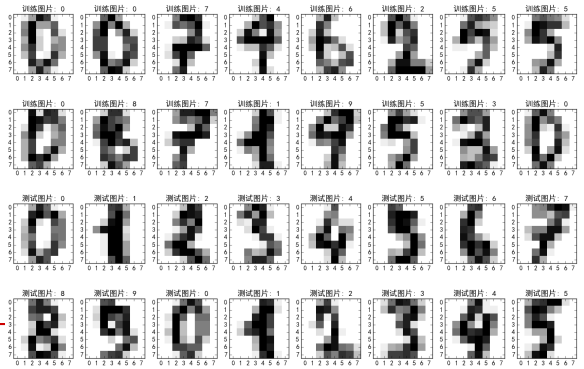
ClassifierIndex

```
Accuracy:   0.5
Precision:  0.6
Recall:     0.75
f1 score:   0.666666666667
F-beta:
    beta=    0.001  F-beta=0.60000
    beta=    0.010  F-beta=0.60001
    beta=    0.100  F-beta=0.60119
    beta=    1.000  F-beta=0.66667
    beta=   10.000  F-beta=0.74815
    beta=  100.000  F-beta=0.74998
    beta= 1000.000  F-beta=0.75000
```

SVM用于手写图片识别

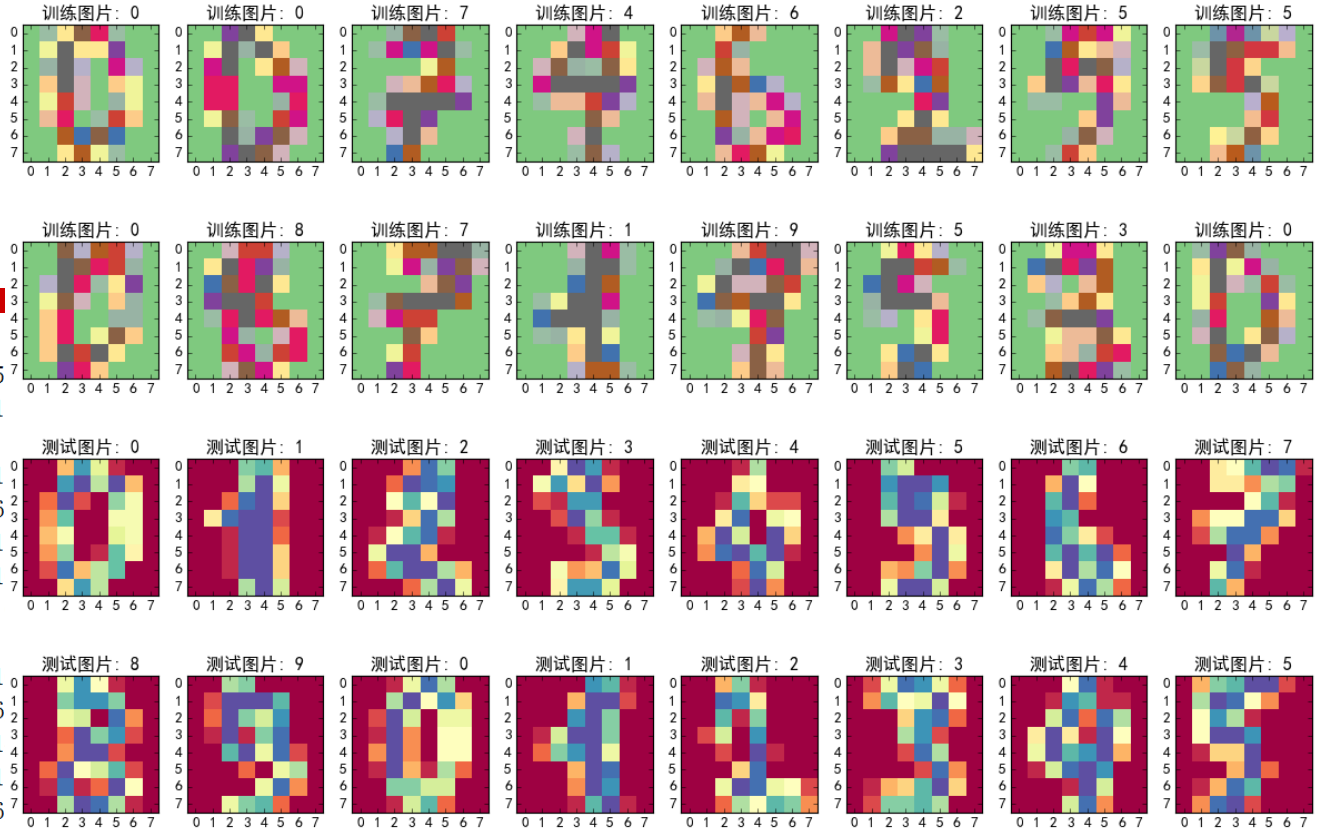


数据描述



- 该数据来自于43人的手写数字，其中30人用于训练，13人用于测试，训练集共3823个图片，测试集共1797个图片，每个图片为8×8的灰度图像，像素值从0到16，其中，16代表全黑，0代表全亮(与通常的像素亮度习惯正好相反)
- 该数据的下载地址为：
  - http://archive.ics.uci.edu/ml/datasets/Optical+Recognition+of+Handwritten+Digits

数据存取



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0, 0, 0, 4, 15, 12, 0, 0, 0, 0, 3, 16, 15, 14, 0, 0, 0, 0, 8,
0, 0, 7, 15, 13, 1, 0, 0, 0, 8, 13, 6, 15, 4, 0, 0, 0, 2, 1, 1
0, 0, 0, 1, 11, 0, 0, 0, 0, 0, 0, 7, 8, 0, 0, 0, 0, 0, 1, 13, 6
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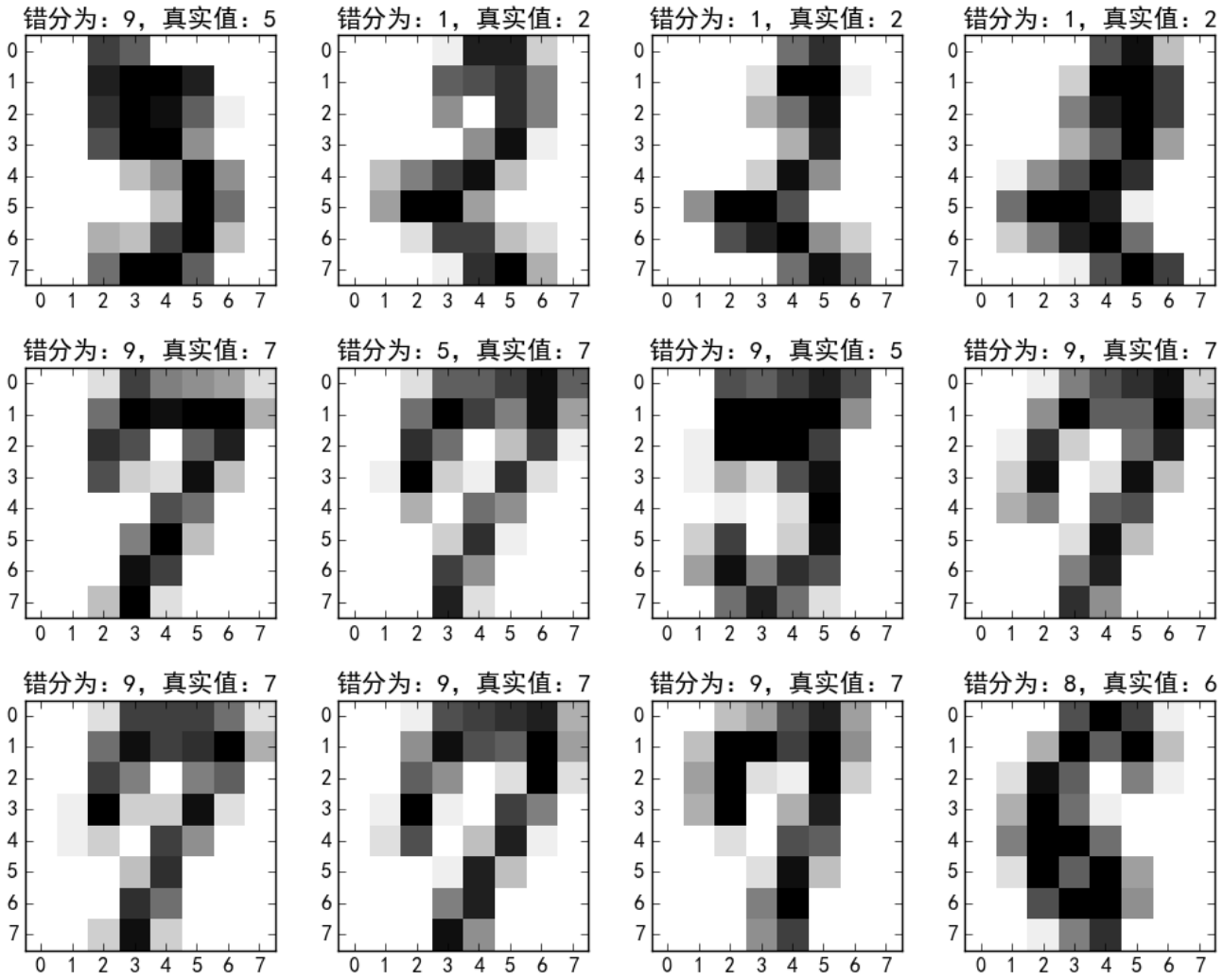
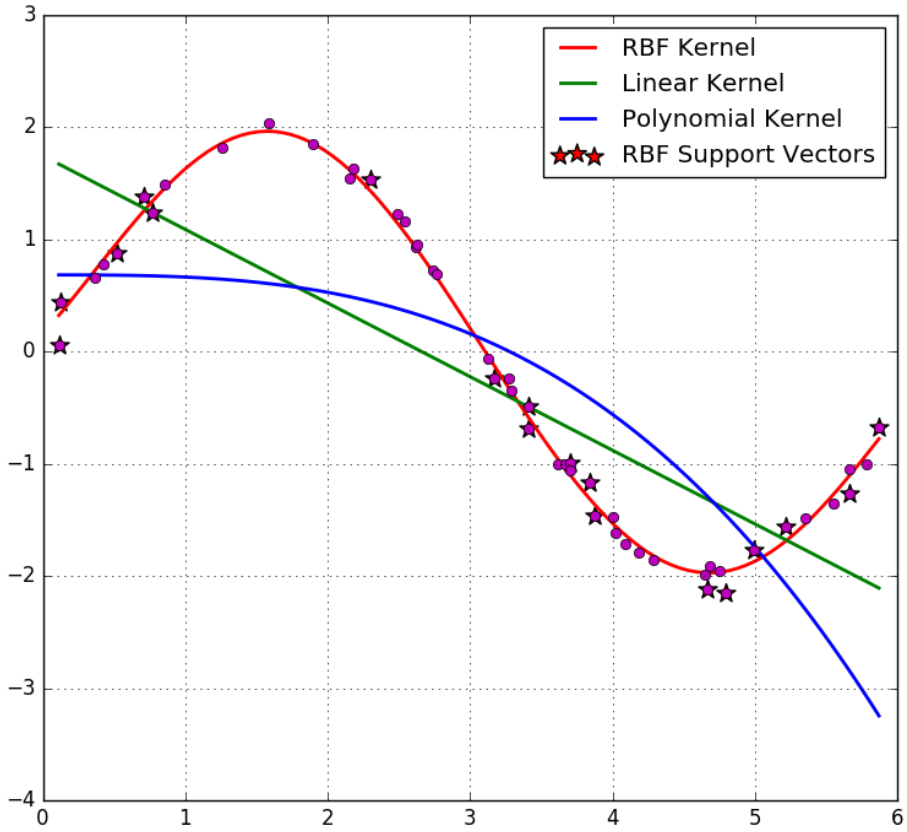
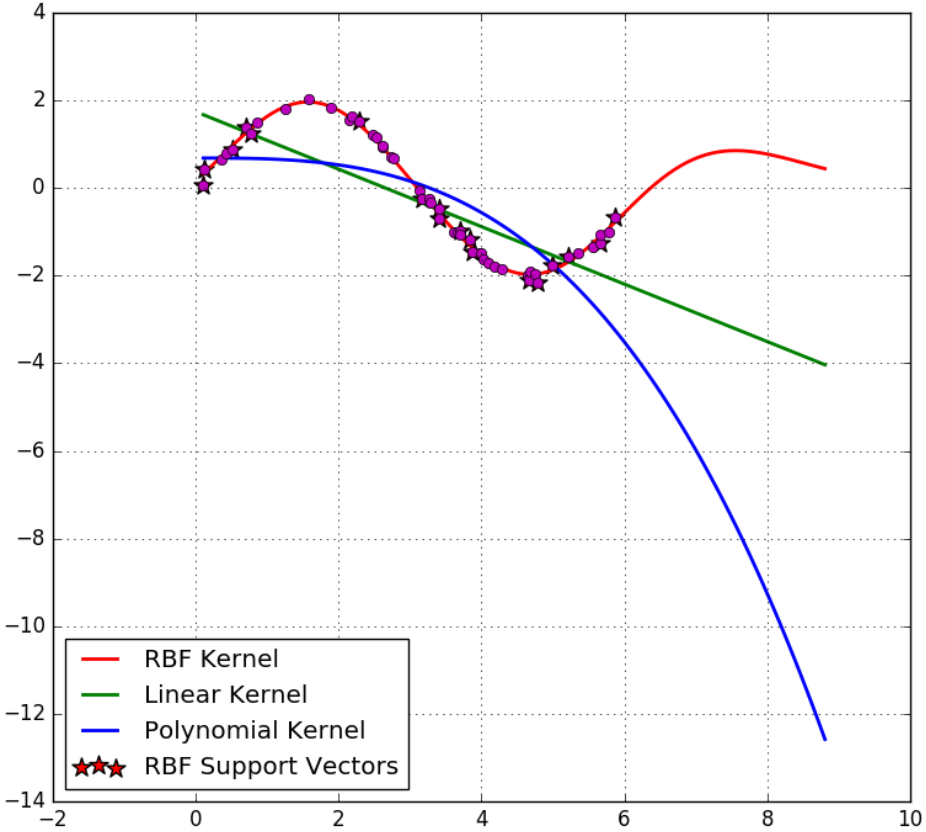
0, 0, 0, 0, 12, 2, 0, 0, 0, 0, 0, 6, 14, 1, 0, 0, 0, 0, 4, 16, 7, 8, 0, 0, 0, 0, 13, 9, 0, 16, 6, 0, 0, 6, 16, 10, 11, 16, 0, 0, 0, 0, 5, 10, 13, 16, 0, 0, 0, 0, 0, 0, 6, 16, 0, 0, 0, 0, 0, 0, 12, 8, 0, 0, 4

训练测试正确率：99.82% - 98.27%



SVR – 预测


RBF Kernel
Linear Kernel
Polynomial Kernel
RBF Support Vectors


RBF Kernel
Linear Kernel
Polynomial Kernel
RBF Support Vectors

Demo

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