In [1]:

```
#打开数据集
import numpy as np
import scipy.io as scio
import matplotlib as mpl
import matplotlib.pyplot as plt

file_path ="C:/Users/70951/Desktop/mnist-original.mat"
mnist = scio.loadmat(file_path)
mnist.keys()

#数据整理
X, y = mnist["data"], mnist["label"]
X = X.transpose()
X.shape
y = y.transpose()
y.shape
y = y.astype(np.uint8)
X_train, X_test, y_train, y_test = X[:60000], X[60000:], y[:60000], y[60000:]
y_train=y_train.ravel()
y_test=y_test.ravel()
```

In [8]:

```
# 随机森林模型

from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import cross_val_score
from sklearn.model_selection import cross_val_predict
from sklearn.metrics import confusion_matrix
from sklearn.metrics import ConfusionMatrixDisplay
forest_clf = RandomForestClassifier(n_estimators=100, max_leaf_nodes=180, random_state=405)
forest_clf.fit(X_train, y_train)
```

Out[8]:

```
RandomForestClassifier(bootstrap=True, ccp_alpha=0.0, class_weight=None,
                       criterion='gini', max_depth=None, max_features='auto',
                       max_leaf_nodes=180, max_samples=None,
                       min_impurity_decrease=0.0, min_impurity_split=None,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, n_estimators=100,
                       n_jobs=None, oob_score=False, random_state=405,
                       verbose=0, warm_start=False)
```

In [9]:

```
#验证
cross_val_score(forest_clf, X_train, y_train, cv=3, scoring="accuracy")# 每一次验证的正确概率输出
```

Out[9]:

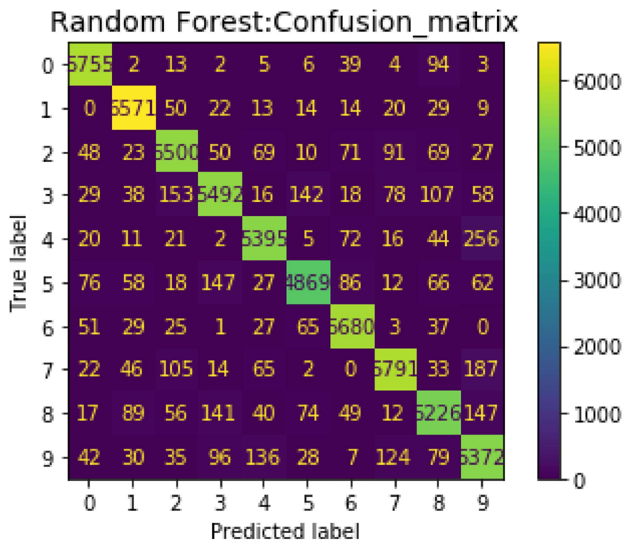
```
array([0.9289 , 0.92275, 0.9309 ])
```

In [10]:

```
y_train_pred = cross_val_predict(forest_clf, X_train, y_train, cv=3) #使用交叉验证输出预测值
conf_mx = confusion_matrix(y_train, y_train_pred)
conf_mx_display = ConfusionMatrixDisplay(conf_mx, display_labels='0123456789')
conf_mx_display.plot(values_format='.4g')
plt.title("Random Forest:Confusion_matrix", fontsize=14)
```

Out[10]:

```
Text(0.5, 1.0, 'Random Forest:Confusion_matrix')
```



In [11]:

```
#Grid寻优
from sklearn.model_selection import GridSearchCV
param_grid = [{'n_estimators': [10, 50, 100], 'max_leaf_nodes': [20, 60, 100, 140, 180]}]
forest_clf = RandomForestClassifier(random_state=405)
grid_search = GridSearchCV(forest_clf, param_grid, cv=3, verbose=3, scoring='roc_auc_ovo')
grid_search.fit(X_train, y_train.ravel())
```

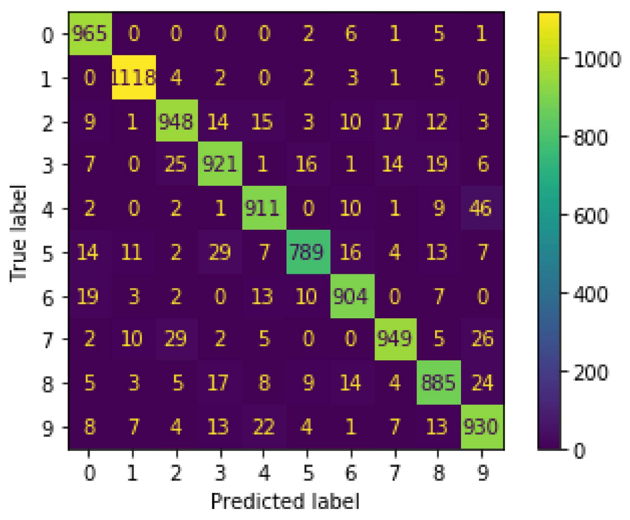
```
Fitting 3 folds for each of 15 candidates, totalling 45 fits
[CV] max_leaf_nodes=20, n_estimators=10 .............................

[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.

[CV] .. max_leaf_nodes=20, n_estimators=10, score=0.965, total=   1.9s
[CV] max_leaf_nodes=20, n_estimators=10 .............................

[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    1.8s remaining:    0.0s

[CV] .. max_leaf_nodes=20, n_estimators=10, score=0.968, total=   1.4s
[CV] max_leaf_nodes=20, n_estimators=10 .............................

[Parallel(n_jobs=1)]: Done   2 out of   2 | elapsed:    3.2s remaining:    0.0s
```

In [15]:

```
#验证测试集
forest_clf = RandomForestClassifier(n_estimators=100, max_leaf_nodes=180, random_state=405)
forest_clf.fit(X_train, y_train)
y_test_pred = forest_clf.predict(X_test)
conf_mx = confusion_matrix(y_test, y_test_pred)
conf_mx_display = ConfusionMatrixDisplay(conf_mx, display_labels='0123456789')
conf_mx_display.plot(values_format='.4g')
```

Out[15]:

```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x1bc5a280f08>
```



In [ ]:

```

```