In [1]:

```
# selecting best algorithm and hyper parameter tuning for digits dataset
from sklearn.datasets import load_digits
digits = load_digits()
dir(digits)
```

Out[1]:

```
['DESCR', 'data', 'images', 'target', 'target_names']
```

In [2]:

```
# importing all the models that need to be tested
from sklearn.svm import SVC
from sklearn.ensemble import RandomForestClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.naive_bayes import GaussianNB
from sklearn.naive_bayes import MultinomialNB
from sklearn.tree import DecisionTreeClassifier
```

In [5]:

```
model_params = {'svm':{
                'model':SVC(gamma = 'auto'),
                 'params':{
                           'C':[1,10,20],
                          'kernel':['linear', 'rbf', 'sigmoid']}
},
                'random_forest':{
                'model':RandomForestClassifier(),
                'params':{
                        'n_estimators':[10,20,30],
                        'criterion':['gini','entropy']}
                },
                'logistic_regression':{
                    'model':LogisticRegression(),
                    'params':{
                      'C':[1,10,20]}
                },
                'GaussianNB':{
                    'model':GaussianNB(),
                    'params':{
                      'var_smoothing':[1*(10**-9), 1*(10**-10)]}
                },
                'MultinomialNB':{
                    'model':MultinomialNB(),
                    'params': {
                        'alpha':[1,2,3]}
                },
                'DecisionTree':{
                    'model':DecisionTreeClassifier(),
                    'params':{
                        'criterion':['gini','entropy']}
                }}
```

In [9]:

```
# importing GridSearchCV for hyper parameter tuning
from sklearn.model_selection import GridSearchCV
scores = []
for model,mod_param in model_params.items():
    clf = GridSearchCV(mod_param['model'], mod_param['params'], cv = 5, return_train_sco
re = False)
    clf.fit(digits.data, digits.target)
    scores.append({
        'model':model,
        'best_parameter':clf.best_params_,
```

```
        'best_score':clf.best_score_
    })
scores
```

```
c:\users\dell\appdata\local\programs\python\python36\lib\site-packages\sklearn\linear_mod
el\_logistic.py:939: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html.
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG)
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```
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    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
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    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
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```

```
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  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG)
```

Out[9]:

```
[{'model': 'svm',
  'best_parameter': {'C': 1, 'kernel': 'linear'},
  'best_score': 0.9476973073351903},
 {'model': 'random_forest',
  'best_parameter': {'criterion': 'entropy', 'n_estimators': 30},
  'best_score': 0.93491643454039},
 {'model': 'logistic_regression',
  'best_parameter': {'C': 1},
  'best_score': 0.9137650882079852},
 {'model': 'GaussianNB',
  'best_parameter': {'var_smoothing': 1e-09},
  'best_score': 0.8069281956050759},
 {'model': 'MultinomialNB',
  'best_parameter': {'alpha': 3},
  'best_score': 0.8720210461157537},
 {'model': 'DecisionTree',
  'best_parameter': {'criterion': 'entropy'},
  'best_score': 0.8169405756731661}]
```

In [11]:

```
import pandas as pd
pd.DataFrame(data = scores)
```

Out[11]:

	model	best_parameter	best_score
0	svm	{'C': 1, 'kernel': 'linear'}	0.947697
1	random_forest	{'criterion': 'entropy', 'n_estimators': 30}	0.934916
2	logistic_regression	{'C': 1}	0.913765
3	GaussianNB	{'var_smoothing': 1e-09}	0.806928
4	MultinomialNB	{'alpha': 3}	0.872021
5	DecisionTree	{'criterion': 'entropy'}	0.816941

So we can say that SVM with C = 1 and kernel = linear is the best algorith and hyper parameters for our digits dataset