IN-STK5000 Reproducibility assignment

```
import handout # Tool for generating report-type documents
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
```

Load the dataset and do label-encoder preprocessing to put all variables on a number format.

```
features = ["Buying", "Maintenaince", "Doors", "Persons", "Luggage", "Safety"]
target = 'Class'
df = pd.read_csv(
'https://archive.ics.uci.edu/ml/machine-learning-databases/car/car.data',
names=features + [target])
```

```
  Buying Maintenaince Doors Persons Luggage Safety  Class
0  vhigh        vhigh     2       2   small    low  unacc
1  vhigh        vhigh     2       2   small    med  unacc
2  vhigh        vhigh     2       2   small   high  unacc
3  vhigh        vhigh     2       2     med    low  unacc
4  vhigh        vhigh     2       2     med    med  unacc
```

Some setup code for the KNN classifier, data encoding, splitting and scaling:

```
from sklearn import preprocessing
le = preprocessing.LabelEncoder()

# convert the categorical columns into numeric (= all columns)
df = df.apply(le.fit_transform)
```

```
   Buying  Maintenaince  Doors  Persons  Luggage  Safety  Class
0       3             3      0        0        2       1      2
1       3             3      0        0        2       2      2
2       3             3      0        0        2       0      2
3       3             3      0        0        1       1      2
4       3             3      0        0        1       2      2
```

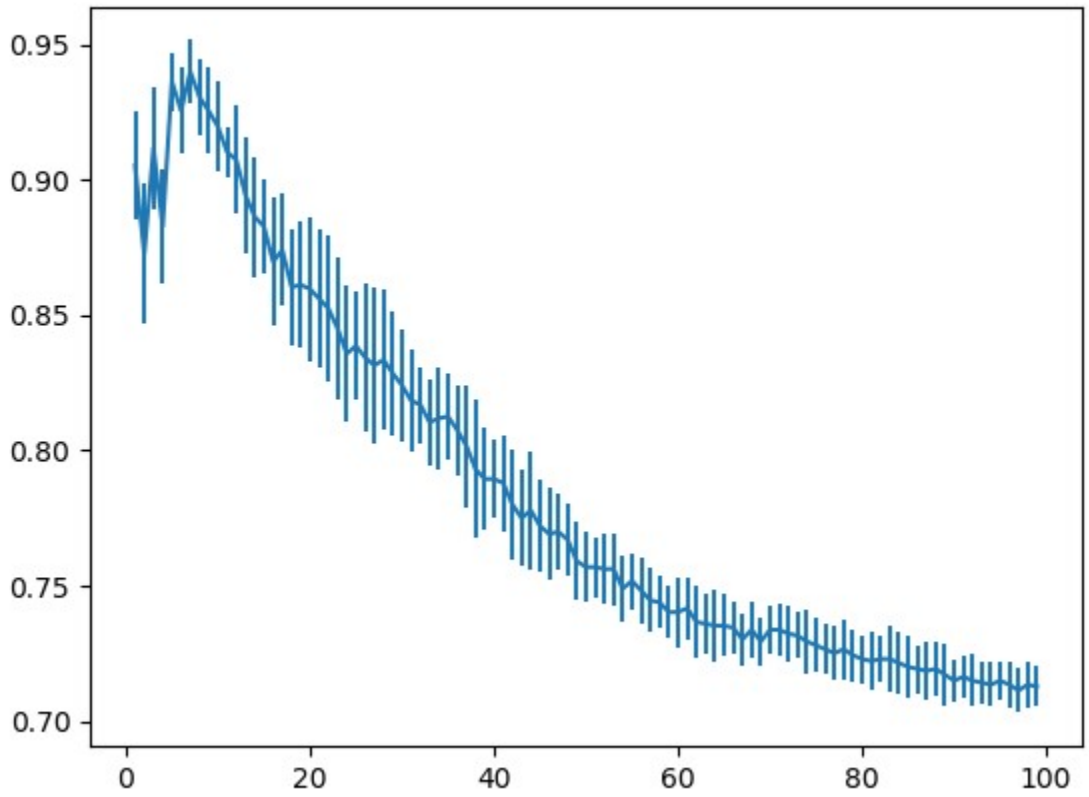
```
from sklearn.model_selection import train_test_split
train_data, test_data = train_test_split(df, test_size=0.2)

from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score
from sklearn.preprocessing import StandardScaler

data_scaled = pd.DataFrame(StandardScaler().fit_transform(df[features]),
columns=features)
data_scaled[target] = df[target]
train_data_s, test_data_s = train_test_split(data_scaled, test_size=0.2)
```

Using cross-validation to test which k produces the best results

This code trains KNN models with different k using cross-validation. The point is to get an impression of how our choice of k will affect the excpected accuracy on the test-set.

```
from sklearn.model_selection import cross_val_score
neighbor_ks = range(1, 100)
untrained_models = [KNeighborsClassifier(n_neighbors=k) for k in neighbor_ks]
k_fold_scores = [cross_val_score(estimator=m, X=train_data_s[features],
 y=train_data_s[target], cv=10) for m in untrained_models]
```

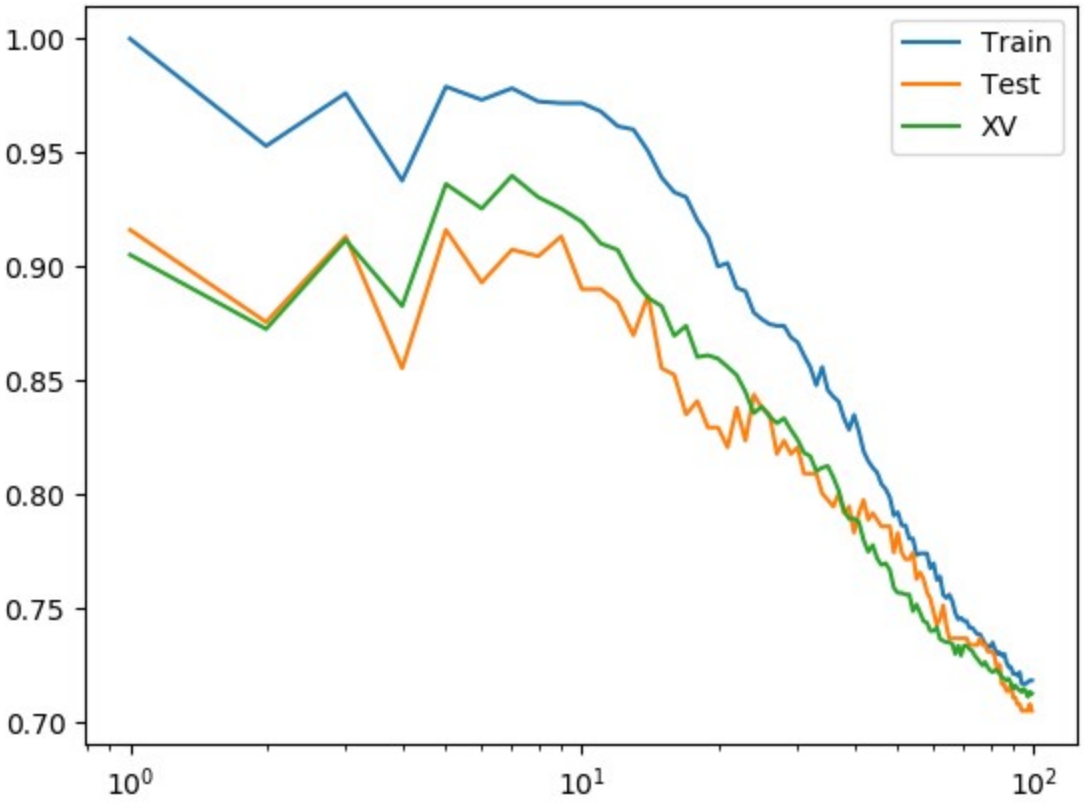
```
mean_xv_scores = [s.mean() for s in k_fold_scores]
plt.errorbar(neighbor_ks, mean_xv_scores,
yerr=[s.std() for s in k_fold_scores])
```



Results of using different k's on the test-set

This code compares KNN models trained with different k on the testset, plotted alongside results on the training data and the results from the cross-validation.

```
models = [KNeighborsClassifier(n_neighbors=k).fit(train_data_s[features],
train_data_s[target]) for k in neighbor_ks]
train_scores = [accuracy_score(train_data_s[target],
 m.predict(train_data_s[features])) for m in models]
test_scores = [accuracy_score(test_data_s[target],
 m.predict(test_data_s[features])) for m in models]
plt.semilogx(neighbor_ks, train_scores, neighbor_ks,
 test_scores, neighbor_ks, mean_xv_scores)
plt.legend(["Train", "Test", "XV"])
```



Conclusion

We expect the model to be slightly more accurate than the cross-validation on the test-set because the cross-validaton models are trained on a slightly smaller dataset. That is also what we observe in the above graph. For a deployment to the "real-world", we'd assume the model to perform slightly worse because of possible sampling bias in the dataset we've used.