In [1]:

```
import warnings

warnings.filterwarnings(action='ignore')
```

알고리즘 체인과 파이프라인

In [2]:

```
from sklearn.svm import SVC
from sklearn.datasets import load_breast_cancer
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler

cancer = load_breast_cancer()
X_train, X_test, y_train, y_test = train_test_split(cancer.data, cancer.target, random_state=0)
scaler = MinMaxScaler().fit(X_train)
```

In [3]:

```
X_train_scaled = scaler.transform(X_train)

svm = SVC()
svm.fit(X_train_scaled, y_train)
X_test_scaled = scaler.transform(X_test)

print("테스트 점수: {:.2f}".format(svm.score(X_test_scaled, y_test)))
```

```
테스트 점수: 0.95
```

데이터 전처리와 매개변수 선택

In [4]:

```
from sklearn.model_selection import GridSearchCV

param_grid = {'C': [0.001, 0.01, 0.1, 1, 10, 100],
              'gamma': [0.001, 0.01, 0.1, 1, 10, 100]}
grid = GridSearchCV(SVC(), param_grid=param_grid, cv=5)
grid.fit(X_train_scaled, y_train)

print("최상의 교차 검증 정확도: {:.2f}".format(grid.best_score_))
print("테스트 점수: {:.2f}".format(grid.score(X_test_scaled, y_test)))
print("최적의 매개변수: ", grid.best_params_)
```

```
최상의 교차 검증 정확도: 0.98
테스트 점수: 0.97
최적의 매개변수:  {'C': 1, 'gamma': 1}
```

In [5]:

```
import mglearn
```

```
C:WAnacondaWlibWsite-packagesWsklearnWexternalsWsix.py:31: DeprecationWarning: The
module is deprecated in version 0.21 and will be removed in version 0.23 since w
e've dropped support for Python 2.7. Please rely on the official version of six (h
ttps://pypi.org/project/six/).
  "(https://pypi.org/project/six/).", DeprecationWarning)
C:WAnacondaWlibWsite-packagesWsklearnWexternalsWjoblibW__init__.py:15: Deprecation
Warning: sklearn.externals.joblib is deprecated in 0.21 and will be removed in 0.2
3. Please import this functionality directly from joblib, which can be installed w
ith: pip install joblib. If this warning is raised when loading pickled models, yo
u may need to re-serialize those models with scikit-learn 0.21+.
  warnings.warn(msg, category=DeprecationWarning)
```

In [7]:

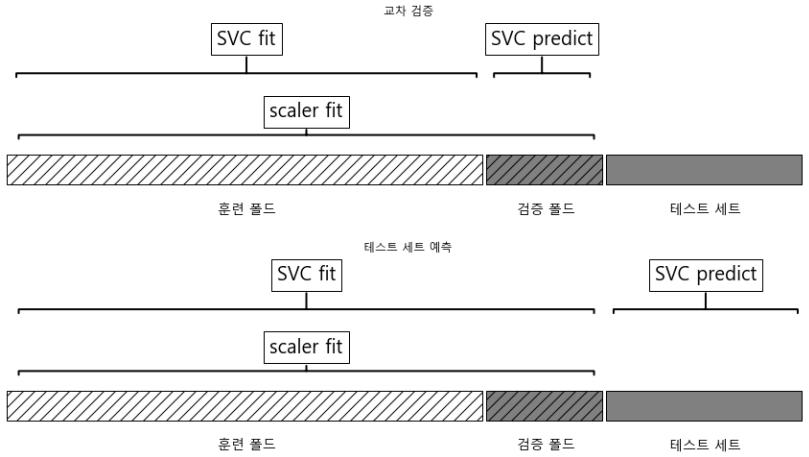
```
import mglearn
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import sklearn
from matplotlib import font_manager, rc

plt.rcParams['axes.unicode_minus'] = False

font_name = font_manager.FontProperties(fname="C:/Windows/Fonts/malgun.ttf").get_name()
rc('font', family=font_name)
```

In [8]:

```
mglearn.plots.plot_improper_processing()
```



파이프라인 구축하기

In [9]:

```
from sklearn.pipeline import Pipeline
pipe = Pipeline([("scaler", MinMaxScaler()), ("svm", SVC())])
```

In [10]:

```
pipe.fit(X_train, y_train)
```

Out[10]:

```
Pipeline(memory=None,
         steps=[('scaler', MinMaxScaler(copy=True, feature_range=(0, 1))),
                ('svm',
                 SVC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,
                     decision_function_shape='ovr', degree=3,
                     gamma='auto_deprecated', kernel='rbf', max_iter=-1,
                     probability=False, random_state=None, shrinking=True,
                     tol=0.001, verbose=False))],
         verbose=False)
```

In [11]:

```
print("테스트 점수: {:.2f}".format(pipe.score(X_test, y_test)))
```

```
테스트 점수: 0.95
```

그리드 서치에 파이프라인 적용하기

In [12]:

```
param_grid = {'svm__C': [0.001, 0.01, 0.1, 1, 10, 100],
              'svm__gamma': [0.001, 0.01, 0.1, 1, 10, 100]}
```

In [13]:

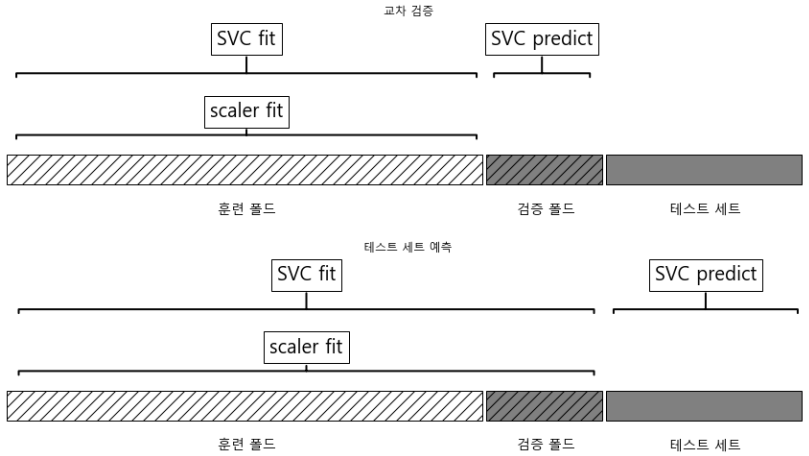
```
grid = GridSearchCV(pipe, param_grid=param_grid, cv=5)
grid.fit(X_train, y_train)

print("최상의 교차 검증 정확도: {:.2f}".format(grid.best_score_))
print("테스트 세트 점수: {:.2f}".format(grid.score(X_test, y_test)))
print("최적의 매개변수: {}".format(grid.best_params_))
```

```
최상의 교차 검증 정확도: 0.98
테스트 세트 점수: 0.97
최적의 매개변수: {'svm__C': 1, 'svm__gamma': 1}
```

In [14]:

```
mglearn.plots.plot_proper_processing()
```



In [15]:

```
rnd = np.random.RandomState(seed=0)
X = rnd.normal(size=(100, 10000))
y = rnd.normal(size=(100,))
```

In [16]:

```
from sklearn.feature_selection import SelectPercentile, f_regression

select = SelectPercentile(score_func=f_regression, percentile=5).fit(X, y)
X_selected = select.transform(X)

print("X_selected.shape: {}".format(X_selected.shape))
```

```
X_selected.shape: (100, 500)
```

In [17]:

```
from sklearn.model_selection import cross_val_score
from sklearn.linear_model import Ridge

print("교차 검증 점수 (릿지): {:.2f}".format(np.mean(cross_val_score(Ridge(), X_selected, y, cv
=5))))
```

```
교차 검증 점수 (릿지): 0.91
```

In [18]:

```
pipe = Pipeline([("select", SelectPercentile(score_func=f_regression, percentile=5)),("ridge", R
idge())])

print("교차 검증 점수 (파이프라인): {:.2f}".format(np.mean(cross_val_score(pipe, X, y, cv=5))))
```

```
교차 검증 점수 (파이프라인): -0.25
```

파이프라인 인터페이스

In [19]:

```
def fit(self, X, y):
    X_transformed = X
    for name, estimator in self.steps[:-1]:
        X_transformed = estimator.fit_transform(X_transformed, y)
    self.steps[-1][1].fit(X_transformed, y)
    return self
```

In [20]:

```
def predict(self, X):
    X_transformed = X
    for step in self.steps[:-1]:
        X_transformed = step[1].transform(X_transformed)
    return self.steps[-1][1].predict(X_transformed)
```

make_pipleline 을 사용한 파이프라인 생성

In [21]:

```
from sklearn.pipeline import make_pipeline

pipe_long = Pipeline([("scaler", MinMaxScaler()), ("svm", SVC(C=100))])
pipe_short = make_pipeline(MinMaxScaler(), SVC(C=100))
```

In [22]:

```
print("파이프라인 단계:₩n{}".format(pipe_short.steps))
```

```
파이프라인 단계:
[('minmaxscaler', MinMaxScaler(copy=True, feature_range=(0, 1))), ('svc', SVC(C=10
0, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=-1, probability=False, random_state=None,
    shrinking=True, tol=0.001, verbose=False))]
```

In [23]:

```
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA

pipe = make_pipeline(StandardScaler(), PCA(n_components=2), StandardScaler())

print("파이프라인 단계:₩n{}".format(pipe.steps))
```

```
파이프라인 단계:
[('standardscaler-1', StandardScaler(copy=True, with_mean=True, with_std=True)),
('pca', PCA(copy=True, iterated_power='auto', n_components=2, random_state=None,
    svd_solver='auto', tol=0.0, whiten=False)), ('standardscaler-2', StandardScale
r(copy=True, with_mean=True, with_std=True))]
```

단계 속성에 접근하기

In [24]:

```
pipe.fit(cancer.data)
components = pipe.named_steps["pca"].components_

print("components.shape: {}".format(components.shape))
```

```
components.shape: (2, 30)
```

그리드 서치 안의 파이프라인의 속성에 접근하기

In [25]:

```
from sklearn.linear_model import LogisticRegression

pipe = make_pipeline(StandardScaler(), LogisticRegression())
```

In [26]:

```
param_grid = {'logisticregression__C': [0.01, 0.1, 1, 10, 100]}
```

In [27]:

```
X_train, X_test, y_train, y_test = train_test_split(cancer.data, cancer.target, random_state=4)
grid = GridSearchCV(pipe, param_grid, cv=5)
grid.fit(X_train, y_train)
```

Out[27]:

```
GridSearchCV(cv=5, error_score='raise-deprecating',
             estimator=Pipeline(memory=None,
                                steps=[('standardscaler',
                                        StandardScaler(copy=True,
                                                       with_mean=True,
                                                       with_std=True)),
                                       ('logisticregression',
                                        LogisticRegression(C=1.0,
                                                           class_weight=None,
                                                           dual=False,
                                                           fit_intercept=True,
                                                           intercept_scaling=1,
                                                           l1_ratio=None,
                                                           max_iter=100,
                                                           multi_class='warn',
                                                           n_jobs=None,
                                                           penalty='l2',
                                                           random_state=None,
                                                           solver='warn',
                                                           tol=0.0001,
                                                           verbose=0,
                                                           warm_start=False))],
                                verbose=False),
             iid='warn', n_jobs=None,
             param_grid={'logisticregression__C': [0.01, 0.1, 1, 10, 100]},
             pre_dispatch='2*n_jobs', refit=True, return_train_score=False,
             scoring=None, verbose=0)
```

In [28]:

```
print("최상의 모델:₩n{}".format(grid.best_estimator_))
```

```
최상의 모델:
Pipeline(memory=None,
         steps=[('standardscaler',
                 StandardScaler(copy=True, with_mean=True, with_std=True)),
                ('logisticregression',
                 LogisticRegression(C=0.1, class_weight=None, dual=False,
                                    fit_intercept=True, intercept_scaling=1,
                                    l1_ratio=None, max_iter=100,
                                    multi_class='warn', n_jobs=None,
                                    penalty='l2', random_state=None,
                                    solver='warn', tol=0.0001, verbose=0,
                                    warm_start=False))],
         verbose=False)
```

In [30]:

```
print("로지스틱 회귀 단계:₩n{}".format(grid.best_estimator_.named_steps["logisticregression"]))
```

```
로지스틱 회귀 단계:
LogisticRegression(C=0.1, class_weight=None, dual=False, fit_intercept=True,
                   intercept_scaling=1, l1_ratio=None, max_iter=100,
                   multi_class='warn', n_jobs=None, penalty='l2',
                   random_state=None, solver='warn', tol=0.0001, verbose=0,
                   warm_start=False)
```

In [29]:

```
print("로지스틱 회귀 계수:₩n{}".format(grid.best_estimator_.named_steps["logisticregression"].coef_))
```

```
로지스틱 회귀 계수:
[[-0.38856355 -0.37529972 -0.37624793 -0.39649439 -0.11519359  0.01709608
  -0.3550729  -0.38995414 -0.05780518  0.20879795 -0.49487753 -0.0036321
  -0.37122718 -0.38337777 -0.04488715  0.19752816  0.00424822 -0.04857196
   0.21023226  0.22444999 -0.54669761 -0.52542026 -0.49881157 -0.51451071
  -0.39256847 -0.12293451 -0.38827425 -0.4169485  -0.32533663 -0.13926972]]
```

전처리와 모델의 매개변수를 위한 그리드 서치

In [31]:

```
from sklearn.datasets import load_boston

boston = load_boston()
X_train, X_test, y_train, y_test = train_test_split(boston.data, boston.target, random_state=0)

from sklearn.preprocessing import PolynomialFeatures

pipe = make_pipeline(
    StandardScaler(),
    PolynomialFeatures(),
    Ridge())
```

In [32]:

```
param_grid = {'polynomialfeatures__degree': [1, 2, 3],
              'ridge__alpha': [0.001, 0.01, 0.1, 1, 10, 100]}
```

In [33]:

```
grid = GridSearchCV(pipe, param_grid=param_grid, cv=5, n_jobs=-1)
grid.fit(X_train, y_train)
```

```
C:WAnacondaWlibWsite-packagesWsklearnWmodel_selectionW_search.py:813: DeprecationW
arning: The default of the `iid` parameter will change from True to False in versi
on 0.22 and will be removed in 0.24. This will change numeric results when test-se
t sizes are unequal.
  DeprecationWarning)
```

Out[33]:

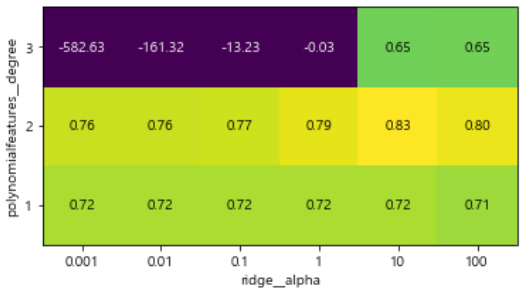
```
GridSearchCV(cv=5, error_score='raise-deprecating',
             estimator=Pipeline(memory=None,
                                steps=[('standardscaler',
                                        StandardScaler(copy=True,
                                                       with_mean=True,
                                                       with_std=True)),
                                       ('polynomialfeatures',
                                        PolynomialFeatures(degree=2,
                                                           include_bias=True,
                                                           interaction_only=False,
                                                           order='C')),
                                       ('ridge',
                                        Ridge(alpha=1.0, copy_X=True,
                                              fit_intercept=True, max_iter=None,
                                              normalize=False,
                                              random_state=None, solver='auto',
                                              tol=0.001))],
                                verbose=False),
             iid='warn', n_jobs=-1,
             param_grid={'polynomialfeatures__degree': [1, 2, 3],
                         'ridge__alpha': [0.001, 0.01, 0.1, 1, 10, 100]},
             pre_dispatch='2*n_jobs', refit=True, return_train_score=False,
             scoring=None, verbose=0)
```

In [34]:

```
mglearn.tools.heatmap(grid.cv_results_['mean_test_score'].reshape(3, -1),
                      xlabel="ridge__alpha", ylabel="polynomialfeatures__degree",
                      xticklabels=param_grid['ridge__alpha'],
                      yticklabels=param_grid['polynomialfeatures__degree'], vmin=0)
```

Out[34]:

```
<matplotlib.collections.PolyCollection at 0x1ad6843fa90>
```



In [35]:

```
print("최적의 매개변수: {}".format(grid.best_params_))
```

```
최적의 매개변수: {'polynomialfeatures__degree': 2, 'ridge__alpha': 10}
```

In [36]:

```
print("테스트 세트 점수: {:.2f}".format(grid.score(X_test, y_test)))
```

```
테스트 세트 점수: 0.77
```

In [37]:

```
param_grid = {'ridge__alpha': [0.001, 0.01, 0.1, 1, 10, 100]}
pipe = make_pipeline(StandardScaler(), Ridge())
grid = GridSearchCV(pipe, param_grid, cv=5)
grid.fit(X_train, y_train)

print("다항 특성이 없을 때 점수: {:.2f}".format(grid.score(X_test, y_test)))
```

```
다항 특성이 없을 때 점수: 0.63

C:WAnacondaWlibWsite-packagesWsklearnWmodel_selectionW_search.py:813: DeprecationW
arning: The default of the `iid` parameter will change from True to False in versi
on 0.22 and will be removed in 0.24. This will change numeric results when test-se
t sizes are unequal.
  DeprecationWarning)
```

모델 선택을 위한 그리드 서치

In [38]:

```
pipe = Pipeline([('preprocessing', StandardScaler()), ('classifier', SVC())])
```

In [39]:

```
from sklearn.ensemble import RandomForestClassifier

param_grid = [
    {'classifier': [SVC()], 'preprocessing': [StandardScaler()],
     'classifier__gamma': [0.001, 0.01, 0.1, 1, 10, 100],
     'classifier__C': [0.001, 0.01, 0.1, 1, 10, 100]},
    {'classifier': [RandomForestClassifier(n_estimators=100)],
     'preprocessing': [None], 'classifier__max_features': [1, 2, 3]}]
```

In [40]:

```
X_train, X_test, y_train, y_test = train_test_split(
    cancer.data, cancer.target, random_state=0)

grid = GridSearchCV(pipe, param_grid, cv=5)
grid.fit(X_train, y_train)

print("최적의 매개변수:₩n{}₩n".format(grid.best_params_))
print("최상의 교차 검증 점수: {:.2f}".format(grid.best_score_))
print("테스트 세트 점수: {:.2f}".format(grid.score(X_test, y_test)))
```

```
최적의 매개변수:
{'classifier': SVC(C=10, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma=0.01, kernel='rbf',
    max_iter=-1, probability=False, random_state=None, shrinking=True,
    tol=0.001, verbose=False), 'classifier__C': 10, 'classifier__gamma': 0.01, 'pr
eprocessing': StandardScaler(copy=True, with_mean=True, with_std=True)}

최상의 교차 검증 점수: 0.99
테스트 세트 점수: 0.98
```

In [ ]:

```

```