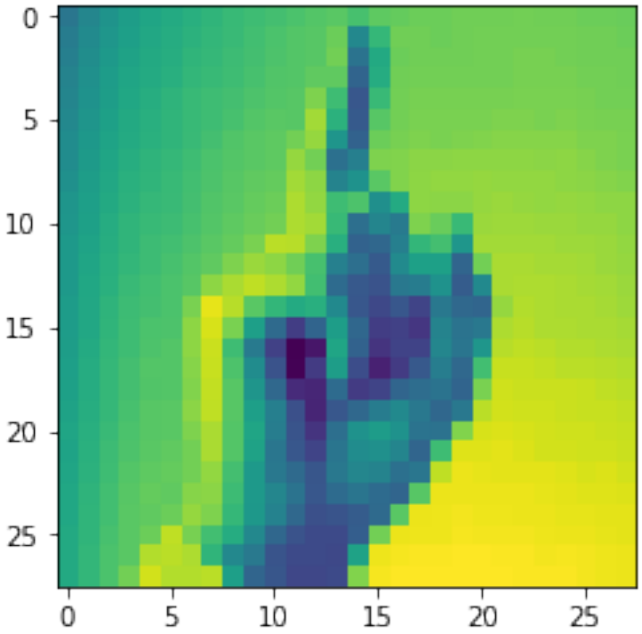
LOG_SignLanguage

May 2, 2020

In [7]:
```
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.svm import SVC
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.decomposition import PCA
import time
import matplotlib.pyplot as plt

train = pd.read_csv('./SignLanguageData/sign_mnist_train.csv')
test = pd.read_csv('./SignLanguageData/sign_mnist_test.csv')

train = train.astype(float)
test = test.astype(float)

Y_train = train['label'].values
train.drop('label', axis = 1, inplace = True)

Y_test = test['label'].values
test.drop('label', axis = 1, inplace = True)

labelizer = LabelEncoder()
Y_train = labelizer.fit_transform(Y_train)
Y_test = labelizer.transform(Y_test)

X_train = train.values
X_test = test.values

pipeline = Pipeline([
            ("std_scale", StandardScaler()),
            ("pca", PCA(.95)),
        ])


X_train_transform = pipeline.fit_transform(X_train, Y_train)
```

```
        X_test_transform = pipeline.transform(X_test)
        plt.imshow(X_train[0].reshape(28,28))
        print(X_test.shape)
        print(X_train.shape)
        print(Y_train[0])
        print(Y_test[0])
```

```
(7172, 784)
(27455, 784)
3
6
```



In [2]:
```
        # This class is taken from lession 08, Machine Learning.
        from sklearn.metrics import classification_report, f1_score
        from time import time
        from sklearn.model_selection import GridSearchCV

        def SearchReport(model):

            def GetBestModelCTOR(model, best_params):
                def GetParams(best_params):
                    ret_str=""
                    for key in sorted(best_params):
                        value = best_params[key]
                        temp_str = "'" if str(type(value))=="<class 'str'>" else ""
```

```
                if len(ret_str)>0:
                    ret_str += ','
                ret_str += f'{key}={temp_str}{value}{temp_str}'
            return ret_str
        try:
            param_str = GetParams(best_params)
            return type(model).__name__ + '(' + param_str + ')'
        except:
            return "N/A(1)"

    print("\nBest model set found on train set:")
    print()
    print(f"\tbest parameters={model.best_params_}")
    print(f"\tbest '{model.scoring}' score={model.best_score_}")
    print(f"\tbest index={model.best_index_}")
    print()
    print(f"Best estimator CTOR:")
    print(f"\t{model.best_estimator_}")
    print()
    try:
        print(f"Grid scores ('{model.scoring}') on development set:")
        means = model.cv_results_['mean_test_score']
        stds  = model.cv_results_['std_test_score']
        i=0
        for mean, std, params in zip(means, stds, model.cv_results_['params']):
            print("\t[%2d]: %0.3f (+/-%0.03f) for %r" % (i, mean, std * 2, params))
            i += 1
    except:
        print("WARNING: the random search do not provide means/stds")

    assert "f1_micro"==str(model.scoring), f"come on, we need to fix the scoring to be a
    return f"best: data=SignLanguageMnist, score={model.best_score_:0.5f}, model={GetBes

def ClassificationReport(model, X_test, y_test, target_names=None):
    assert X_test.shape[0]==y_test.shape[0]
    print("\nDetailed classification report:")
    print("\tThe model is trained on the full development set.")
    print("\tThe scores are computed on the full evaluation set.")
    print()
    y_true, y_pred = y_test, model.predict(X_test)
    print(classification_report(y_true, y_pred, target_names))
    print()

def FullReport(model, X_test, y_test, t):
    print(f"SEARCH TIME: {t:0.2f} sec")
    beststr, bestmodel = SearchReport(model)
    ClassificationReport(model, X_test, y_test)
    print(f"CTOR for best model: {bestmodel}\n")
```

```
        print(f"{beststr}\n")
        return beststr, bestmodel
```

In [ ]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.preprocessing import StandardScaler
from sklearn.pipeline import Pipeline
from sklearn.decomposition import PCA

import sys
old_stdout = sys.stdout
sys.stdout = open('output_log.txt', 'w')

model_pipe = Pipeline([
    ("std_scaler", StandardScaler())
])

tuning_parameters_1 = {
    'solver':('newton-cg', 'lbfgs', 'sag'),
    'max_iter':[100, 1000, 10000],
    'C': [1, 10, 100]
}

tuning_parameters_2 = {
    'solver':('liblinear', 'saga'),
    'penalty':('l1', 'l2'),
    'max_iter':[100, 1000, 10000],
    'C': [1, 10, 100]
}

tuning_array = [tuning_parameters_1, tuning_parameters_2]


model = LogisticRegression()

CV=5
VERBOSE=0

# This training took 8,5 hours - best model is the one used in the next section
for i in range(2):
    start = time()
    random_grid_tuned = GridSearchCV(model, tuning_array[i], cv=CV, scoring='f1_micro',
    random_grid_tuned.fit(X_train_transform, Y_train)
    t = time()-start

    # Report result
    # There will be a lot of different combinations and it will take longer for it to se
    b0, m0= FullReport(random_grid_tuned, X_test_transform, Y_test, t)
```

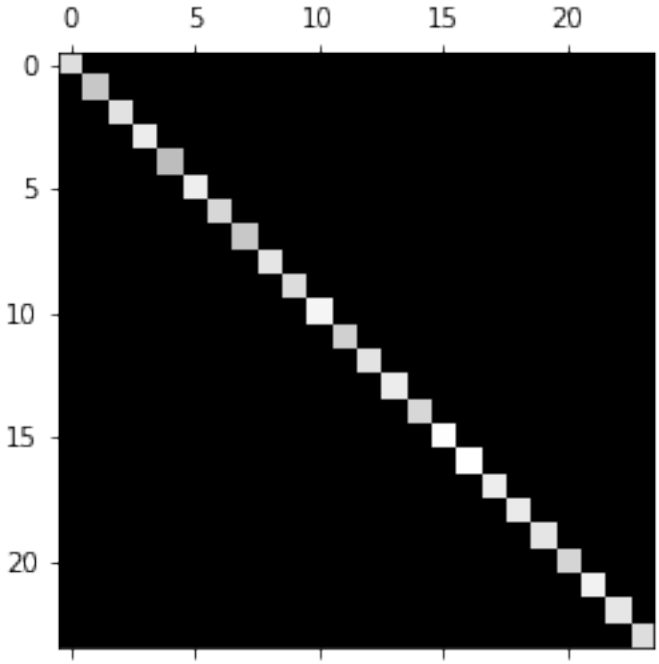
```
sys.stdout = old_stdout

# OUTPUT:
# 1. Tuning block
# CTOR for best model: LogisticRegression(C=10, class_weight=None,
#           dual=False, fit_intercept=True,
#           intercept_scaling=1, max_iter=1000, multi_class='warn',
#           n_jobs=None, penalty='l2', random_state=None, solver='lbfgs',
#           tol=0.0001, verbose=0, warm_start=False)

# best: data=SignLanguageMnist, score=0.96365,
# model=LogisticRegression(C=10,max_iter=1000,solver='lbfgs')


# 2. Tuning block
# CTOR for best model: LogisticRegression(C=10, class_weight=None,
#           dual=False, fit_intercept=True,
#           intercept_scaling=1, max_iter=100, multi_class='warn',
#           n_jobs=None, penalty='l1', random_state=None, solver='liblinear',
#           tol=0.0001, verbose=0, warm_start=False)

# best: data=SignLanguageMnist, score=0.96361,
# model=LogisticRegression(C=10,max_iter=100,penalty='l1',solver='liblinear')
```

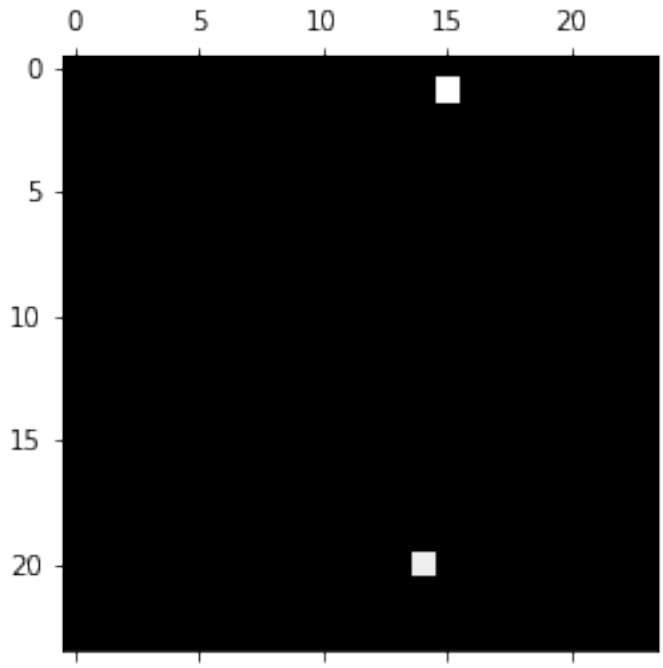
In [6]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import cross_val_score
from sklearn.model_selection import cross_val_predict
from sklearn.metrics import confusion_matrix
import numpy as np
import matplotlib.pyplot as plt

# Best model from grid search
model = LogisticRegression(solver='lbfgs', multi_class='auto', max_iter=10000,
                           penalty='l2');

# Inspiration from page 102 - 105, Chapter 3, 'Hands-On Machine Learning'
print("Cross Validation Matrix")
score = cross_val_score(model, X_train_transform, Y_train, cv=3, scoring="accuracy")
print(score)

print("Confusion Matrix")
Y_pred = cross_val_predict(model, X_train_transform, Y_train, cv=3)
conf_mx = confusion_matrix(Y_train, Y_pred)
print(conf_mx)

# Plot confusion matrix
plt.matshow(conf_mx, cmap=plt.cm.gray)
```

```
        # Plot errors
        row_sums = conf_mx.sum(axis=1, keepdims=True)
        norm_conf_mx = conf_mx / row_sums

        np.fill_diagonal(norm_conf_mx, 0)
        plt.matshow(norm_conf_mx, cmap=plt.cm.gray)
        plt.show()
```

```
Cross Validation Matrix
[1.         0.99978147 1.        ]
Confusion Matrix
[[1126    0    0    0    0    0    0    0    0    0    0    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0 1009    0    0    0    0    0    0    0    0    0    0    0    0
     0    1    0    0    0    0    0    0    0    0]
 [   0    0 1144    0    0    0    0    0    0    0    0    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0 1196    0    0    0    0    0    0    0    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0  957    0    0    0    0    0    0    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0 1204    0    0    0    0    0    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0 1090    0    0    0    0    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0 1013    0    0    0    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0 1162    0    0    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0    0 1114    0    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0    0    0 1241    0    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0    0    0    0 1055    0    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0    0    0    0    0 1151    0
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0    0    0    0    0    0 1196
     0    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0    0    0    0    0    0    0
  1088    0    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0    0    0    0    0    0    0
     0 1279    0    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0    0    0    0    0    0    0
     0    0 1294    0    0    0    0    0    0    0]
 [   0    0    0    0    0    0    0    0    0    0    0    0    0    0
     0    0    0 1199    0    0    0    0    0    0]
```

```
[   0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0 1186    0    0    0    0    0]
[   0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0 1161    0    0    0    0]
[   0    0    0    0    0    0    0    0    0    0    0    0    0    0
    1    0    0    0    0    0 1081    0    0    0]
[   0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0 1225    0    0]
[   0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0 1164    0]
[   0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0 1118]]
```





In [ ]: