In [1]:

```
from sklearn import datasets
import numpy as np
import pandas as pd
pd.set_option('display.max.columns', 55)
from matplotlib import pyplot as plt
import tracemalloc
import random
import scipy
```

# Ćwiczenie zaliczeniowe

## Celem ćwiczenia jest:

- przećwiczenie wiedzy o klasyfikatorach

## Zadanie:

## Część 1:

- pobierz bazę danych covertype (https://archive.ics.uci.edu/ml/da /Covertype (https://archive.ics.uci.edu/ml/datasets/Covertype)) należy wykorzystać funkcję: https://scikit-learn.org/stable/modul /generated/sklearn.datasets.fetch_covtype.html (https://scikit-le /stable/modules/generated/sklearn.datasets.fetch_covtype.html
- zwizualizuj dane przy użyciu TSNE
- napisz własna implementację klasyfikatora kNN
- naucz klasyfikator kNN
- naucz KNeighborsClassifier ze scikit-learn
- przeanalizuj i porównaj wyniki klasyfikatorów (confusion matrix, accuracy)
- napisz własną implementację klasyfikatora kNM
- naucz klasyfikator kNM
- porównaj accuracy własnego kNM z obiema wersjami kNN
- porównaj zużycie pamięci obu typów klasyfikacji

## Część 2:

- wykorzystując bazę danych GTSRB zbuduj własną reprezentac znakach (własny wektor cech, minimum 5 cech)
- zwizualizuj dane przy użyciu TSNE
- w oparciu o stworzony zestaw cech porównaj klasyfikatory z cz

# Część 1

In [2]:
```python
dataset = datasets.fetch_covtype(return_X_y = True)
features, target = datasets.fetch_covtype(return_X_y = True)
```

In [3]:
```python
features_df = pd.DataFrame(data = features, index = target)
features_df
```

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 2596.0 | 51.0 | 3.0 | 258.0 | 0.0 | 510.0 | 221.0 | 232.0 | 148.0 | 6279.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 2590.0 | 56.0 | 2.0 | 212.0 | -6.0 | 390.0 | 220.0 | 235.0 | 151.0 | 6225.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 2804.0 | 139.0 | 9.0 | 268.0 | 65.0 | 3180.0 | 234.0 | 238.0 | 135.0 | 6121.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 2785.0 | 155.0 | 18.0 | 242.0 | 118.0 | 3090.0 | 238.0 | 238.0 | 122.0 | 6211.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 2595.0 | 45.0 | 2.0 | 153.0 | -1.0 | 391.0 | 220.0 | 234.0 | 150.0 | 6172.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 3 | 2396.0 | 153.0 | 20.0 | 85.0 | 17.0 | 108.0 | 240.0 | 237.0 | 118.0 | 837.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2391.0 | 152.0 | 19.0 | 67.0 | 12.0 | 95.0 | 240.0 | 237.0 | 119.0 | 845.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2386.0 | 159.0 | 17.0 | 60.0 | 7.0 | 90.0 | 236.0 | 241.0 | 130.0 | 854.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2384.0 | 170.0 | 15.0 | 60.0 | 5.0 | 90.0 | 230.0 | 245.0 | 143.0 | 864.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2383.0 | 165.0 | 13.0 | 60.0 | 4.0 | 67.0 | 231.0 | 244.0 | 141.0 | 875.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |

581012 rows × 54 columns

In [4]:
```python
from sklearn.manifold import TSNE
from sklearn.preprocessing import StandardScaler
```

In [5]:
```python
features_droped = features_df.drop([i for i in range(10, 54)], axis=1)
A = features_droped[:5000]
B = features_droped[5000:20000]
```

In [6]:
```python
features_droped
```

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 2596.0 | 51.0 | 3.0 | 258.0 | 0.0 | 510.0 | 221.0 | 232.0 | 148.0 | 6279.0 |
| 5 | 2590.0 | 56.0 | 2.0 | 212.0 | -6.0 | 390.0 | 220.0 | 235.0 | 151.0 | 6225.0 |
| 2 | 2804.0 | 139.0 | 9.0 | 268.0 | 65.0 | 3180.0 | 234.0 | 238.0 | 135.0 | 6121.0 |
| 2 | 2785.0 | 155.0 | 18.0 | 242.0 | 118.0 | 3090.0 | 238.0 | 238.0 | 122.0 | 6211.0 |
| 5 | 2595.0 | 45.0 | 2.0 | 153.0 | -1.0 | 391.0 | 220.0 | 234.0 | 150.0 | 6172.0 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 3 | 2396.0 | 153.0 | 20.0 | 85.0 | 17.0 | 108.0 | 240.0 | 237.0 | 118.0 | 837.0 |
| 3 | 2391.0 | 152.0 | 19.0 | 67.0 | 12.0 | 95.0 | 240.0 | 237.0 | 119.0 | 845.0 |
| 3 | 2386.0 | 159.0 | 17.0 | 60.0 | 7.0 | 90.0 | 236.0 | 241.0 | 130.0 | 854.0 |
| 3 | 2384.0 | 170.0 | 15.0 | 60.0 | 5.0 | 90.0 | 230.0 | 245.0 | 143.0 | 864.0 |
| 3 | 2383.0 | 165.0 | 13.0 | 60.0 | 4.0 | 67.0 | 231.0 | 244.0 | 141.0 | 875.0 |

581012 rows × 10 columns

In [7]:

```
scaler = StandardScaler()
A = scaler.fit_transform(A)
```

In [8]:

```
A
```

```
array([[ 1.46471134e-02, -9.52803948e-01, -1.55323806e+00, ...,
         6.54715715e-01,  3.40156162e-01,  3.59472542e+00],
       [-7.64411643e-04, -9.07228152e-01, -1.65963151e+00, ...,
         7.74007980e-01,  3.99353563e-01,  3.55395870e+00],
       [ 5.48913315e-01, -1.50669936e-01, -9.14877323e-01, ...,
         8.93300245e-01,  8.36340887e-02,  3.47544503e+00],
       ...,
       [ 1.67138606e+00, -9.43688789e-01,  3.61844142e-01, ...,
        -1.01537600e+00, -8.43791867e-01,  1.72549597e+00],
       [ 9.98416130e-01, -1.16245261e+00,  7.87417964e-01, ...,
        -1.49254506e+00, -5.87269794e-01,  1.55789947e+00],
       [ 1.11400257e+00, -1.87130573e-01, -9.14877323e-01, ...,
         8.13772068e-01,  4.41691545e-02, -1.97334160e-01]])
```

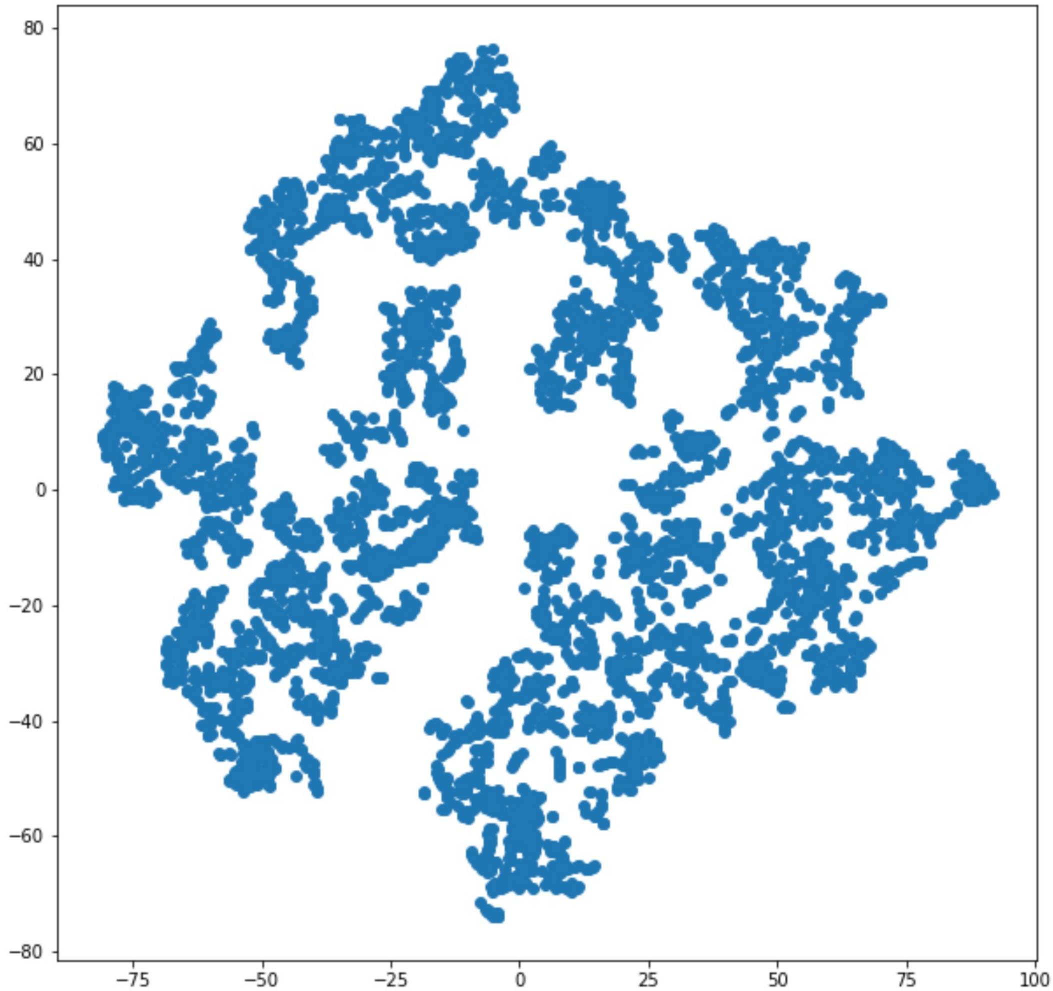
In [9]:

```
%%time
tsne = TSNE(random_state=17)
tsne_representation = tsne.fit_transform(A)
plt.rcParams['figure.figsize'] = (10, 10)
```

```
Wall time: 43 s
```

In [10]:

```
plt.scatter(tsne_representation[:, 0], tsne_representation[:, 1]);
```



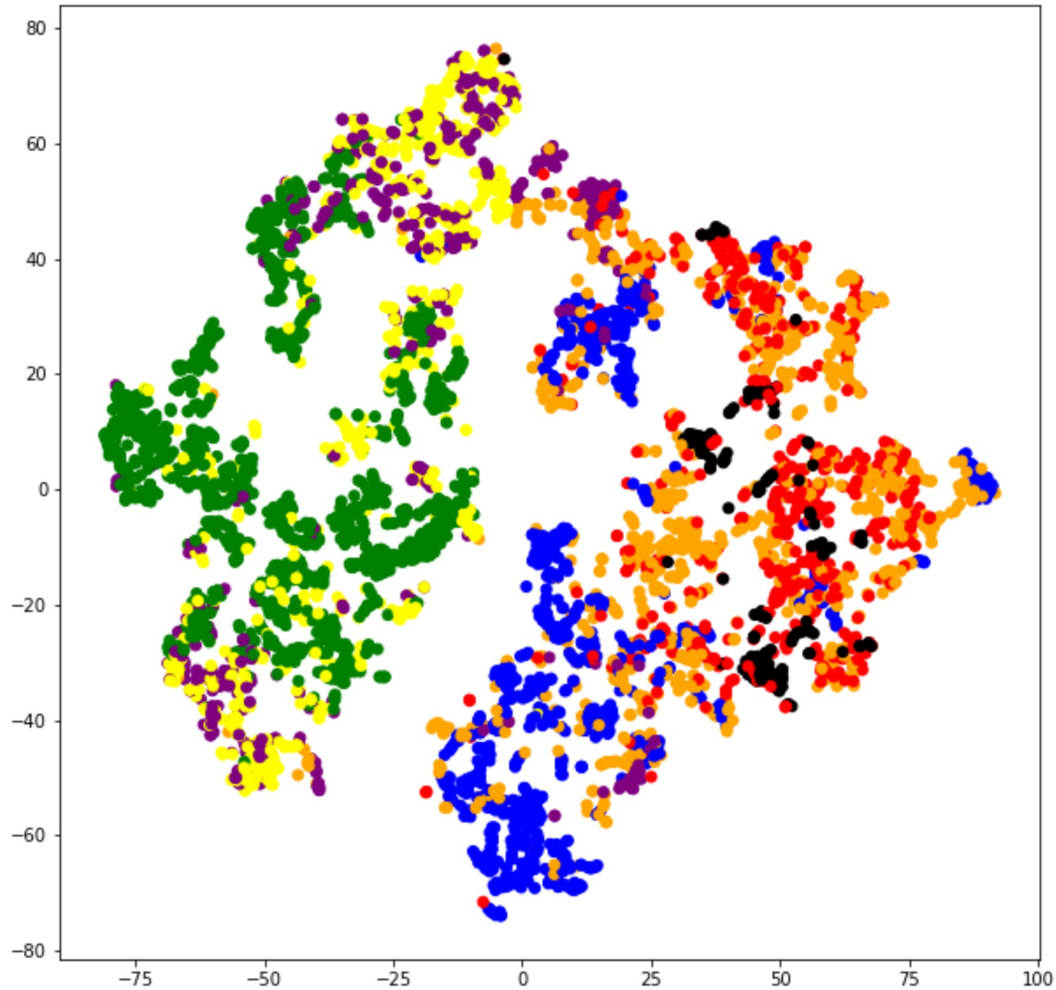

In [11]:

```
features_droped[:5000].index.unique()
```

```
Int64Index([5, 2, 1, 7, 3, 6, 4], dtype='int64')
```

In [12]:

```
plt.scatter(tsne_representation[:, 0], tsne_representation[:, 1],
            c=features_droped[:5000].index.map({ 1: 'red', 2: 'orange', 3: 'yell
```




## Część 1 - KNN

In [13]:

```
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.neighbors import KNeighborsClassifier
from memory_profiler import memory_usage,profile
```

In [14]:

```
features_df
```

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 2596.0 | 51.0 | 3.0 | 258.0 | 0.0 | 510.0 | 221.0 | 232.0 | 148.0 | 6279.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 2590.0 | 56.0 | 2.0 | 212.0 | -6.0 | 390.0 | 220.0 | 235.0 | 151.0 | 6225.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 2804.0 | 139.0 | 9.0 | 268.0 | 65.0 | 3180.0 | 234.0 | 238.0 | 135.0 | 6121.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 2785.0 | 155.0 | 18.0 | 242.0 | 118.0 | 3090.0 | 238.0 | 238.0 | 122.0 | 6211.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 2595.0 | 45.0 | 2.0 | 153.0 | -1.0 | 391.0 | 220.0 | 234.0 | 150.0 | 6172.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 3 | 2396.0 | 153.0 | 20.0 | 85.0 | 17.0 | 108.0 | 240.0 | 237.0 | 118.0 | 837.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2391.0 | 152.0 | 19.0 | 67.0 | 12.0 | 95.0 | 240.0 | 237.0 | 119.0 | 845.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2386.0 | 159.0 | 17.0 | 60.0 | 7.0 | 90.0 | 236.0 | 241.0 | 130.0 | 854.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2384.0 | 170.0 | 15.0 | 60.0 | 5.0 | 90.0 | 230.0 | 245.0 | 143.0 | 864.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2383.0 | 165.0 | 13.0 | 60.0 | 4.0 | 67.0 | 231.0 | 244.0 | 141.0 | 875.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |

581012 rows × 54 columns

In [15]:

```
features_droped = features_df.drop([i for i in range(10, 54)], axis=1)
A = features_droped[:500]  #train
B = features_droped[500:1000] #test
from sklearn import preprocessing
min_max_scaler = preprocessing.MinMaxScaler()
```

In [16]:

```
B
```

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2617.0 | 15.0 | 14.0 | 30.0 | 0.0 | 1652.0 | 207.0 | 211.0 | 139.0 | 1383.0 |
| 2 | 2998.0 | 340.0 | 7.0 | 108.0 | 16.0 | 2978.0 | 205.0 | 230.0 | 163.0 | 6224.0 |
| 2 | 2962.0 | 276.0 | 7.0 | 497.0 | 47.0 | 3610.0 | 201.0 | 242.0 | 179.0 | 5658.0 |
| 2 | 2759.0 | 160.0 | 12.0 | 120.0 | 35.0 | 2782.0 | 233.0 | 242.0 | 139.0 | 2462.0 |
| 2 | 2646.0 | 9.0 | 33.0 | 60.0 | 9.0 | 1771.0 | 165.0 | 156.0 | 112.0 | 1518.0 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1 | 2982.0 | 10.0 | 18.0 | 30.0 | 7.0 | 4562.0 | 197.0 | 200.0 | 136.0 | 2538.0 |
| 1 | 3032.0 | 339.0 | 14.0 | 95.0 | 23.0 | 4710.0 | 189.0 | 219.0 | 169.0 | 518.0 |
| 2 | 2896.0 | 72.0 | 16.0 | 319.0 | 44.0 | 3294.0 | 236.0 | 208.0 | 98.0 | 2726.0 |
| 1 | 2846.0 | 135.0 | 2.0 | 0.0 | 0.0 | 3056.0 | 222.0 | 238.0 | 152.0 | 2349.0 |
| 1 | 2995.0 | 39.0 | 18.0 | 0.0 | 0.0 | 4472.0 | 218.0 | 198.0 | 109.0 | 2609.0 |

500 rows × 10 columns

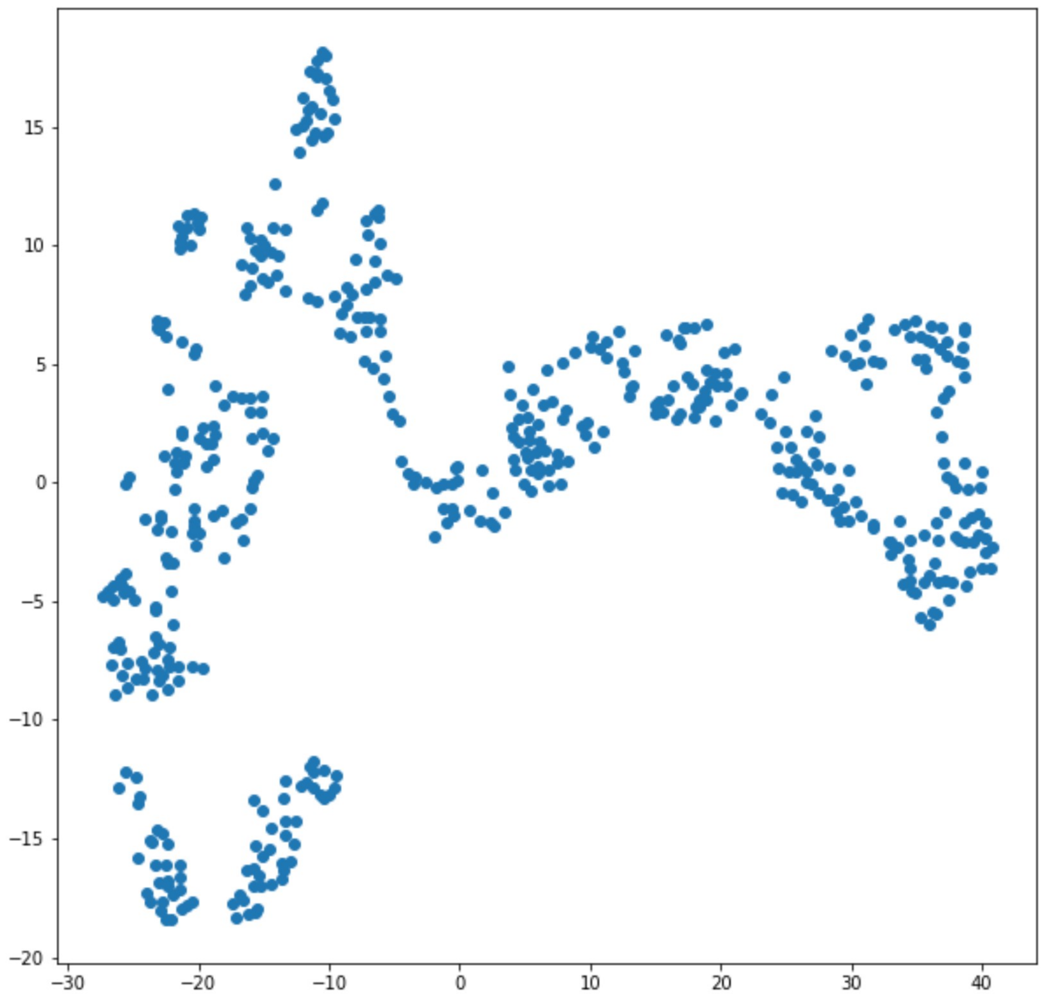
In [17]:

```
%%time
tsne = TSNE(random_state=17)
tsne_representation = tsne.fit_transform(B)
plt.rcParams['figure.figsize'] = (10, 10)
```

```
Wall time: 2.79 s
```

In [18]:

```
plt.scatter(tsne_representation[:, 0], tsne_representation[:, 1]);
```

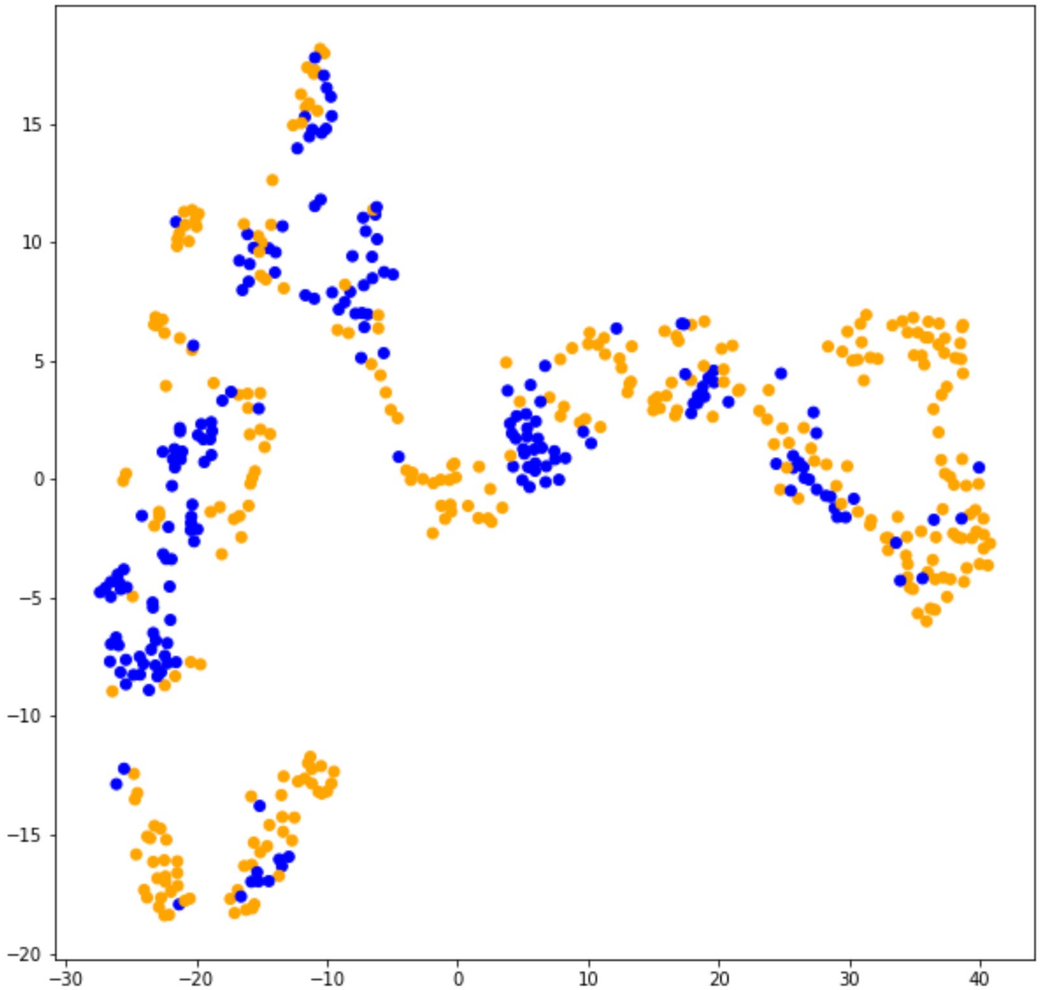



In [19]:

```
B.index.unique()
```

```
Int64Index([2, 1, 5], dtype='int64')
```

In [20]:
```
plt.scatter(tsne_representation[:, 0], tsne_representation[:, 1],
            c=B.index.map({ 1: 'blue', 2: 'orange', 3: 'red', 4: 'green', 5: 'bl
```




In [ ]:
```

```

In [ ]:
```

```

In [21]:
```
def predict(train, test, n):
    distances = [(train.columns[k], (np.linalg.norm(train.iloc[:,k] - test))) fo
    distances.sort(key=lambda tup: tup[1])
    neighbours = [distances[i][0] for i in range(n)]
    prediction = max(set(neighbours), key=neighbours.count)
    return(prediction)
```

In [22]:
```
def knn(train, test, n):
    TrainIndexNames, TestIndexNames = train.index.values, test.index.values
    A_scaled = min_max_scaler.fit_transform(train)
    B_scaled = min_max_scaler.fit_transform(test)
    train_df, test_df = pd.DataFrame(data = A_scaled, index = TrainIndexNames),
    test_predict = [predict(train_df.T, test_df.T[k], n) for k in test_df.T.colu
    return(test_predict, TestIndexNames)
```

In [23]:
```
%load_ext memory_profiler
```

In [ ]:
```

```

In [ ]:
```

```

In [24]:
```
def knn_descr():
    prediction, test_labels = knn(A, B, 1) #n
    print(prediction[:10])
    print(list(test_labels[:10]))
    display(accuracy_score(test_labels, prediction, normalize=True))
    display(confusion_matrix(test_labels, prediction))
```

In [25]:
```
def knn_descr_scipy():
    knn = KNeighborsClassifier(n_neighbors=1) #n
    knn.fit(A, A.index.values)
    knn_pred = knn.predict(B)
    accuracy_score(B.index.values, knn_pred)
    display(accuracy_score(B.index.values, knn_pred))
    display(confusion_matrix(B.index.values, knn_pred))
```

In [26]:

```
%%time
%memit knn_descr_scipy()
```

```
0.402

array([[ 43,  45,   0],
       [127, 158,  18],
       [ 64,  45,   0]], dtype=int64)

0.402

array([[ 43,  45,   0],
       [127, 158,  18],
       [ 64,  45,   0]], dtype=int64)

0.402

array([[ 43,  45,   0],
       [127, 158,  18],
       [ 64,  45,   0]], dtype=int64)

peak memory: 727.54 MiB, increment: 0.14 MiB
Wall time: 2.19 s
```

In [27]:

```
%%time
knn_descr()
%memit knn_descr()
```

```
[2, 1, 2, 2, 2, 2, 2, 2, 2, 2]
[2, 2, 2, 2, 2, 2, 2, 1, 2, 2]

0.488

array([[ 55,  33,   0],
       [102, 189,  12],
       [ 56,  53,   0]], dtype=int64)

[2, 1, 2, 2, 2, 2, 2, 2, 2, 2]
[2, 2, 2, 2, 2, 2, 2, 1, 2, 2]

0.488

array([[ 55,  33,   0],
       [102, 189,  12],
       [ 56,  53,   0]], dtype=int64)

peak memory: 727.73 MiB, increment: 0.00 MiB
Wall time: 2min 7s
```

In [ ]:

```

```

In [ ]:

```

```

# Część 1 - NM

In [28]:

```
features_df
```

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 2596.0 | 51.0 | 3.0 | 258.0 | 0.0 | 510.0 | 221.0 | 232.0 | 148.0 | 6279.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 5 | 2590.0 | 56.0 | 2.0 | 212.0 | -6.0 | 390.0 | 220.0 | 235.0 | 151.0 | 6225.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 2 | 2804.0 | 139.0 | 9.0 | 268.0 | 65.0 | 3180.0 | 234.0 | 238.0 | 135.0 | 6121.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 2 | 2785.0 | 155.0 | 18.0 | 242.0 | 118.0 | 3090.0 | 238.0 | 238.0 | 122.0 | 6211.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 5 | 2595.0 | 45.0 | 2.0 | 153.0 | -1.0 | 391.0 | 220.0 | 234.0 | 150.0 | 6172.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 3 | 2396.0 | 153.0 | 20.0 | 85.0 | 17.0 | 108.0 | 240.0 | 237.0 | 118.0 | 837.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 3 | 2391.0 | 152.0 | 19.0 | 67.0 | 12.0 | 95.0 | 240.0 | 237.0 | 119.0 | 845.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 3 | 2386.0 | 159.0 | 17.0 | 60.0 | 7.0 | 90.0 | 236.0 | 241.0 | 130.0 | 854.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 3 | 2384.0 | 170.0 | 15.0 | 60.0 | 5.0 | 90.0 | 230.0 | 245.0 | 143.0 | 864.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 3 | 2383.0 | 165.0 | 13.0 | 60.0 | 4.0 | 67.0 | 231.0 | 244.0 | 141.0 | 875.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.( |

581012 rows × 54 columns

In [29]:

```
A = features_droped[:500]   #train
B = features_droped[500:1000] #test
```

In [30]:

```
A
```

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 2596.0 | 51.0 | 3.0 | 258.0 | 0.0 | 510.0 | 221.0 | 232.0 | 148.0 | 6279.0 |
| 5 | 2590.0 | 56.0 | 2.0 | 212.0 | -6.0 | 390.0 | 220.0 | 235.0 | 151.0 | 6225.0 |
| 2 | 2804.0 | 139.0 | 9.0 | 268.0 | 65.0 | 3180.0 | 234.0 | 238.0 | 135.0 | 6121.0 |
| 2 | 2785.0 | 155.0 | 18.0 | 242.0 | 118.0 | 3090.0 | 238.0 | 238.0 | 122.0 | 6211.0 |
| 5 | 2595.0 | 45.0 | 2.0 | 153.0 | -1.0 | 391.0 | 220.0 | 234.0 | 150.0 | 6172.0 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 2 | 2909.0 | 72.0 | 5.0 | 324.0 | 5.0 | 4554.0 | 226.0 | 230.0 | 138.0 | 5006.0 |
| 2 | 2909.0 | 0.0 | 3.0 | 350.0 | 5.0 | 4582.0 | 215.0 | 233.0 | 156.0 | 4985.0 |
| 2 | 2900.0 | 180.0 | 3.0 | 300.0 | -2.0 | 4725.0 | 220.0 | 241.0 | 156.0 | 4880.0 |
| 2 | 2867.0 | 143.0 | 12.0 | 437.0 | 114.0 | 3363.0 | 237.0 | 237.0 | 129.0 | 2963.0 |
| 1 | 3047.0 | 356.0 | 10.0 | 618.0 | 75.0 | 5664.0 | 204.0 | 222.0 | 156.0 | 3811.0 |

500 rows × 10 columns

In [31]:

```
pd.DataFrame(data = features_df.index.to_series(), index = target)
```

| | 0 |
|---|---|
| 5 | 5 |
| 5 | 5 |
| 2 | 2 |
| 2 | 2 |
| 5 | 5 |
| ... | ... |
| 3 | 3 |
| 3 | 3 |
| 3 | 3 |
| 3 | 3 |
| 3 | 3 |

581012 rows × 1 columns

In [104]:

```
df_1 = features_df.loc[1,:]
df_1
```

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2699.0 | 347.0 | 3.0 | 0.0 | 0.0 | 2096.0 | 213.0 | 234.0 | 159.0 | 6853.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | 2739.0 | 323.0 | 25.0 | 85.0 | 43.0 | 3118.0 | 149.0 | 205.0 | 192.0 | 6219.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | 2696.0 | 72.0 | 2.0 | 30.0 | 0.0 | 3271.0 | 222.0 | 234.0 | 149.0 | 6071.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | 2722.0 | 315.0 | 24.0 | 30.0 | 19.0 | 3216.0 | 148.0 | 212.0 | 200.0 | 6132.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | 2919.0 | 13.0 | 13.0 | 90.0 | 6.0 | 5321.0 | 207.0 | 214.0 | 142.0 | 4060.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1 | 2826.0 | 72.0 | 14.0 | 67.0 | 13.0 | 2984.0 | 235.0 | 213.0 | 106.0 | 2082.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | 2820.0 | 69.0 | 14.0 | 42.0 | 7.0 | 2954.0 | 234.0 | 211.0 | 106.0 | 2065.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | 2812.0 | 67.0 | 16.0 | 30.0 | 0.0 | 2925.0 | 234.0 | 206.0 | 99.0 | 2047.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | 2832.0 | 45.0 | 17.0 | 85.0 | 19.0 | 2989.0 | 222.0 | 200.0 | 106.0 | 2058.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | 2827.0 | 43.0 | 18.0 | 67.0 | 14.0 | 2960.0 | 221.0 | 199.0 | 107.0 | 2040.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

211840 rows × 54 columns

In [32]:

```
def NM():
    df_1 = features_df.loc[1,:]
    df_2 = features_df.loc[2,:]
    df_3 = features_df.loc[3,:]
    df_4 = features_df.loc[4,:]
    df_5 = features_df.loc[5,:]
    df_6 = features_df.loc[6,:]
    df_7 = features_df.loc[7,:]

    df_1_mean = df_1.mean(axis=0)
    df_2_mean = df_2.mean(axis=0)
    df_3_mean = df_3.mean(axis=0)
    df_4_mean = df_4.mean(axis=0)
    df_5_mean = df_5.mean(axis=0)
    df_6_mean = df_6.mean(axis=0)
    df_7_mean = df_7.mean(axis=0)

    frames = [df_1_mean,df_2_mean,df_3_mean,df_4_mean,df_5_mean,df_6_mean,df_7_m
    meansy = pd.concat(frames, axis=1, join='outer', ignore_index=False)
    meansy = meansy.transpose()


    meansy_dropped =  meansy.iloc[:,[0,1,2,3,4,5,6,7,8,9]] #bo 10 cech ma A,B
    distanceNM = scipy.spatial.distance.cdist(meansy_dropped, B, metric='euclide
    Dist_df = pd.DataFrame(data = distanceNM)
    dist_df_min = pd.DataFrame(data = Dist_df.idxmin(axis=0, skipna=True))
    dist_z_bledem = dist_df_min.values
    dist = ( dist_z_bledem +1)
    Truth = pd.DataFrame(data = B.index.to_series())
    display(accuracy_score(Truth.values, dist, normalize=True))
    display(confusion_matrix(Truth.values, dist))
```

In [33]:

```
NM()
```

```
0.152
```

```
array([[  4,  19,   1,   7,   1,  56],
       [ 26,  58,  16,  53,  25, 125],
       [  0,   0,   0,   0,   0,   0],
       [  2,  33,   0,  14,   0,  60],
       [  0,   0,   0,   0,   0,   0],
       [  0,   0,   0,   0,   0,   0]], dtype=int64)
```

In [34]:

```
%%time
NM()
%memit NM()
```

```
0.152

array([[  4,  19,   1,   7,   1,  56],
       [ 26,  58,  16,  53,  25, 125],
       [  0,   0,   0,   0,   0,   0],
       [  2,  33,   0,  14,   0,  60],
       [  0,   0,   0,   0,   0,   0],
       [  0,   0,   0,   0,   0,   0]], dtype=int64)

0.152

array([[  4,  19,   1,   7,   1,  56],
       [ 26,  58,  16,  53,  25, 125],
       [  0,   0,   0,   0,   0,   0],
       [  2,  33,   0,  14,   0,  60],
       [  0,   0,   0,   0,   0,   0],
       [  0,   0,   0,   0,   0,   0]], dtype=int64)

peak memory: 980.29 MiB, increment: 243.17 MiB
Wall time: 1.56 s
```

In [35]:

```
%%time
%memit knn_descr()
```

```
[2, 1, 2, 2, 2, 2, 2, 2, 2, 2]
[2, 2, 2, 2, 2, 2, 2, 1, 2, 2]

0.488

array([[ 55,  33,   0],
       [102, 189,  12],
       [ 56,  53,   0]], dtype=int64)

peak memory: 737.12 MiB, increment: 0.00 MiB
Wall time: 1min 5s
```

In [ ]:

```

```

In [36]:

```
%%time
%memit knn_descr_scipy()
```

```
0.402

array([[ 43,  45,   0],
       [127, 158,  18],
       [ 64,  45,   0]], dtype=int64)

0.402

array([[ 43,  45,   0],
       [127, 158,  18],
       [ 64,  45,   0]], dtype=int64)

0.402

array([[ 43,  45,   0],
       [127, 158,  18],
       [ 64,  45,   0]], dtype=int64)

peak memory: 737.12 MiB, increment: 0.00 MiB
Wall time: 1.92 s
```

## Część 1 - Podsumowanie

Algorytmy scipy są zdecydowanie szybsze(2s vs minuta), jednak dla grup testowych, algorytm własny wydaje się bardziej dokładny. Algo zdecydowniae szybszy, na poziomie scipy KNN, jednak jego precyz bardzo nikła oraz posiada on najwyższe zużycie pamięci

In [ ]:

```

```

## Część 2

In [38]:

```
import matplotlib.pyplot as plt
import numpy as np
import csv

# function for reading the images
# arguments: path to the traffic sign data, for example './GTSRB/Training'
# returns: list of images, list of corresponding labels
def readTrafficSigns(rootpath):
    '''Reads traffic sign data for German Traffic Sign Recognition Benchmark.

    Arguments: path to the traffic sign data, for example './GTSRB/Training'
    Returns:   list of images, list of corresponding labels'''
    images = [] # images
    labels = [] # corresponding labels
    # loop over all 42 classes
    for c in range(0,43):
        prefix = rootpath + '/' + format(c, '05d') + '/' # subdirectory for clas
        gtFile = open(prefix + 'GT-'+ format(c, '05d') + '.csv') # annotations f
        gtReader = csv.reader(gtFile, delimiter=';') # csv parser for annotation
        next(gtReader) # skip header !!!!!!!!!!!!!!!!!TUTAJ NALEŻY KONIECZKIE Z
        # loop over all images in current annotations file
        for row in gtReader:
            x1,y1,x2,y2 = map(int,row[3:7])
            images.append(np.array(plt.imread(prefix + row[0]))[y1:y2,x1:x2]) #
            labels.append(int(row[7])) # the 8th column is the label# TU ZMIENIĆ
        gtFile.close()
    return np.array(images), np.array(labels)# I TU JESZCZE TROCHĘ
```

In [39]:

```
path = r"C:\Users\sticz\Desktop\Magisterka sezon drugi\Podstawy Uczenia Maszynow
images, labels = readTrafficSigns(path)
```

In [40]:

```
class_names=["zakazu", "ostrzegawcze", "informacyjne", "nakazu"]
sign_groups = [0,0,0,0,0,0,0,0,0,0,0,1,2,1,0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,0
labels_groups = np.array([sign_groups[cls] for cls in labels])
```

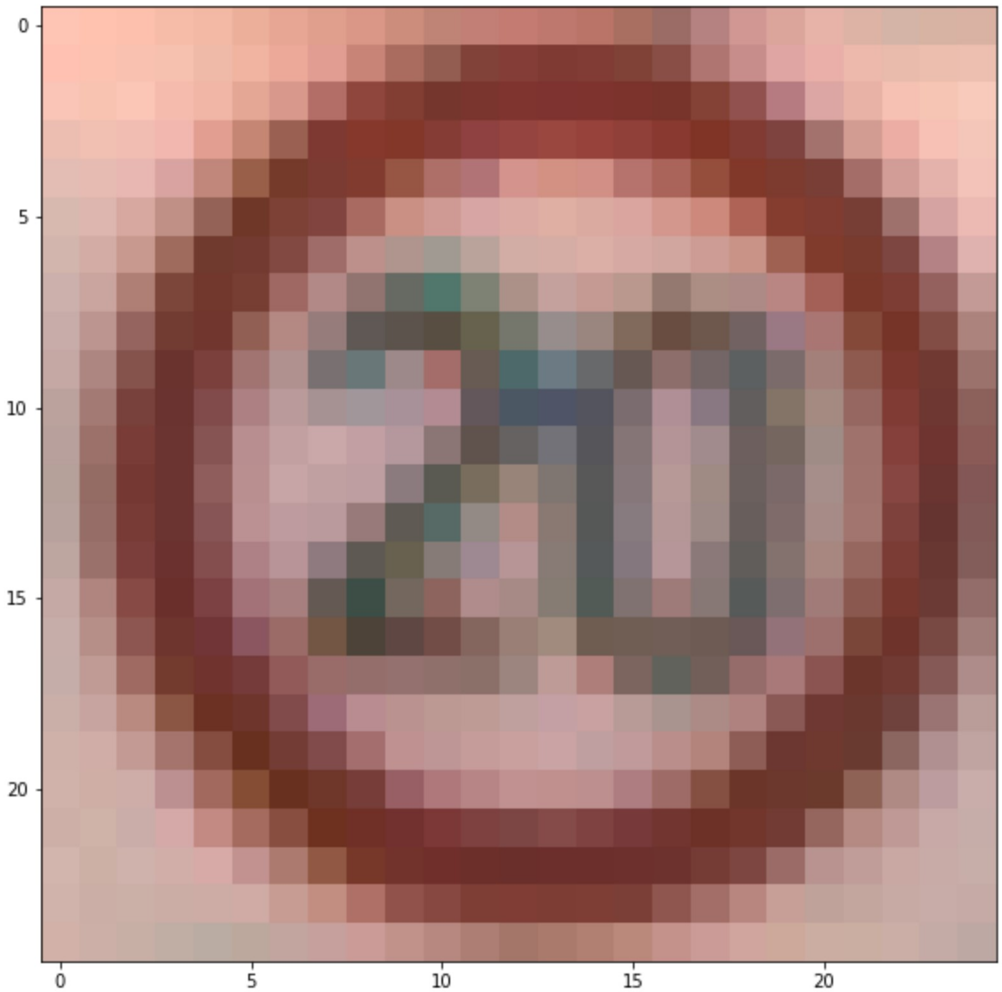
In [119]:

```
lg = pd.DataFrame(data =labels_groups)
lg
```

| | 0 |
|---|---|
| 0 | 0 |
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| ... | ... |
| 39204 | 0 |
| 39205 | 0 |
| 39206 | 0 |
| 39207 | 0 |
| 39208 | 0 |

39209 rows × 1 columns

In [41]:
```
plt.figure()
plt.imshow(images[100])
plt.show()
```




In [42]:
```
img=images[100]
features=np.array([np.sum(img[:,:,0]),np.sum(img[:,:,1]),np.sum(img[:,:,2])])
features=features/np.sum(features)
features
```

```
array([0.41163983, 0.30225772, 0.28610245])
```

In [43]:
```
from sklearn.mode lection import train_test_split
training_set, tes t, training_labels, test_labels = train_test_split(images,
```

In [44]:
```
def convertToRelativeRGB(arr):
    result = [np.array([np.sum(img[:,:,0]),np.sum(img[:,:,1]),np.sum(img[:,:,2])])
    result = result/np.sum(result,axis=1)[:,None]
    return result
```

In [45]:
```
image_features = convertToRelativeRGB(images)
training_vec = convertToRelativeRGB(training_set)
test_vec = convertToRelativeRGB(test_set)
```

In [46]:
```
print(np.shape(training_vec))
print(np.shape(test_vec))
```

```
(31367, 3)
(7842, 3)
```

In [125]:
```
training_df = pd.DataFrame(data = training_vec,index = training_labels)
```

In [126]:
```
training_df[3] = training_df[0] / ( training_df[1])
training_df[4] = training_df[1] / ( training_df[2])
```

In [127]:
```
training_df
```

| | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 5 | 0.381992 | 0.307066 | 0.310942 | 1.244005 | 0.987536 |
| 25 | 0.377253 | 0.320273 | 0.302474 | 1.177913 | 1.058841 |
| 35 | 0.261371 | 0.318120 | 0.420509 | 0.821610 | 0.756514 |
| 13 | 0.334737 | 0.316305 | 0.348958 | 1.058275 | 0.906427 |
| 15 | 0.377899 | 0.315657 | 0.306444 | 1.197181 | 1.030065 |
| ... | ... | ... | ... | ... | ... |
| 42 | 0.293942 | 0.311669 | 0.394390 | 0.943122 | 0.790256 |
| 18 | 0.390866 | 0.308146 | 0.300988 | 1.268442 | 1.023784 |
| 7 | 0.335223 | 0.304185 | 0.360593 | 1.102037 | 0.843568 |
| 1 | 0.347016 | 0.304401 | 0.348583 | 1.139997 | 0.873251 |
| 3 | 0.318040 | 0.304606 | 0.377354 | 1.044105 | 0.807215 |

31367 rows × 5 columns

In [122]:
```
test_df = pd.DataFrame(data = test_vec, index = test_labels)
```

In [123]:
```
test_df[3] = test_df[0] / ( test_df[1])
test_df[4] = test_df[1] / ( test_df[2])
```

In [170]:
```
image_features_df = pd.DataFrame(data = image_features, index = labels)
```

In [171]:
```
image_features_df[3] = image_features_df[0] / ( image_features_df[1])
image_features_df[4] = image_features_df[1] / ( image_features_df[2])
```

In [172]:
```
image_features_df
```

| | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 0 | 0.388223 | 0.299714 | 0.312063 | 1.295310 | 0.960430 |
| 0 | 0.384023 | 0.302212 | 0.313765 | 1.270710 | 0.963178 |
| 0 | 0.381788 | 0.300540 | 0.317672 | 1.270343 | 0.946068 |
| 0 | 0.381825 | 0.304077 | 0.314098 | 1.255683 | 0.968096 |
| 0 | 0.395549 | 0.297565 | 0.306887 | 1.329287 | 0.969624 |
| ... | ... | ... | ... | ... | ... |
| 42 | 0.287313 | 0.321295 | 0.391392 | 0.894235 | 0.820902 |
| 42 | 0.287875 | 0.320836 | 0.391289 | 0.897264 | 0.819947 |
| 42 | 0.287277 | 0.320460 | 0.392263 | 0.896451 | 0.816952 |
| 42 | 0.287722 | 0.320912 | 0.391366 | 0.896578 | 0.819978 |
| 42 | 0.284333 | 0.321476 | 0.394191 | 0.884462 | 0.815533 |

39209 rows × 5 columns

In [128]:
```
def knn_descr():
    prediction, test_labels = knn(training_df, test_df, 1) #n
    print(prediction[:10])
    print(list(test_labels[:10]))
    display(accuracy_score(test_labels, prediction, normalize=True))
    display(confusion_matrix(test_labels, prediction))
```

In [139]:
```
def knn_descr_scipy():
    knn = KNeighborsClassifier(n_neighbors=1) #n
    knn.fit(training_df, training_labels)
    knn_pred = knn.predict(test_df)
    accuracy_score(test_labels, knn_pred)
    display(accuracy_score(test_labels, knn_pred))
    display(confusion_matrix(test_labels, knn_pred))
```

In [140]:
```
%%time
%memit knn_descr_scipy()
```

```
0.19867380770211682
```

```
array([[ 2,  4,  3, ...,  0,  0,  0],
       [ 5, 72, 39, ...,  0,  1,  0],
       [ 2, 34, 73, ...,  0,  1,  0],
       ...,
       [ 0,  1,  0, ..., 17,  0,  1],
       [ 0,  1,  0, ...,  0, 11,  0],
       [ 0,  1,  0, ...,  0,  0, 11]], dtype=int64)
```

```
peak memory: 1215.25 MiB, increment: 1.20 MiB
Wall time: 1 s
```

In [97]:

```
#%%time
#%memit knn_descr()
```

In [ ]:

```

```

In [185]:

```
def NM():
    meansy = []
    for i in range(0,42):
        df_x = image_features_df.loc[i,:]
        df_x_mean = df_x.mean(axis=0)
        meansy.append(df_x_mean)
        meansy_df = pd.DataFrame(data=meansy)


    #meansy = meansy.transpose()


    #meansy_dropped =  meansy_df.iloc[:,[0,1,2,3,4]] #bo 5 cech ma
    distanceNM = scipy.spatial.distance.cdist(meansy_df, test_df, metric='euclid
    Dist_df = pd.DataFrame(data = distanceNM)
    dist_df_min = pd.DataFrame(data = Dist_df.idxmin(axis=0, skipna=True))
    dist_z_bledem = dist_df_min.values
    dist = ( dist_z_bledem +1)
    display(accuracy_score(test_labels, dist, normalize=True))
    display(confusion_matrix(test_labels, dist))
```

In [180]

```

```

In [ ]:

```

```

In [ ]:

```

```

In [186]:

```
%%time
NM()
%memit NM()
```

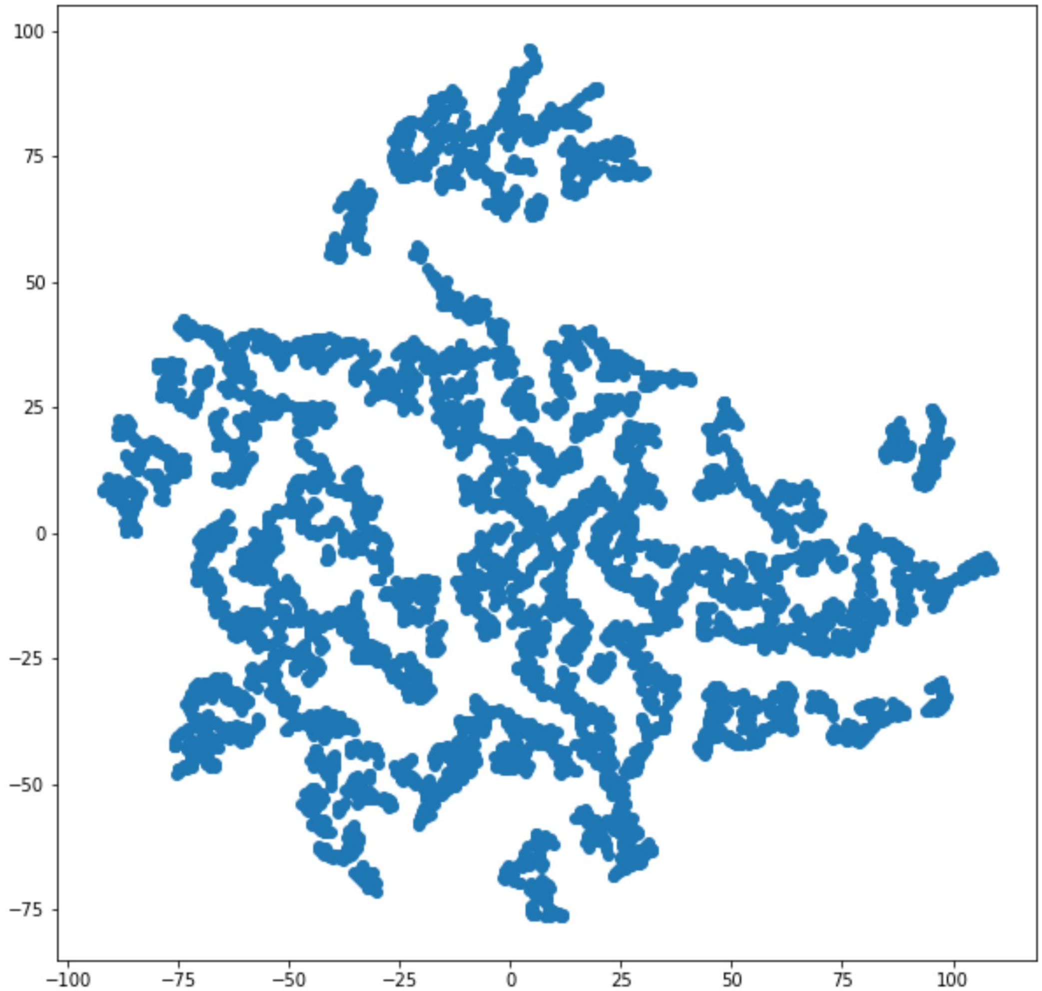
```
0.04106095383830655


array([[ 0,  0,  0, ...,  0,  0,  0],
       [ 0,  9,  2, ...,  0,  7,  3],
       [ 0, 14,  1, ...,  0,  0,  3],
       ...,
       [ 0,  0,  0, ..., 18, 14,  0],
       [ 0,  0,  0, ...,  0,  3,  8],
       [ 0,  0,  0, ...,  0, 15,  2]], dtype=int64)


0.04106095383830655


array([[ 0,  0,  0, ...,  0,  0,  0],
       [ 0,  9,  2, ...,  0,  7,  3],
       [ 0, 14,  1, ...,  0,  0,  3],
       ...,
       [ 0,  0,  0, ..., 18, 14,  0],
       [ 0,  0,  0, ...,  0,  3,  8],
       [ 0,  0,  0, ...,  0, 15,  2]], dtype=int64)


0.04106095383830655


array([[ 0,  0,  0, ...,  0,  0,  0],
       [ 0,  9,  2, ...,  0,  7,  3],
       [ 0, 14,  1, ...,  0,  0,  3],
       ...,
       [ 0,  0,  0, ..., 18, 14,  0],
       [ 0,  0,  0, ...,  0,  3,  8],
       [ 0,  0,  0, ...,  0, 15,  2]], dtype=int64)


peak memory: 1271.50 MiB, increment: 2.52 MiB
Wall time: 1.91 s
```

In [187]:

```
%%time
tsne = TSNE(random_state=17)
tsne_representation = tsne.fit_transform(test_df,train_df)
plt.rcParams['figure.figsize'] = (10, 10)
```

```
Wall time: 1min 21s
```

In [188]:
```
plt.scatter(tsne_representation[:, 0], tsne_representation[:, 1]);
```




In [ ]:

In [ ]:

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