In [1]:

```
import numpy as np
import pandas as pd
import scipy as sp
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D

from sklearn.decomposition import PCA
from sklearn.manifold import TSNE
from sklearn.linear_model import LogisticRegression
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score
```

In [2]:

```
X_train = pd.read_csv("hw11t5v3_train.txt", sep="\t", header=None)
print X_train.shape
X_train.head()
```

(500, 3)

Out[2]:

	0	1	2
0	0.895	-2.873	0.504
1	2.856	0.168	1.951
2	-0.576	-0.238	-0.437
3	-0.277	0.205	-0.218
4	3.494	-0.137	1.955

In [3]:

```
X_test = pd.read_csv("hw11t5v3_test.txt", sep="\t", header=None)
print X_test.shape
X_test.head()
```

(50, 3)

Out[3]:

	0	1	2
0	2.106	0.760	1.731
1	0.108	0.010	0.907
2	-2.145	-2.176	0.975
3	2.733	0.914	1.373
4	1.493	-3.425	1.007

In [4]:

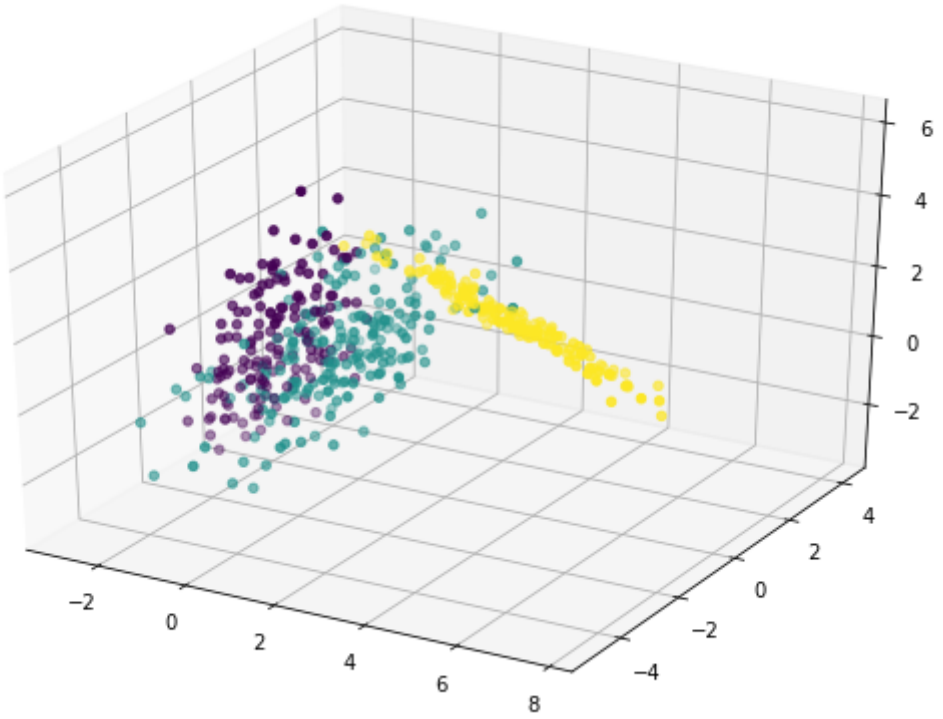
```
y_train = pd.read_csv("hw11t5v3_target.txt", sep="\t", header=None)
y_test = pd.read_csv("hw11t5v3_target_test.txt", sep="\t", header=None)
```

Изобразим обучающую выборку.

In [5]:

```
plt.close()
fig = plt.figure(figsize=(10,7))
ax = fig.add_subplot(111, projection='3d')

ax.scatter(X_train.values[:,0], X_train.values[:,1], X_train.values[:,2], c=y_train
plt.show()
```

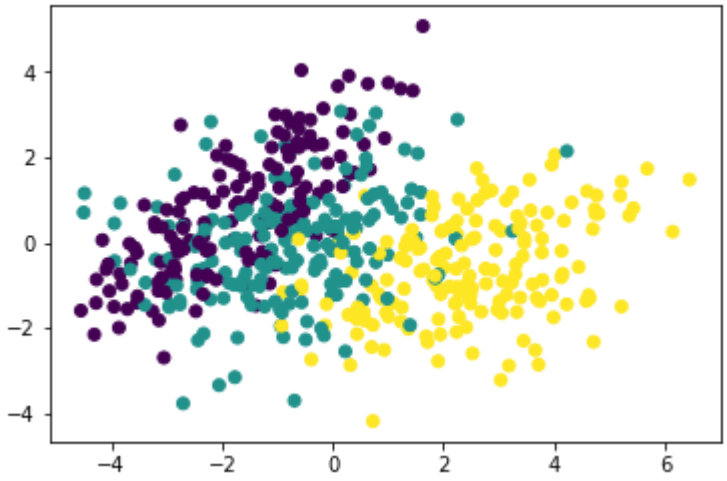


Видно как минимум 2 кластера, имеющие, каждый в отдельности, хороший отклик с меткой.

Изобразим проекции обучающей выборки на 1 и 2-мерные пространства.

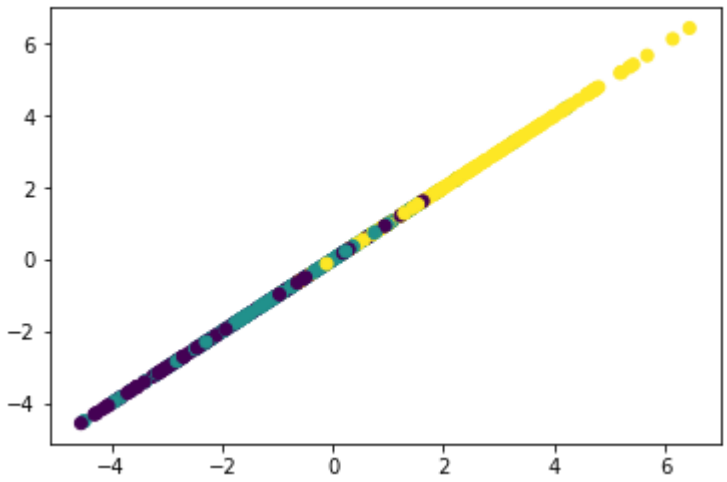
In [6]:

```
pca = PCA(n_components=2)
X_train_transformed = pca.fit_transform(X_train)
plt.scatter(X_train_transformed[:,0], X_train_transformed[:,1], c=y_train)
plt.show()
```



In [7]:

```
pca = PCA(n_components=1)
X_train_transformed = pca.fit_transform(X_train)
plt.scatter(X_train_transformed, X_train_transformed, c=y_train)
plt.show()
```

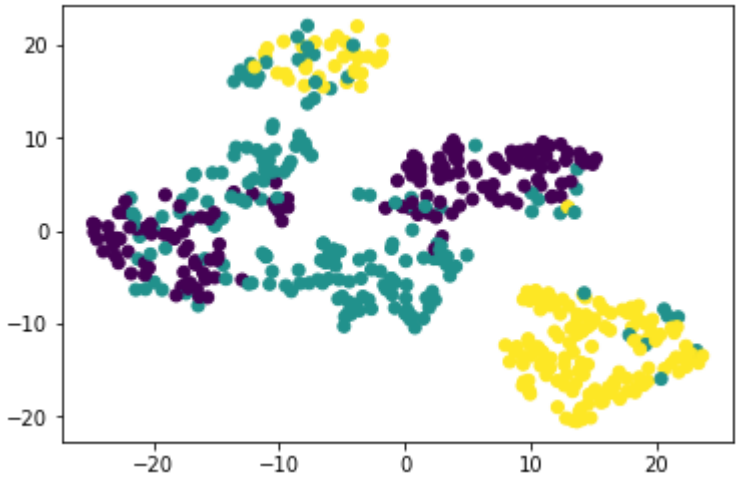


При проецировании на 1 и 2 компоненты кластеры смешиваются, но метка остаётся разделимой.

Попробуем нелинейное преобразование.

In [9]:

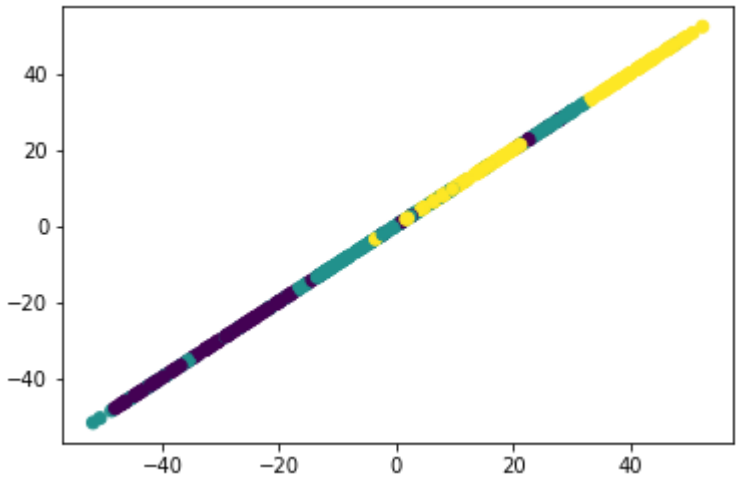
```
tsne = TSNE(n_components=2)
X_train_transformed = tsne.fit_transform(X_train)
plt.scatter(X_train_transformed[:,0], X_train_transformed[:,1], c=y_train)
plt.show()
```



В 2-мерном пространстве появилось что-то похожее на кластеры, которые к тому же хорошо откликаются на метку.

In [10]:

```
tsne = TSNE(n_components=1)
X_train_transformed = tsne.fit_transform(X_train)
plt.scatter(X_train_transformed, X_train_transformed, c=y_train)
plt.show()
```



В 1-мерном пространстве нет кластеров и метка линейно не разделима.

Протестируем модель, обученную на исходной выборке.

In [11]:

```
clf = LogisticRegression()
clf.fit(X_train, y_train)
y_predicted = clf.predict(X_test)
print accuracy_score(y_test, y_predicted)
```

```
0.88
```

```
/home/ilivans/.virtualenvs/cmn/local/lib/python2.7/site-packages/sklea
rn/utils/validation.py:526: DataConversionWarning: A column-vector y w
as passed when a 1d array was expected. Please change the shape of y t
o (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

In [12]:

```
knn = KNeighborsClassifier()
knn.fit(X_train, y_train)
y_predicted = knn.predict(X_test)

print accuracy_score(y_test, y_predicted)
```

```
0.9
```

```
/home/ilivans/.virtualenvs/cmn/lib/python2.7/site-packages/ipykernel_l
auncher.py:2: DataConversionWarning: A column-vector y was passed when
a 1d array was expected. Please change the shape of y to (n_samples,
 ), for example using ravel().
```

Теперь спроецируем выборку и обучим kNN.