Predictive clustering

In [1]:
```
import numpy as np
import pandas as pd
import math
import json
import os
from numba import jit, njit, prange
from tqdm import tqdm
from dbscanld.core import DBSCANlD
import matplotlib.pyplot as plt
```

In [2]:
```
# загрузим построенную нами обучающую выборку
train_pat = np.load('train_pat_1000_wishart_totlist3.npy')
print (train_pat.shape)
print (type(train_pat) , train_pat.nbytes/10e+8)

# Загрузим список наблюдений для тестовой выборки
new_test_tot3 = np.load('new_test_tot3.npy')
print(new_test_tot3.shape)
```

```
(1000, 2441, 5)
<class 'numpy.ndarray'> 0.09764
(64, 5)
```

In [3]:
```
# тестовые сэмплы
k = [28,10,63,59,56,17,5]
n = [195,152,175,175,240,475,345]

item = new_test_tot3[5]
name = item[0]
date = item[1]
parent_dir = 'C:/Users/Kuanysh/Downloads/pump_and_dump/train3'
ts = pd.read_csv(os.path.join(parent_dir, name + '_' + date + '.csv')).to_numpy().ravel()
min_ts = -0.9274193543487099
ts_diff = np.diff(ts)
ts_diff = ts_diff - np.full((ts_diff.shape[0], ), min_ts)

x1 = 345
x2 = x1+100

train_data = ts_diff[:x1].tolist()
test_data = ts_diff[x1:x2].tolist()
plt.plot(ts[:x1], color = 'black', linewidth=0.5);
plt.plot(ts[x1:x2], color = 'blue', alpha=0.5, linewidth=0.5);
```

In [4]:
```
N = np.array([0.6666], dtype=np.float32)
K = np.array([0.7777], dtype=np.float32)
train_vec = train_pat[:,:,:-1]

print(train_vec.shape)
patterns = np.load('patterns_1000_patterns_for_wishart.npy')
patterns
```

```
(1000, 2441, 4)
```

Out[4]:
```
array([[ 3,  7,  6,  7],
       [ 1,  5,  5,  6],
       [10,  6,  1,  6],
       ...,
       [ 3,  7,  5,  8],
       [ 1,  5,  4, 10],
       [ 9,  5,  1,  5]], dtype=uint8)
```

In [5]:
```
@njit(parallel=True)
def last_vec(patterns,train_data):
    f_arr = np.zeros((patterns.shape[0],4), dtype=np.float32)
    for i in prange(patterns.shape[0]):
        c = train_data.shape[0] - np.cumsum(patterns[i][::-1])).astype(np.int64)
        a1 = train_data[c_[0]]
        a2 = train_data[c_[1]]
        a3 = train_data[c_[2]]
        a4 = train_data[c_[3]]
        f_arr[i] = np.array([a4,a3,a2,a1],dtype=np.float32)
        if np.any(f_arr[i] == K[0]):
            f_arr[i] = 2*np.ones((4,), dtype=np.float32)
    return f_arr
```

In [6]:
```
@jit(nopython=True, fastmath=True)
def euclidean(u, v):
    n = len(u)
    dist = 0
    for i in prange(n):
        dist += abs(u[i] - v[i]) ** 2
    return dist ** (1 / 2)
```

In [7]:
```
@njit(parallel=True)
def vec_distance(train_vec,f_arr,eps):
    n, m = train_vec.shape[0], train_vec.shape[1]
    dist=np.zeros((n, m), dtype=np.float32)
    for i in prange(n):
        for j in prange(m):
            if (train_vec[i,j][0]!=N):
                dist[i,j] = euclidean(f_arr[i], train_vec[i,j])
            else:
                dist[i,j] = 2
    return dist
```

In [8]:
```
@njit(parallel=True)
def forcast_sets(dist, train_pat, eps):
    f_vecs = (dist<eps).nonzero()
    result = np.vstack((f_vecs[0],f_vecs[1])).T
    k = result.shape[0]
    forcast_set = np.zeros((k, 1), dtype=np.float32)
    weights = np.zeros((k, 1), dtype=np.float32)
    for i in prange(k):
        forcast_set[i]=train_pat[result[i,0],result[i,1],4]
        weights[i]=1-dist[result[i,0],result[i,1]]/eps
    return forcast_set, weights
```

In [9]:
```
def frct_cl_tr(train_data, train_pat, train_vec, patterns, eps, K, S_max, steps):
    train_data_all=np.array((train_data))
    weights_all = np.array([1], dtype=np.float32)
    #cwns_all = []
    fls_all = []
    for i in tqdm(range(steps)):
        #print(i)
        trs = []
        wts = []
        #cwns = []
        fls = []
        for train_tr, train_wt in zip(train_data_all, weights_all):
            f_arr = last_vec(patterns,train_tr)
            dist = vec_distance(train_vec,f_arr, eps)
            forcast_set, weights = forcast_sets(dist, train_pat, eps)
            #plt.hist(forcast_set, np.linspace(0, 1, 100));
            if forcast_set.size == 0:
                f_mean_1 = f_mean_2 = K[0]
                mean_weight_1 = mean_weight_2 = 0.00001
                #print('forcast_set.size == 0', i)

            else:
                f_mean_1, f_mean_2, mean_weight_1, mean_weight_2, fl = dbs_mean_cpu_tr(forcast_set, weights, 0.
                #print('forcast_set.size != 0', i, forcast_set.size)

            train_data_1 = np.hstack((train_tr, f_mean_1))
            train_data_2 = np.hstack((train_tr, f_mean_2))
            train_data_12 = np.vstack((train_data_1, train_data_2))
            trs.append(train_data_12)

            weights_1 = np.hstack((train_wt, mean_weight_1))
            weights_2 = np.hstack((train_wt, mean_weight_2))
            weights_12 = np.vstack((weights_1, weights_2))
            wts.append(weights_12)

            #cwns.append(cwn)
            fls.append(fl)

        #cwns_all.append(cwns)
        fls_all.append(fls)
        train_data_all = np.vstack(trs)
        weights_all = np.vstack(wts)
        #print ('before', weights_all.shape)

        if weights_all.shape[0] > S_max:
            traj_wts = np.prod(weights_all,1)
            pct = np.sort(traj_wts)[::-1][S_max-1]
            cut_traj_weights = np.where(traj_wts>=pct)
            train_data_all = train_data_all[cut_traj_weights[0]]
            weights_all = weights_all[cut_traj_weights[0]]
            #print ('after', weights_all.shape)
        #else:
            #print('less')
    return train_data_all[:,-100:], fls_all #cwns_all
```

In [10]:
```
def dbs_mean_cpu_tr(forcast_set, weights, eps, K):
    db = DBSCANlD(eps=eps, min_samples=3).fit(forcast_set)
    labels = db.labels_
    clusters_all = np.stack(np.unique(labels, return_counts = True),1)
    clusters_wn = clusters_all[clusters_all[:,0]>-1]
    #cwn = clusters_wn[:,1]
    if clusters_wn.shape[0] == 0:
        f_mean_1 = f_mean_2 = K[0]
        mean_weight_1 = mean_weight_2 = 0.00001
    elif clusters_wn[:,1].size == 1:
        f_mean_1 = f_mean_2 = np.mean(forcast_set[np.where(labels == 0)])
        mean_weight_1 = mean_weight_2 = np.mean(weights[np.where(labels == 0)])
    else:
        #print ('size > 1',clusters_wn[:,1].size)
        sorted_labels = np.argsort(clusters_wn[:,1], axis=0)
        first_cl = clusters_wn[:,0][sorted_labels[-1]]
        second_cl = clusters_wn[:,0][sorted_labels[-2]]
        if clusters_wn[first_cl,1] > 0.10*np.sum(clusters_wn[:,1]):
            #print (first_cl)
            f_mean_1 = np.mean(forcast_set[np.where(labels == first_cl)])
            f_mean_2 = np.mean(forcast_set[np.where(labels == second_cl)])
            mean_weight_1 = np.mean(weights[np.where(labels == first_cl)])
            mean_weight_2 = np.mean(weights[np.where(labels == second_cl)])
        else:
            f_mean_1 = f_mean_2 = K[0]
            mean_weight_1 = mean_weight_2 = 0.00001
    labelsr = labels.reshape(labels.shape[0],1)
    fl = np.hstack((forcast_set, labelsr))
    return f_mean_1, f_mean_2, mean_weight_1, mean_weight_2, fl
```

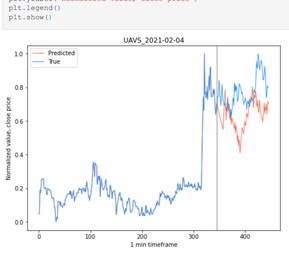
In [11]:
```
steps = 100
S_max = 5
frct_cl_tr, fls_all = frct_cl_tr(train_data, train_pat, train_vec, patterns, 0.02, K, S_max, steps)
```

```
100%|██████████| 100/100 [01:34<00:00, 1.06it/s]
```

In [13]:
```
inv_ts1 = [ts[x1]]
new_val1 = ts[x1]
for i in range(len(ts_diff[x1:x2])):
    new_val1 += + ts_diff[x1:x2][i] + min_ts
    inv_ts1.append(new_val1)

inv_ts2 = [ts[x1]]
new_val2 = ts[x1]
for i in range(len(frct_cl_tr[4])):
    new_val2 += frct_cl_tr[4][i] - np.mean(frct_cl_tr[4])
    inv_ts2.append(new_val2)

plt.figure(figsize=(8, 6))
plt.title(str(name) + ' ' + str(date))
plt.plot(ts[:x1].tolist() + inv_ts2, linewidth=1, label='Predicted', color='tomato')
plt.plot(ts[:x1].tolist() + ts[x1:x2].tolist(), linewidth=1, label='True', color='dodgerblue')
plt.axvline(x=x1, linewidth=0.5, color='black')
plt.xlabel('1 min timeframe')
plt.ylabel('Normalized value, close price')
plt.legend()
plt.show()
```



In [ ]:
```
```