Odus C

May 12, 2020

Table of Contents

[1]:
```
# %load_ext autoreload
# %autoreload 2
```

1 Installation

You need to have python 3.7 to run this notebook.

You'll also find that you need some packages. You'll find that out when you run into an `ImportError`. Usually, you can figure google the missing package and find out how to install it. Usually it's just running `pip install THE_PACKAGE_YOU_WANT` in the terminal.

But that only works for "pypi" published packages. Some of the following (my) packages are not published yet.

Here's how to install them (assuming you have python 3.7, pip, and git):

In your python (3.7) environment…

For py2store you can just do: `pip install git+https://github.com/i2mint/py2store`

For ut and hyp you'll have to do a bit more:

Make a projects folder somewhere. Let's say you have it here: `~/py/proj`.

Now go to that folder:

`cd ~/py/proj`

Run `pwd` and copy the full path of the proj folder somewhere warm.

Now do this:

`git clone https://github.com/thorwhalen/ut`

Then

`git clone https://github.com/thorwhalen/hyp`

Then

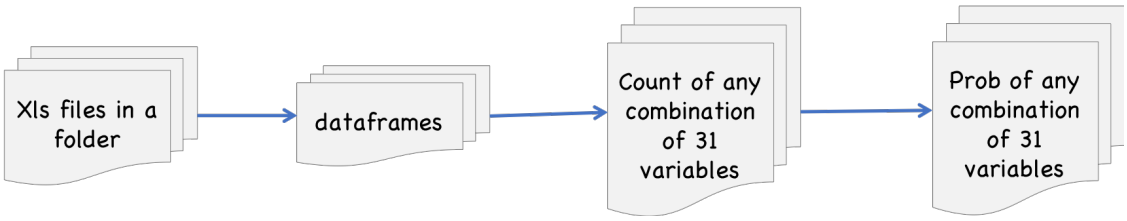
`git clone https://github.com/thorwhalen/odus`

Now add that project folder you saved somewhere to your PYTHONPATH. How? LMGTFY:

https://stackoverflow.com/questions/3402168/permanently-add-a-directory-to-pythonpath

[4]:
```
Image(filename = "odus_store.png", width=800, height=800)
```

[4]:



2 Getting some resources

[1]:
```
from matplotlib.pylab import *
from numpy import *
import seaborn as sns

import os
from py2store.stores.local_store import RelativePathFormatStore
from py2store.mixins import ReadOnlyMixin
from py2store.base import Store
# from ut.util.imports.ipython_utils import *
# from ut.util.imports.data_analysis import *
from odus.analysis_utils import *

from io import BytesIO
from hyp.ppi.pot import Pot, ProbPot
from collections import UserDict, Counter
import numpy as np
import pandas as pd
```

```
from ut.ml.feature_extraction.sequential_var_sets import PVar, VarSet, DfData,␣
 ↪VarSetFactory
from IPython.display import Image

# get odus at https://github.com/thorwhalen/odus
# Depends on https://github.com/thorwhalen/hyp too.
from odus.dacc import DfStore, counts_of_kps, Dacc, plot_life_course,␣
 ↪VarSetCountsStore, \
    mk_pvar_struct, PotStore, _commun_columns_of_dfs, Struct,␣
 ↪mk_pvar_str_struct, \
    VarStr
```

[2]:
```
from odus import data_dir, data_path_of
survey_dir = data_dir
data_dir
```

[2]: '/D/Dropbox/dev/p3/proj/odus/odus/data'

[3]:
```
df_store = DfStore(data_dir + '/{}.xlsx')
len(df_store)
cstore = VarSetCountsStore(df_store)
v = mk_pvar_struct(df_store, only_for_cols_in_all_dfs=True)
s = mk_pvar_str_struct(v)
f, df = cstore.df_store.head()
pstore = PotStore(df_store)
```

3 Poking around

3.1 df_store

A df_store is a key-value store where the key is the xls file and the value is the prepared dataframe

[4]:
```
len(df_store)
```

[4]: 119

[5]:
```
it = iter(df_store.values())
for i in range(5):  # skip five first
    _ = next(it)
df = next(it)  # get the one I want
df.head(3)
```

[5]:

category	RURAL	SUBURBAN	URBAN/CITY	HOMELESS	INCARCERATION	WORK	\
age							
11	0	1	0	0	0	0	
12	0	1	0	0	0	0	

```
13            0         1           0         0              0     0

category  SON/DAUGHTER  SIBLING  FATHER/MOTHER  SPOUSE  …  METHAMPHETAMINE  \
age                                                    …
11                   1        1              0       0  …                0
12                   1        1              0       0  …                0
13                   1        1              0       0  …                0

category  AS PRESCRIBED OPIOID  NOT AS PRESCRIBED OPIOID  HEROIN  \
age
11                           0                         0       0
12                           1                         0       0
13                           0                         0       0

category  OTHER OPIOID  INJECTED  IN TREATMENT  Selects States below  Georgia  \
age
11                   0         0             0                     1        1
12                   0         0             0                     1        1
13                   0         0             0                     1        1

category  Pennsylvania
age
11                   0
12                   0
13                   0

[3 rows x 31 columns]
```

[6]:
```
print(df.columns.values)
```

```
['RURAL' 'SUBURBAN' 'URBAN/CITY' 'HOMELESS' 'INCARCERATION' 'WORK'
 'SON/DAUGHTER' 'SIBLING' 'FATHER/MOTHER' 'SPOUSE'
 'OTHER (WHO?, FILL IN BRACKETS HERE)' 'FRIEND USER' 'FRIEND NON USER'
 'MENTAL ILLNESS' 'PHYSICAL ILLNESS' 'LOSS OF LOVED ONE' 'TOBACCO'
 'MARIJUANA' 'ALCOHOL' 'HAL/LSD/XTC/CLUBDRUG' 'COCAINE/CRACK'
 'METHAMPHETAMINE' 'AS PRESCRIBED OPIOID' 'NOT AS PRESCRIBED OPIOID'
 'HEROIN' 'OTHER OPIOID' 'INJECTED' 'IN TREATMENT' 'Selects States below'
 'Georgia' 'Pennsylvania']
```

[7]:
```
t = df[['ALCOHOL', 'TOBACCO']]
t.head(3)
```

[7]:
```
category  ALCOHOL  TOBACCO
age
11              0        0
12              0        0
13              0        0
```

[8]:
```
c = Counter()
for i, r in t.iterrows():
    c.update([tuple(r.to_list())])
c
```

[8]:
```
Counter({(0, 0): 6, (1, 0): 4, (1, 1): 9, (0, 1): 2})
```

[9]:
```
def count_tuples(dataframe):
    c = Counter()
    for i, r in dataframe.iterrows():
        c.update([tuple(r.to_list())])
    return c
```

[10]:
```
fields = ['ALCOHOL', 'TOBACCO']
# do it for every one
c = Counter()
for df in df_store.values():
    c.update(count_tuples(df[fields]))
c
```

[10]:
```
Counter({(0, 1): 903, (1, 1): 1343, (0, 0): 240, (1, 0): 179})
```

[11]:
```
pd.Series(c)
```

[11]:
```
0  1     903
1  1    1343
0  0     240
1  0     179
dtype: int64
```

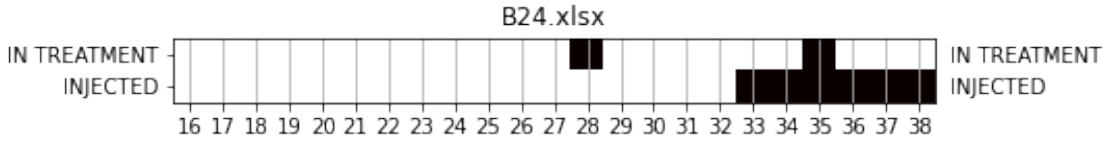
[12]:
```
# Powerful! You can use that with several pairs and get some nice probabilities.
 ↪ Look up Naive Bayes.
```

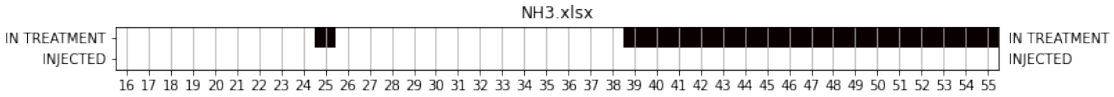
3.2 Making a pdf of trajectories

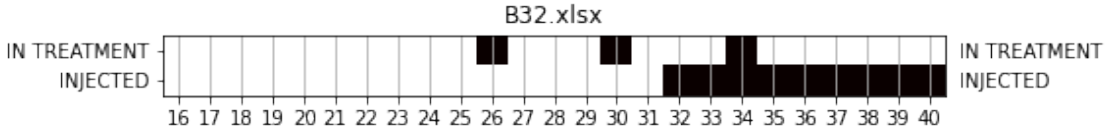
[13]:
```
import itertools
from functools import partial
from ut.pimg.utils import write_images

ihead = lambda it: itertools.islice(it, 0, 5)
```

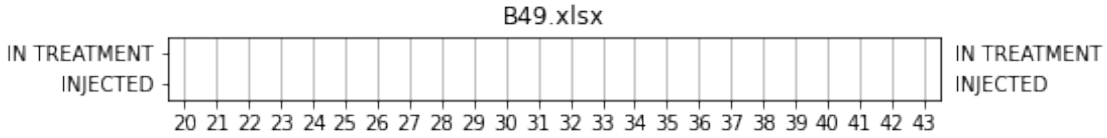
[14]:
```
fields = [s.in_treatment, s.injected]

def plot_life(df, fields=None, title=None, ax=None):
    if fields is None:
        fields = slice(None,None)
    plot_life_course(df[fields], ax=ax);
```

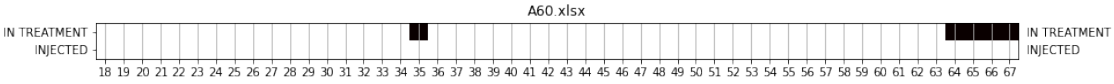
```
    plt.grid(which='both', axis='x')
    if title is not None:
        plt.title(title)
        plt.gca().xaxis.set_tick_params(labeltop=False, labelbottom=True)

axs = list()
for k, df in itertools.islice(df_store.items(), 0, 5):
    plot_life(df, fields, title=k.split('/')[1])
    axs.append(plt.gca())
```









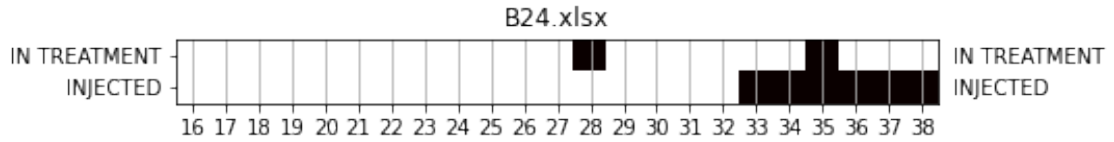


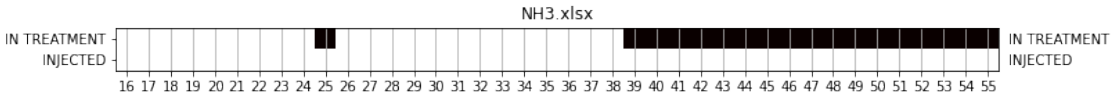
[15]:
```
def write_trajectories_to_file(df_store, fields=None, fp='test.pdf',␣
↪pil_write_format=None,
                               to_pil_image_kwargs=None, **pil_save_kwargs):
```

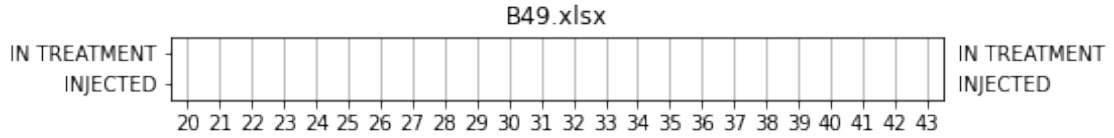
```
    def figs():
#         fig_gen = map(lambda k, df: plot_life(df, fields, title=k.split('/
 ↪')[1]), *zip(*df_store.items()))
        fig_gen = map(lambda k, df: plot_life(df, fields, title=k.split('/
 ↪')[1]), *ihead(zip(*df_store.items())))
        for _ in fig_gen:
            fig = plt.gcf()
            yield fig
            fig.clear()

    write_images(figs(), fp, pil_write_format, to_pil_image_kwargs,␣
 ↪**pil_save_kwargs)
```

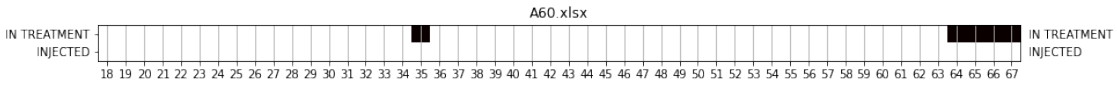
[16]:
```
fig_gen = map(lambda k, df: plot_life(df, fields, title=k.split('/')[1]),␣
 ↪*(zip(*ihead(df_store.items()))))
len(list(fig_gen))
```

[16]: 5









[ ]:

[17]:
```
# write_trajectories_to_file(df_store, fp='test.pdf')
```

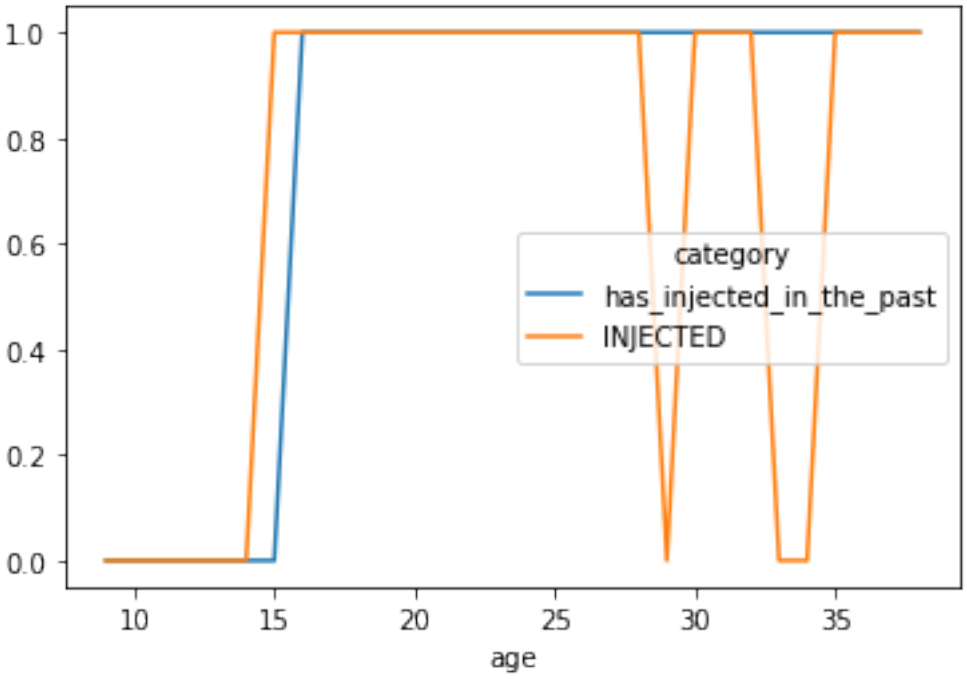
[18]:
```
np.hstack(([False], array(cumsum(df[s.injected]) > 0)[:-1]))
```

[18]:
```
array([False, False, False, False, False, False, False, False, False,
       False, False, False, False, False, False, False, False, False,
       False, False, False, False, False, False, False, False, False,
       False, False, False, False, False, False, False, False, False,
       False, False, False, False, False, False, False, False, False,
       False, False, False, False, False])
```

[19]:
```
k, df = next(itertools.islice(df_store.items(), 7, 100))
print(k)
df['has_injected_in_the_past'] = np.hstack(([False], array(cumsum(df[s.
 ↪injected]) > 0)[:-1])).astype(int)
# plot(df[s.injected], 'r-')
# plot('bo')
df[['has_injected_in_the_past', s.injected]].plot()
```

```
surveys/A21.xlsx
```

[19]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x12b71f4f0>
```



[ ]:

3.3 Demo s and v

[21]:
```
print(list(filter(lambda x: not x.startswith('__'), dir(s))))
```

```
['alcohol', 'as_prescribed_opioid', 'cocaine_crack', 'father_mother',
'hal_lsd_xtc_clubdrug', 'heroin', 'homeless', 'in_treatment', 'incarceration',
'injected', 'loss_of_loved_one', 'marijuana', 'mental_illness',
'methamphetamine', 'not_as_prescribed_opioid', 'other_opioid',
'physical_illness', 'rural', 'sibling', 'son_daughter', 'suburban', 'tobacco',
'urban_city', 'work']
```

[22]:
```
s.heroin
```

[22]: 'HEROIN'

[23]:
```
v.heroin
```

[23]: PVar('HEROIN', 0)

[24]:
```
v.heroin - 1
```

[24]: PVar('HEROIN', -1)

3.4 cstore

[25]:
```
cstore[v.alcohol, v.tobacco]
```

[25]:
```
Counter({(0, 1): 903, (1, 1): 1343, (0, 0): 240, (1, 0): 179})
```

[26]:
```
cstore[v.alcohol, v.tobacco, v.heroin]
```

[26]:
```
Counter({(0, 0, 1): 427,
         (1, 0, 1): 656,
         (1, 1, 1): 687,
         (0, 0, 0): 189,
         (0, 1, 1): 476,
         (0, 1, 0): 51,
         (1, 0, 0): 133,
         (1, 1, 0): 46})
```

[27]:
```
cstore[v.alcohol-1, v.alcohol]
```

[27]:
```
Counter({(0, 0): 994, (1, 1): 1375, (1, 0): 90, (0, 1): 87})
```

[28]:
```
cstore[v.alcohol-1, v.alcohol, v.tobacco]
```

[28]:
```
Counter({(0, 0, 1): 807,
         (1, 1, 1): 1220,
         (1, 0, 0): 26,
         (0, 1, 1): 76,
         (0, 0, 0): 187,
         (1, 1, 0): 155,
         (0, 1, 0): 11,
         (1, 0, 1): 64})
```

3.5 pstore

[29]:
```
t = pstore[s.alcohol-1, s.alcohol]
t
```

[29]:

		pval
ALCOHOL-1	ALCOHOL	
0	0	994
	1	87
1	0	90
	1	1375

[30]:
```
t.tb
```

[30]:
```
   ALCOHOL-1  ALCOHOL  pval
           0        0   994
           0        1    87
           1        0    90
           1        1  1375
```

[31]:
```
t / []
```

[31]:
```
                       pval
ALCOHOL-1 ALCOHOL
0         0        0.390416
          1        0.034171
1         0        0.035350
          1        0.540063
```

[32]:
```
t / t[s.alcohol-1]
```

[32]:
```
                       pval
ALCOHOL-1 ALCOHOL
0         0        0.919519
          1        0.080481
1         0        0.061433
          1        0.938567
```

[33]:
```
tt = pstore[s.alcohol, s.tobacco]
tt
```

[33]:
```
                  pval
ALCOHOL TOBACCO
0       0          240
        1          903
1       0          179
        1         1343
```

[34]:
```
tt / tt[s.alcohol]
```

[34]:
```
                     pval
ALCOHOL TOBACCO
0       0        0.209974
        1        0.790026
1       0        0.117608
        1        0.882392
```

[35]:
```
tt / tt[s.tobacco]
```

[35]:
```
                     pval
ALCOHOL TOBACCO
```

```
0       0       0.572792
1       0       0.427208
0       1       0.402048
1       1       0.597952
```

[ ]:

[ ]:

[ ]:

4 Potential Calculus Experimentations

[36]:
```
# survey_dir = '/D/Dropbox/others/Miriam/python/ProcessedSurveys'
df_store = DfStore(survey_dir + '/{}.xlsx')
len(df_store)
```

[36]: 119

[37]:
```
cstore = VarSetCountsStore(df_store)
v = mk_pvar_struct(df_store, only_for_cols_in_all_dfs=True)
s = mk_pvar_str_struct(v)
f, df = cstore.df_store.head()
df.head(3)
```

[37]:
```
category  RURAL  SUBURBAN  URBAN/CITY  HOMELESS  INCARCERATION  WORK  \
age
16            0         1           0         0              1     0
17            0         1           0         0              0     1
18            0         1           0         0              0     1

category  SON/DAUGHTER  SIBLING  FATHER/MOTHER  SPOUSE  …  \
age                                                    …
16                   1        1              1       0  …
17                   1        1              1       0  …
18                   1        1              1       0  …

category  HAL/LSD/XTC/CLUBDRUG  COCAINE/CRACK  METHAMPHETAMINE  \
age
16                           0              0                0
17                           0              0                0
18                           0              0                0

category  AS PRESCRIBED OPIOID  NOT AS PRESCRIBED OPIOID  HEROIN  \
age
16                           0                         0       0
```

```
17                          0                          1       0
18                          0                          1       0

category  OTHER OPIOID  INJECTED  IN TREATMENT  Massachusetts
age
16                   0         0             0              1
17                   0         0             0              1
18                   0         0             0              1

[3 rows x 29 columns]
```

[38]:
```
cstore = VarSetCountsStore(df_store)
cstore.mk_pvar_attrs()
```

[39]:
```
from odus.dacc import DfStore, counts_of_kps, Dacc, plot_life_course,␣
 ↪VarSetCountsStore, mk_pvar_struct, PotStore
pstore = PotStore(df_store)
pstore.mk_pvar_attrs()
p = pstore[v.homeless - 1, v.incarceration]
p
```

[39]:
```
                          pval
HOMELESS-1 INCARCERATION
0          0              1690
           1               577
1          0               192
           1                87
```

[40]:
```
p / []
```

[40]:
```
                             pval
HOMELESS-1 INCARCERATION
0          0             0.663786
           1             0.226630
1          0             0.075412
           1             0.034171
```

[41]:
```
pstore[v.incarceration]
```

[41]:
```
               pval
INCARCERATION
0              1989
1               676
```

[42]:
```
pstore[v.alcohol-1, v.loss_of_loved_one]
```

[42]:
```
                                pval
ALCOHOL-1 LOSS OF LOVED ONE
0         0                     990
          1                      91
1         0                    1321
          1                     144
```

[43]:
```
tw = pstore[v.tobacco, v.work]
mw = pstore[v.marijuana, v.work]
aw = pstore[v.alcohol, v.work]
w = pstore[v.work]
```

[44]:
```
evid_t = Pot.from_hard_evidence(**{s.tobacco: 1})
evid_m = Pot.from_hard_evidence(**{s.marijuana: 1})
evid_a = Pot.from_hard_evidence(**{s.alcohol: 1})
evid_a
```

[44]:
```
          pval
ALCOHOL
1            1
```

[45]:
```
aw
```

[45]:
```
                pval
ALCOHOL WORK
0       0        431
        1        712
1       0        448
        1       1074
```

[46]:
```
w / []
```

[46]:
```
           pval
WORK
0      0.329831
1      0.670169
```

[47]:
```
(evid_m * mw) / []
```

[47]:
```
                     pval
MARIJUANA WORK
1         0      0.350603
          1      0.649397
```

[48]:
```
(evid_t * tw) / []
```

[48]:
```
                    pval
TOBACCO WORK
1       0     0.313001
        1     0.686999
```

[49]:
```
(evid_a * aw) / []
```

[49]:
```
                    pval
ALCOHOL WORK
1       0     0.29435
        1     0.70565
```

[ ]:

[ ]: