A tutorial of:

```
1) downloading needed files from brain observatory api and converting them
to matlab tables

2) building a brain_observatory_cache object to a) get general information
of the whole brain observatory dataset

b) select sessions by

conditions such as brain

areas, imaging depth and

stimuli

c) download nwb files of selected sessions

3) importing imgaging data from nwb files to a) get fluorescence traces

b) plot fluorescence traces

c) transform the interested

fluorescence trace data of

the interested subexperiment

into raster formats for decoding
```

important information about this dataset:

An "experiment container" (named by allen institute) contains a set of "subexperiments" (defined by us as one subexperiment only adopted one kind of stimuli, allen institue doesn't seem to have a name for this concept) that were operated on a singe mouse, recorded in a single brain space (same targeted_structure and same imaging depth), performed during one out of three sessions (allen institue equates "session" with "ophys_experiment", in allen_sdk they use "ophys_experiment, in whitepapers they use "session").

Different sessions in the same experiment container may have adopted the same stimulus, which means they may share the same type of "subexperiment":

session_by_stimuli.three_session_A =
{'drifting_gratings','natural_movie_one','natural_movie_three','spontaneous_activity'};
session_by_stimuli.three_session_B =
{'static_gratings','natural_scene','natural_movie_one','spontaneous_activity'};
session_by_stimuli.three_session_C =
{'locally_sparse_noise_four_degree','natural_movie_one','natural_movie_two','spontaneous_activity'};
session_by_stimuli.three_session_C2 =
{'locally_sparse_noise_four_degree','locally_sparse_noise_eight_degree', ...
'natural_movie_one','natural_movie_two','spontaneous_activity'};

our shorthand: container = experiment_container

the three names we use: container > session > subexperiment

0)

```
% set your bot_dir
```

```
bot_dir_name = '/om/user/xf15/Brain-Observatory-Toolbox/';

% add path to bot_dir
addpath(bot_dir_name)
```

1) download needed files from brain observatory api and converting them to matlab tables

```
get_files_from_brain_obs_api()

load('references')
```

2) build a brain_observatory_cache object

```
% building a brain_observatory_cache object
boc = brain_observatory_cache (references)
```

```
boc = 
  brain_observatory_cache with properties:

              session_table: [597×14 table]
            container_table: [199×13 table]
     selected_session_table: [597×14 table]
                    stimuli: []
         targeted_structure: []
              imaging_depth: []
               container_id: []
                 session_id: []
               session_type: []
                 references: [1×1 struct]
```

2a) get general information of the whole brain observatory dataset

```
boc.get_total_of_containers()
```

```
ans = 199
```

```
boc.get_all_imaging_depths()
```

```
ans = 11×1 cell array
    '175'
    '265'
    '275'
    '300'
    '320'
    '325'
    '335'
    '350'
    '365'
    '375'
    '435'
```

```
boc.get_all_cre_lines()
```

```
ans = 6×1 cell array
```

```
    'Cux2-CreERT2'
    'Emx1-IRES-Cre'
    'Nr5a1-Cre'
    'Rbp4-Cre_KL100'
    'Rorb-IRES2-Cre'
    'Scnn1a-Tg3-Cre'
```

```
boc.get_all_targeted_structures()
```

```
ans = 6×1 cell array
    'VISal'
    'VISam'
    'VISl'
    'VISp'
    'VISpm'
    'VISrl'
```

```
boc.get_all_session_types()
```

```
ans = 4×1 cell array
    'three_session_A'
    'three_session_B'
    'three_session_C'
    'three_session_C2'
```

```
boc.get_all_stimuli()
```

```
ans = 9×1 cell array
    'drifting_gratings'
    'locally_sparse_noise_eight_degree'
    'locally_sparse_noise_four_degree'
    'natural_movie_one'
    'natural_movie_three'
    'natural_movie_two'
    'natural_scene'
    'spontaneous_activity'
    'static_gratings'
```

```
boc.get_summary_of_container_along_targeted_structures()
```

```
     VISal      33
     VISam      25
     VISl       36
     VISp       54
     VISpm      35
     VISrl      16
```

```
boc.get_summary_of_containers_along_imaing_depths()
```

```
     175      50
     265       1
     275      72
     300       4
     320       1
     325       3
     335       3
     350      33
     365       1
     375      30
     435       1
```

```
boc.get_summary_of_containers_along_depths_and_structures()
```

```
ans = 12×7 table
             VISal    VISam    VISl    VISp    VISpm    VISrl    total
             -----    -----    ----    ----    -----    -----    -----

    175       8        5       10      11      11        5        50
    265       1        0        0       0       0        0         1
    275      12        9       15      20      11        5        72
    300       1        0        1       1       1        0         4
    320       0        1        0       0       0        0         1
    325       0        1        1       0       1        0         3
    335       0        0        0       2       1        0         3
    350       4        4        4      13       4        4        33
    365       1        0        0       0       0        0         1
    375       6        4        5       7       6        2        30
    435       0        1        0       0       0        0         1
    total    33       25       36      54      35       16       199
```

2b) select sessions by conditions such as brain areas, imaging depth and stimuli

```
% Example: search for experiments that primary visual cortex was
% recorded at 275 mm deep as drifting gratings were shown

% reinitialize to have a "clean start"
boc = brain_observatory_cache (references)
```

```
boc = 
  brain_observatory_cache with properties:

             session_table: [597×14 table]
           container_table: [199×13 table]
    selected_session_table: [597×14 table]
                   stimuli: []
        targeted_structure: []
             imaging_depth: []
              container_id: []
                session_id: []
              session_type: []
                references: [1×1 struct]
```

```


% set conditions
boc.get_sessions_by_stimuli('drifting_gratings')
```

```
ans = 
  brain_observatory_cache with properties:

             session_table: [597×14 table]
           container_table: [199×13 table]
    selected_session_table: [199×14 table]
                   stimuli: 'drifting_gratings'
        targeted_structure: []
             imaging_depth: []
              container_id: []
                session_id: []
              session_type: []
                references: [1×1 struct]
```

```
boc.get_sessions_by_targeted_structure('VISp')
```

```
ans = 
  brain_observatory_cache with properties:

             session_table: [597×14 table]
           container_table: [199×13 table]
    selected_session_table: [54×14 table]
                   stimuli: 'drifting_gratings'
        targeted_structure: 'VISp'
             imaging_depth: []
              container_id: []
                session_id: []
              session_type: []
                references: [1×1 struct]
```

```
boc.get_sessions_by_imaging_depth(275)
```

```
ans = 
  brain_observatory_cache with properties:

             session_table: [597×14 table]
           container_table: [199×13 table]
    selected_session_table: [20×14 table]
                   stimuli: 'drifting_gratings'
        targeted_structure: 'VISp'
             imaging_depth: 275
              container_id: []
                session_id: []
              session_type: []
                references: [1×1 struct]
```

```
boc.get_sessions_by_container_id(527550471)
```

```
ans = 
  brain_observatory_cache with properties:

             session_table: [597×14 table]
           container_table: [199×13 table]
    selected_session_table: [1×14 table]
                   stimuli: {4×1 cell}
        targeted_structure: 'VISp'
             imaging_depth: 275
              container_id: 527550471
                session_id: 527745328
              session_type: {'three_session_A'}
                references: [1×1 struct]
```

```

% get more detailed metedata of selected session(s)
boc.selected_session_table
```

```
ans = 1×14 table
     date_of_acquisition      experiment_container_id    fail_eye_tracking        id         imaging_dept
    ______________________    _______________________    _________________    __________    _____________

    '2016-07-08T15:59:05Z'    5.2755e+08                 true                 5.2775e+08    275
```

```

% % you can also use brain_observatory_cache to look up metedata of
% % selected session(s) by container_id or session_id
% %
% boc = brain_observatory_cache(references)
% boc.get_sessions_by_container_id (506823562)
% boc.get_sessions_by_session_id (527676626)
```

2c) download nwb files of selected sessions

```
% download nwb file of the first session in selected sessions into a directory called nwb_file
nwb_dir_name = [bot_dir_name,'nwb_files/'];

% the size of a nwb file is at the scale of 100 MB
boc.get_session_data(nwb_dir_name);
```

```
desired nwb file already exists
```

3 import imgaging data from nwb files

```
% add path to nwb files
addpath ([bot_dir_name, 'nwb_files/'])
```

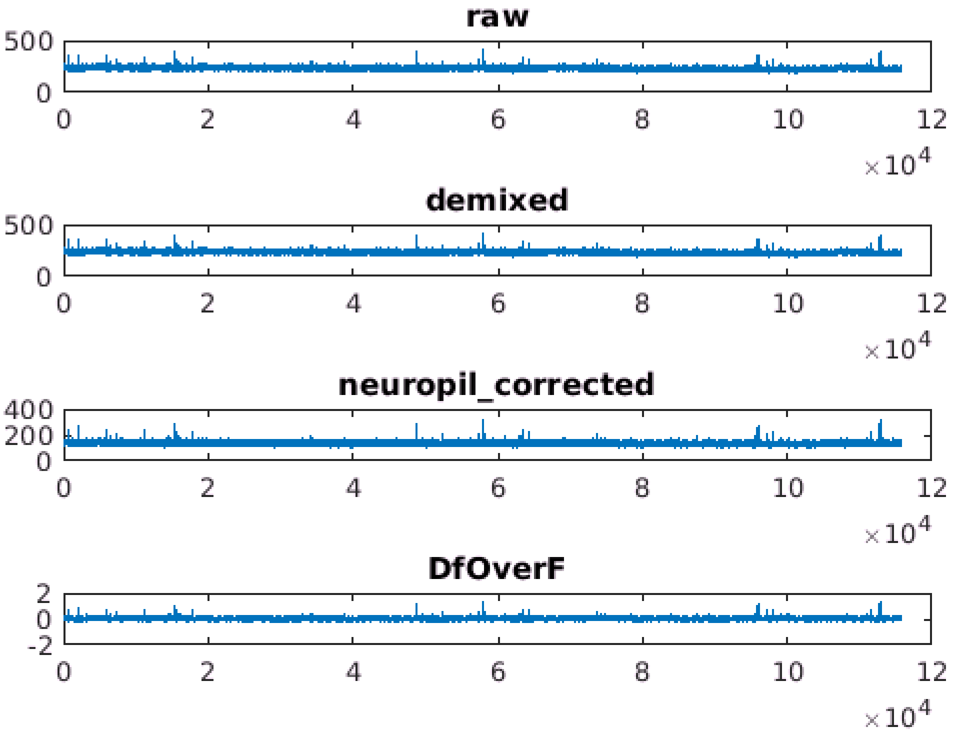
3a) get_fluorescence_traces_of_selected_session

```
[raw,demixed,neuropil_corrected,DfOverF] = get_fluorescence_traces_of_selected_session (boc.se
```

```
Elapsed time is 5.519662 seconds.
```

3b) plot the f traces of one cell in session 517745328

```
cell_specimen_id = 529022196;
plot_fluorecence_traces_of_selected_cell_in_selected_session(boc.session_id,cell_specimen_id);
```



3c) transform data of the selected fluorescence trace of the selected subexperiment into raster format

```
raster_dir_name = [bot_dir_name, 'raster/'];

stimuli = 'drifting_gratings';
fluorescence_trace = DfOverF;

current_raster_dir_name = transform_fluorescenece_trace_into_raster_format(fluorescence_trace,
    boc.session_id, stimuli,raster_dir_name);
```

```
/om/user/xf15/Brain-Observatory-Toolbox/raster/drifting_gratings_527745328/ already exists
```