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) plot fluorescence traces

b) transform them 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) 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 equated session with experiment), that may have adopted the same stimulus as another subexperiment in another session within the same experiment container.

our shorthand: container = experiment_container

the three names we use: container > session > subexperiment

0)

```
% set your base_directory
base_dir_name = '/om/user/xf15/Brain-Observatory-Toolbox/';

% add path to sdk
addpath([base_dir_name, 'sdk/'])
```

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: [648×14 table]
          container_table: [216×13 table]
   selected_session_table: []
                  stimuli: []
        targeted_structure: []
            imaging_depth: []
             container_id: []
               session_id: []
```

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

```
boc.get_total_of_containers()
```

```
ans = 199
```

```
boc.get_all_imaing_depths()
```

```
ans = 12×1 cell array
     '175'
     '250'
     '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   35
    VISam   25
    VISl   38
    VISp   66
    VISpm   36
    VISrl   16

```
boc.get_summary_of_containers_along_imaing_depths()
```

    175   53
    250   1
    265   1
    275   75
    300   4
    320   1
    325   3
    335   3
    350   33
    365   1
    375   40
    435   1

```
boc.get_summary_of_containers_along_depths_and_structures()
```

ans = *13×7 table*

	VISal	VISam	VISl	VISp	VISpm	VISrl	total
175	8	5	10	11	11	5	50
250	0	0	0	0	0	0	0
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

```matlab
% 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: [648×14 table]
            container_table: [216×13 table]
      selected_session_table: []
                     stimuli: []
          targeted_structure: []
               imaging_depth: []
                container_id: []
                  session_id: []
```

```matlab
% set conditions
boc.stimuli = 'drifting_gratings'
```

```
  boc =

    brain_observatory_cache with properties:

              session_table: [648×14 table]
            container_table: [216×13 table]
      selected_session_table: []
                     stimuli: 'drifting_gratings'
          targeted_structure: []
               imaging_depth: []
                container_id: []
                  session_id: []
```

```matlab
boc.targeted_structure = 'VISp'
```

```
  boc =

    brain_observatory_cache with properties:

              session_table: [648×14 table]
            container_table: [216×13 table]
      selected_session_table: []
                     stimuli: 'drifting_gratings'
          targeted_structure: 'VISp'
               imaging_depth: []
                container_id: []
                  session_id: []
```

```matlab
boc.imaging_depth = 275
```

```
  boc =

    brain_observatory_cache with properties:

              session_table: [648×14 table]
            container_table: [216×13 table]
      selected_session_table: []
                     stimuli: 'drifting_gratings'
          targeted_structure: 'VISp'
               imaging_depth: 275
                container_id: []
                  session_id: []
```

```
% %  all filters are optional; all sessions will be returned if no filter
% %  is applied
% %
% % you can also use brain_observatory_cache to look up manifest of
% % selected session(s) by container_id or session_id
% %
% boc = brain_observatory_cache(references)
% boc.container_id = 527550471
% boc.session_id = 527745328

%  pass conditions
boc.get_session()
boc
```

```
  boc =

    brain_observatory_cache with properties:

              session_table: [648×14 table]
            container_table: [216×13 table]
      selected_session_table: [20×14 table]
                    stimuli: 'drifting_gratings'
          targeted_structure: 'VISp'
              imaging_depth: 275
                container_id: []
                  session_id: []
```

```
% get manifest of selected sessions
boc.selected_session_table
```

ans = *20×14 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
'2016-03-24T21:53:32Z'	5.1151e+08	true	5.1021e+08	275
'2016-07-27T22:01:36Z'	5.2896e+08	false	5.3101e+08	275
'2016-07-11T22:27:09Z'	5.2768e+08	false	5.284e+08	275
'2016-01-29T22:34:54Z'	5.1151e+08	false	5.0113e+08	275
'2016-08-17T21:15:59Z'	5.3024e+08	true	5.3967e+08	275
'2016-02-22T19:21:33Z'	5.1151e+08	true	5.0311e+08	275
'2016-02-03T18:27:55Z'	5.1151e+08	true	5.0148e+08	275
'2016-06-20T20:06:13Z'	5.2469e+08	true	5.2469e+08	275
'2016-02-04T23:20:58Z'	5.1151e+08	true	5.0157e+08	275
'2016-02-05T20:11:06Z'	5.1151e+08	true	5.0172e+08	275
'2016-04-07T15:29:01Z'	5.1212e+08	false	5.1227e+08	275
'2016-03-18T15:46:38Z'	5.1151e+08	true	5.0875e+08	275
'2016-08-01T22:51:54Z'	5.3074e+08	true	5.3135e+08	275
'2016-12-12T20:49:52Z'	5.6131e+08	false	5.6131e+08	275
'2016-08-05T15:24:21Z'	5.3182e+08	true	5.3542e+08	275
'2016-08-16T17:41:00Z'	5.3558e+08	true	5.395e+08	275
'2016-02-05T21:15:35Z'	5.1151e+08	false	5.0173e+08	275
'2016-02-17T18:53:08Z'	5.1151e+08	true	5.0261e+08	275
'2016-07-01T15:45:44Z'	5.2648e+08	true	5.2705e+08	275

```
% get id of the first session in the current list for fun
session_id = boc.selected_session_table.id(1)
```

```
session_id = 527745328
```

2c) download nwb files of selected sessions

```
% download nwb file of the first session in selected sessions into a directory called nwb_file
boc.session_id = session_id
```

```
boc =
  brain_observatory_cache with properties:

              session_table: [648×14 table]
            container_table: [216×13 table]
     selected_session_table: [20×14 table]
                    stimuli: 'drifting_gratings'
          targeted_structure: 'VISp'
              imaging_depth: 275
               container_id: []
                 session_id: 527745328
```

```
boc.get_session()
nwb_dir_name = [base_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 ([base_dir_name, 'nwb_files/'])
```

3a) plot fluorescence traces of the selcted cell from the selected session

```
% get fluoroscence traces of all cells in this session and plot ones of
% selected cells
session_id = 527745328;
cell_specimen_id = 529022196;

[raw,demixed,neuropil_corrected,DfOverF] = get_fluorescence_traces (session_id,cell_specimen_i
```
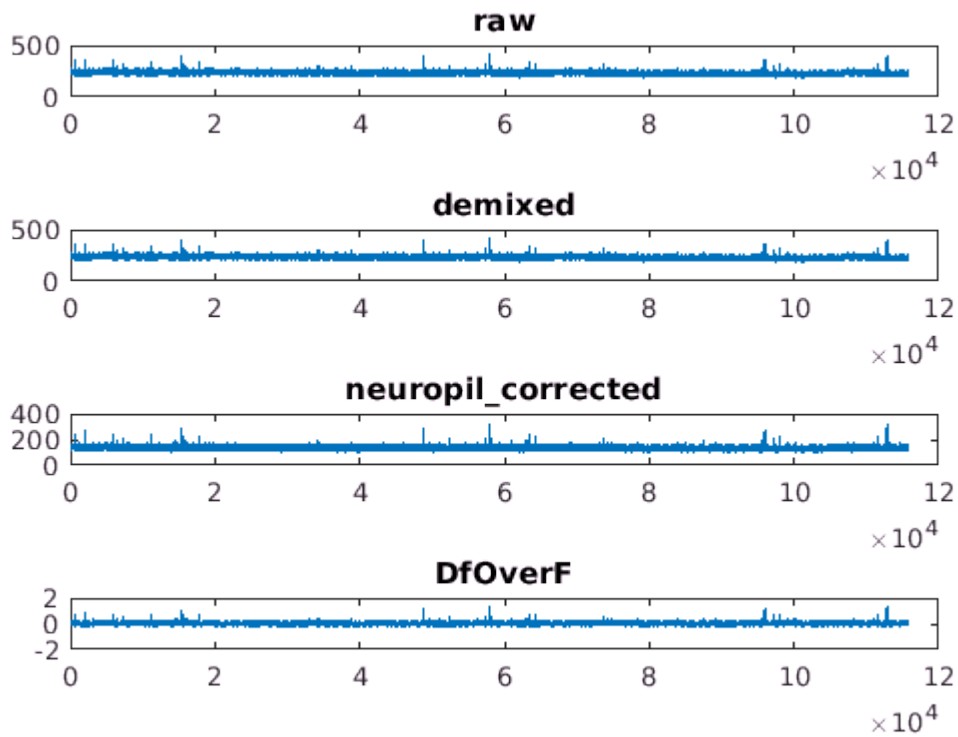
3b) transform data of the selected fluorescence trace of the selected subexperiment into raster format

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

stimuli = 'drifting_gratings';
fluorescence_trace = DfOverF;

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

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