

In [1]:

```
# Import modules
import pandas as pd
from nilearn import input_data
import seaborn as sns
import matplotlib.pyplot as plt
from os.path import normpath
import nideconv
```

In [2]:

```
# Paths
path_data = normpath("I:/fMRI/NROST_data/")
path_masks = normpath("I:/fMRI/NROST_analysis/masks/")
path_subs = normpath("I:/fMRI/NROST_analysis/")
path_save = normpath("I:/fMRI/NROST_analysis/results/")
path_fmriprep = normpath("I:/fMRI/NROST_analysis/derivatives/fmriprep/")
```

In [3]:

```
# Basic parameters
get_data = 1
subjects = [
    '01', '02', '03', '04', '05', '06', '07', '08', '09', '10',
    '11', '13', '15', '16', '17', '18', '19', '20',
    '21', '22', '23', '24'
]
include = ['X', 'Y', 'Z', 'RotX', 'RotY', 'RotZ', 'FramewiseDisplacement',
    u'aCompCor00', u'aCompCor01', u'aCompCor02', u'aCompCor03', u'aCompCor04', u'aCompCor05',
    'Cosine00', 'Cosine01', 'Cosine02', 'Cosine03', 'Cosine04', 'Cosine05']
get_mask = 'anat' # 'func' or 'anat'
interval = [-1.6, 17.3]
t_r = 0.7
```

In [4]:

```

if get_data:
    data_allsubs = []
    data_singlesub = []
    design_allsubs = []
    design_singlesub = []
    confounds_allsubs = []
    confounds_singlesub = []
    for subj in range(len(subjects)):
        subIdx = subjects[subj]
        if get_mask=='func':
            mask = path_masks+'/LOCmask_sub{0}.nii.gz'.format(subIdx)
        elif get_mask=='anat':
            mask = path_masks+'/LOCatlas_resampled.nii.gz'
        masker = input_data.NiftiMasker(mask, t_r=t_r)
        # According to the newest van Driel paper, it is best to do one GLM including
        # the high pass filtering in order to avoid spurious activity.
        # We can do that by using the cosine confound outputs from fmriprep
        # (see http://www.brainvoyager.com/bvqx/doc/UsersGuide/Preprocessing/TemporalHighPa
        # to see some documentation about what they do).
        # So let's not high pass filter the data now but later.
        for run in range(1,9):
            print(path_fmriprep+'/sub-{0}/ses-01/func/sub-{0}_ses-01_task-NRoST_run-{1}_bol
            print(path_subs+'/sub-{0}/ses-01/func/sub-{0}_ses-01_task-NRoST_run-{1}_events.
            print(path_fmriprep+'/sub-{0}/ses-01/func/sub-{0}_ses-01_task-NRoST_run-{1}_bol

            da = masker.fit_transform(path_fmriprep+'/sub-{0}/ses-01/func/sub-{0}_ses-01_ta
            de = pd.read_table(path_subs+'/sub-{0}/ses-01/func/sub-{0}_ses-01_task-NRoST_ru
            co = pd.read_table(path_fmriprep+'/sub-{0}/ses-01/func/sub-{0}_ses-01_task-NRoS
            co = co[include].fillna(method='bfill')

            da = pd.DataFrame(da)
            de = pd.DataFrame(de)
            co = pd.DataFrame(co)

            # Add info
            da['run'] = run
            da['subject'] = int(subIdx)
            de['run'] = run
            de['subject'] = int(subIdx)
            co['run'] = run
            co['subject'] = int(subIdx)
            # Store for all subs
            data_allsubs.append(da)
            design_allsubs.append(de)
            confounds_allsubs.append(co)
            # Store for single sub
            data_singlesub.append(da)
            design_singlesub.append(de)
            confounds_singlesub.append(co)

            # Save individual subjects (does not work yet: not a dataframe so no to_pickle meth
            #data_singlesub.to_pickle(storePath+'data_sub-{0}_{1}.pkl'.format(get_mask))
            #design_singlesub.to_pickle(storePath+'design_sub-{0}_{1}.pkl'.format(get_mask))
            #confounds_singlesub.to_pickle(storePath+'confounds__sub-{0}_{1}.pkl'.format(get_ma
            # Reset individual subject objects
            data_singlesub = []
            design_singlesub = []
            confounds_singlesub = []

```

```

data_allsubs = pd.concat(data_allsubs)
design_allsubs = pd.concat(design_allsubs)
confounds_allsubs = pd.concat(confounds_allsubs)

```

```

I:\fMRI\NROST_analysis\derivatives\fmriprep/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-1_bold_space-MNI152NLin2009cAsym_preproc.nii
I:\fMRI\NROST_analysis/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-1_events.tsv
I:\fMRI\NROST_analysis\derivatives\fmriprep/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-1_bold_confounds.tsv
I:\fMRI\NROST_analysis\derivatives\fmriprep/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-2_bold_space-MNI152NLin2009cAsym_preproc.nii
I:\fMRI\NROST_analysis/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-2_events.tsv
I:\fMRI\NROST_analysis\derivatives\fmriprep/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-2_bold_confounds.tsv
I:\fMRI\NROST_analysis\derivatives\fmriprep/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-3_bold_space-MNI152NLin2009cAsym_preproc.nii
I:\fMRI\NROST_analysis/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-3_events.tsv
I:\fMRI\NROST_analysis\derivatives\fmriprep/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-3_bold_confounds.tsv
I:\fMRI\NROST_analysis\derivatives\fmriprep/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-4_bold_space-MNI152NLin2009cAsym_preproc.nii
I:\fMRI\NROST_analysis/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-4_events.tsv
I:\fMRI\NROST_analysis\derivatives\fmriprep/sub-01/ses-01/func/sub-01_ses-01_task-NROST_run-4_bold_confounds.tsv

```

In [5]:

```

if get_data:
    # Save this, so that we don't have to do it again...
    data_allsubs.to_pickle(path_save+'/data_allSubs_{0}.pkl'.format(get_mask))
    design_allsubs.to_pickle(path_save+'/design_allSubs_{0}.pkl'.format(get_mask))
    confounds_allsubs.to_pickle(path_save+'/confounds_allSubs_{0}.pkl'.format(get_mask))

```

In [6]:

```

# Reload
data_allsubs = pd.read_pickle(path_save+'/data_allSubs_{0}.pkl'.format(get_mask))
design_allsubs = pd.read_pickle(path_save+'/design_allSubs_{0}.pkl'.format(get_mask))
confounds_allsubs = pd.read_pickle(path_save+'/confounds_allSubs_{0}.pkl'.format(get_mask))
design_allsubs.drop(['trial_type', 'duration', 'condition', 'condition_nonTTemplate'], axis=1)
design_allsubs.rename(columns={'trial_type_extended': 'trial_type'}, inplace=True)

```

In [7]:

```

g_model = nideconv.GroupResponseFitter(data_allsubs, design_allsubs, 1/t_r,
                                       concatenate_runs=False, confounds=confounds_allsubs)

```

In [8]:

design\_allsubs

Out[8]:

|     | onset | response_time | correct | trial_type           | run | subject |
|-----|-------|---------------|---------|----------------------|-----|---------|
| 0   | 10.0  | 2608.0        | 1       | positive-dresser-4-1 | 1   | 1       |
| 1   | 29.4  | 1287.0        | 1       | drop-dresser-2-1     | 1   | 1       |
| 2   | 49.0  | 1068.0        | 1       | negative-cow-4-1     | 1   | 1       |
| 3   | 68.6  | 995.0         | 1       | drop-skate-3-1       | 1   | 1       |
| 4   | 88.2  | 2012.0        | 1       | positive-dresser-3-1 | 1   | 1       |
| ... | ...   | ...           | ...     | ...                  | ... | ...     |
| 19  | 382.9 | 3499.0        | 0       | positive-skate-2-4   | 8   | 24      |
| 20  | 402.5 | 2944.0        | 1       | negative-dresser-3-4 | 8   | 24      |
| 21  | 422.1 | 1508.0        | 1       | neutral-skate-4-4    | 8   | 24      |
| 22  | 441.7 | 3498.0        | 0       | drop-skate-3-4       | 8   | 24      |
| 23  | 461.3 | 3109.0        | 1       | drop-dresser-2-4     | 8   | 24      |

4224 rows × 6 columns

In [30]:

data\_allsubs

Out[30]:

|     | 0          | 1          | 2          | 3          | 4          | 5           | 6           |
|-----|------------|------------|------------|------------|------------|-------------|-------------|
| 0   | 562.941772 | 747.344666 | 647.205444 | 915.572876 | 713.356567 | 1139.070557 | 1056.384399 |
| 1   | 566.888611 | 775.104126 | 719.448364 | 842.438477 | 738.645630 | 1093.548828 | 944.219055  |
| 2   | 641.178406 | 759.243958 | 635.827942 | 885.940125 | 743.435791 | 1118.361206 | 1001.020081 |
| 3   | 554.048096 | 754.454773 | 681.388489 | 821.368774 | 733.310730 | 1103.261841 | 946.785217  |
| 4   | 577.731018 | 764.601318 | 695.314331 | 927.124390 | 694.759033 | 1074.117920 | 1064.080078 |
| ... | ...        | ...        | ...        | ...        | ...        | ...         | ...         |
| 695 | 77.609039  | 203.317566 | 199.775055 | 69.487717  | 273.990356 | 342.076508  | 238.554886  |
| 696 | 101.978149 | 217.156647 | 206.234238 | 84.506744  | 268.546448 | 353.257568  | 253.974121  |
| 697 | 94.281921  | 217.835754 | 226.387314 | 96.744934  | 253.371170 | 357.355133  | 255.527283  |
| 698 | 90.250610  | 212.815521 | 211.315933 | 93.491737  | 266.312103 | 341.943390  | 270.396179  |
| 699 | 87.242455  | 206.858383 | 205.845734 | 86.401138  | 260.093109 | 340.541748  | 240.138550  |

123680 rows × 3919 columns

In [31]:

confounds\_allsubs

Out[31]:

|     | X         | Y         | Z         | RotX      | RotY      | RotZ     | FrameworkDisplacement | a        |
|-----|-----------|-----------|-----------|-----------|-----------|----------|-----------------------|----------|
| 0   | 0.000000  | -0.016696 | -0.037026 | 0.000000  | -0.000000 | 0.000000 |                       | 0.131705 |
| 1   | 0.000000  | 0.026362  | 0.039044  | -0.000252 | -0.000000 | 0.000000 |                       | 0.131705 |
| 2   | 0.000000  | 0.026396  | 0.081948  | 0.000000  | -0.000000 | 0.000000 |                       | 0.055516 |
| 3   | -0.000045 | 0.010411  | 0.111841  | -0.000493 | 0.000109  | 0.000000 |                       | 0.076064 |
| 4   | 0.006142  | 0.029510  | 0.081337  | -0.000103 | -0.000442 | 0.000000 |                       | 0.102868 |
| ... | ...       | ...       | ...       | ...       | ...       | ...      |                       | ...      |
| 695 | 0.087986  | 0.248837  | -0.085472 | 0.003185  | 0.000662  | 0.001111 |                       | 0.087224 |
| 696 | 0.076057  | 0.219365  | -0.048455 | 0.003481  | 0.000589  | 0.000972 |                       | 0.103805 |
| 697 | 0.073210  | 0.209885  | -0.042055 | 0.003585  | 0.000912  | 0.000935 |                       | 0.041929 |
| 698 | 0.072388  | 0.245366  | -0.087020 | 0.003575  | 0.000879  | 0.001053 |                       | 0.089368 |
| 699 | 0.079281  | 0.243450  | -0.105564 | 0.003695  | 0.000695  | 0.000985 |                       | 0.045952 |

123680 rows × 21 columns

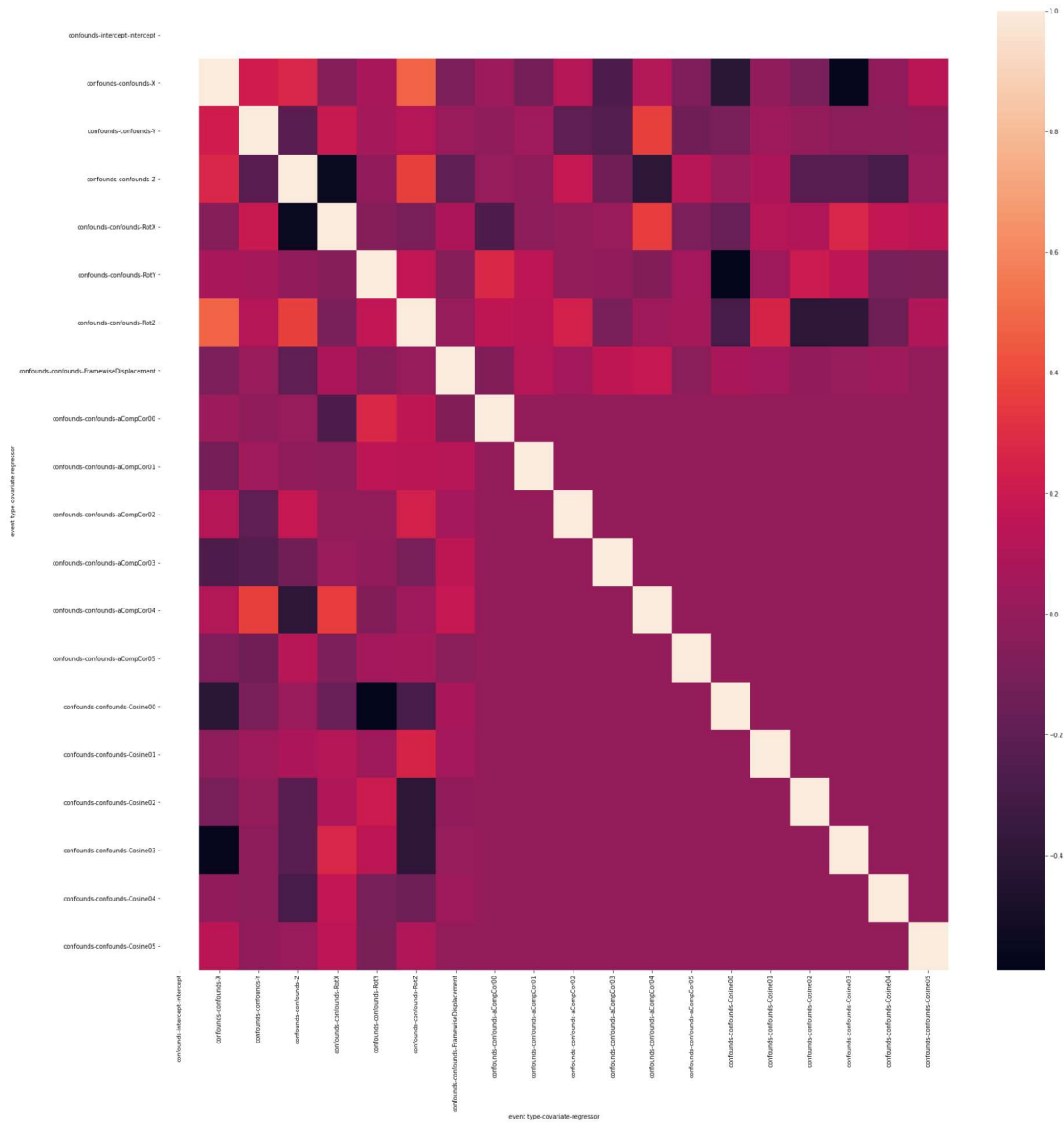
In [53]:

```
for trial_type in design_allsubs.trial_type.unique():
    g_model.add_event(trial_type,
                      interval=interval, basis_set='fourier', n_regressors=9)
```

```
warnings.warn('Event %s is not available for run %s. Event is ignored fo
r this '
C:\Users\Michl\Anaconda3\envs\nideconv\lib\site-packages\nideconv\group_an
alysis.py:157: UserWarning: Event positive-dresser-4-1 is not available fo
r run (2, 6). Event is ignored for this run
  warnings.warn('Event %s is not available for run %s. Event is ignored fo
r this '
C:\Users\Michl\Anaconda3\envs\nideconv\lib\site-packages\nideconv\group_an
alysis.py:157: UserWarning: Event positive-dresser-4-1 is not available fo
r run (2, 7). Event is ignored for this run
  warnings.warn('Event %s is not available for run %s. Event is ignored fo
r this '
C:\Users\Michl\Anaconda3\envs\nideconv\lib\site-packages\nideconv\group_an
alysis.py:157: UserWarning: Event positive-dresser-4-1 is not available fo
r run (2, 8). Event is ignored for this run
  warnings.warn('Event %s is not available for run %s. Event is ignored fo
r this '
C:\Users\Michl\Anaconda3\envs\nideconv\lib\site-packages\nideconv\group_an
alysis.py:157: UserWarning: Event positive-dresser-4-1 is not available fo
r run (3, 1). Event is ignored for this run
  warnings.warn('Event %s is not available for run %s. Event is ignored fo
```

In [20]:

```
sns.heatmap(g_model.response_fitters.iloc[0].X.corr())
plt.gcf().set_size_inches(30,30)
```



In [34]:

```
g_model.fit()
```

In [35]:

```
g_model
```

Out[35]:

```
<nideconv.group_analysis.GroupResponseFitter at 0x13a2347beb0>
```

In [37]:

```
tc = g_model.get_timecourses(oversample=1)
```

In [38]:

```
tc_t = g_model.get_t_value_timecourses(oversample=1)
```

In [39]:

```
tcs = tc.groupby(['run', 'event type', 'covariate', 'time']).mean().mean(1)
```

```
-----
KeyError                                Traceback (most recent call last)
<ipython-input-39-13572f789490> in <module>
----> 1 tcs = tc.groupby(['run', 'event type', 'covariate', 'time']).mean().
mean(1)

~\Anaconda3\envs\nideconv\lib\site-packages\pandas\core\frame.py in groupby
(self, by, axis, level, as_index, sort, group_keys, squeeze, observed)
    5799         axis = self._get_axis_number(axis)
    5800
-> 5801         return groupby_generic.DataFrameGroupBy(
    5802             obj=self,
    5803             keys=by,

~\Anaconda3\envs\nideconv\lib\site-packages\pandas\core\groupby\groupby.py i
n __init__(self, obj, keys, axis, level, grouper, exclusions, selection, as_
index, sort, group_keys, squeeze, observed, mutated)
    401         from pandas.core.groupby.grouper import get_grouper
    402
--> 403         grouper, exclusions, obj = get_grouper(
    404             obj,
    405             keys,

~\Anaconda3\envs\nideconv\lib\site-packages\pandas\core\groupby\grouper.py i
n get_grouper(obj, key, axis, level, sort, observed, mutated, validate)
    598         in_axis, name, level, gpr = False, None, gpr, None
    599         else:
--> 600             raise KeyError(gpr)
    601         elif isinstance(gpr, Grouper) and gpr.key is not None:
    602             # Add key to exclusions
```

**KeyError:** 'event type'

In [40]:

```
tc
```

Out[40]:

```
subject run
```

In [41]:

```
tc_t
```

Out[41]:

```
stat t
```

```
0 1 2 3 4 5 6 7 8 9 ... 3907 3908 3909 3910 3911 3912 3913
```

```
subject run
```

---

0 rows × 3917 columns



In [ ]: