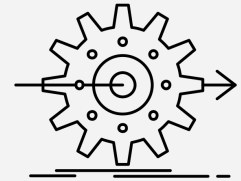
fMRIDenoise:
automated denoising strategies comparison and QC

Karolina Finc, Kamil Bonna
Centre for Modern Interdisciplinary Technologies
Nicolaus Copernicus University in Toruń, Poland

https://github.com/nbraingroup/fmridenoise



Bob

Graduate student

You will work on network analysis of X data. We have Y research question.

Bob
Graduate student

You will work on network analysis of X data. We have Y research question.

Amazing! Sounds so exciting!

Bob
Graduate student

Bob

Graduate student

Denoise the data first!

Bob
Graduate student

Sure, no problem!

Denoise the data first!

Bob
Graduate student

censoring

24 motion parameters

filtering

aCompCor

ICA-AROMA

cerebrospinal fluid

???

scrubbing

framewise displacement

temporal derivatives

despiking

Bob
Graduate student

white matter

global signal

DVARS

6 motion parameters

quadratic terms

Possible scenarios in selecting denoising pipeline

Ask your colleague

No gold standard, no right answer

Check papers

Huge variability
May depend on the data

Compare strategies, select best, and report quality measures

Time consuming

Possible scenarios in selecting denoising pipeline

Ask your colleague

No gold standard, no right answer

Check papers

Huge variability
May depend on the data

fMRIDenoise!

Denoising, pipelines comparison
and FC QC with almost no effort!

fMRIDenoise

+ pybids

fMRIDenoise

+ pybids

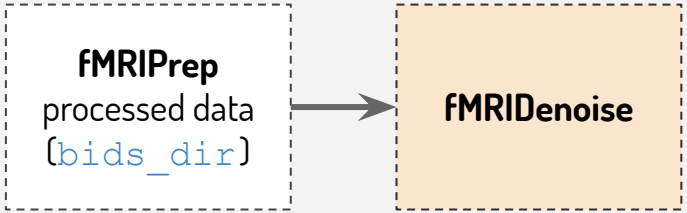
fMRIPrep
processed data
(`bids_dir`)

fMRIDenoise

BIDS
BRAIN IMAGING DATA STRUCTURE
+ pybids

Nipype

ni learn

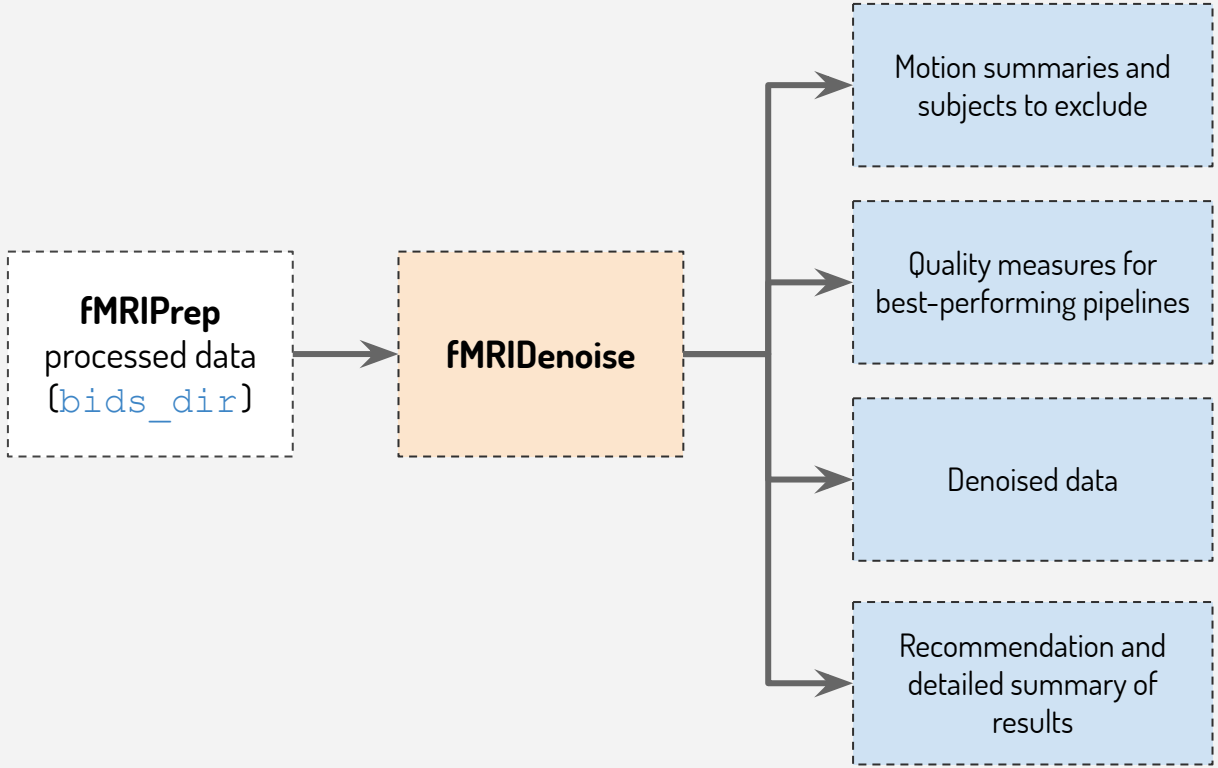


fMRIDenoise

BIDS
BRAIN IMAGING DATA STRUCTURE
+ pybids

Nipype

ni learn



Pipelines

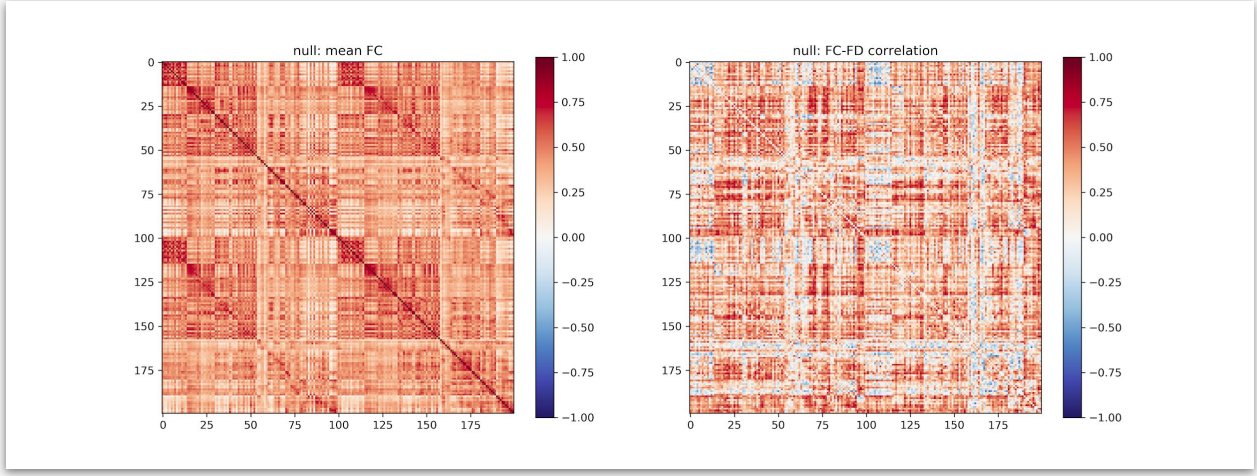
```
├── pipelines
│   ├── pipeline-36_parameters_gs.json
│   ├── pipeline-36_parameters.json
│   ├── pipeline-acomp_cor_gs.json
│   ├── pipeline-acomp_cor.json
│   ├── pipeline-gs.json
│   └── pipeline-null.json
```

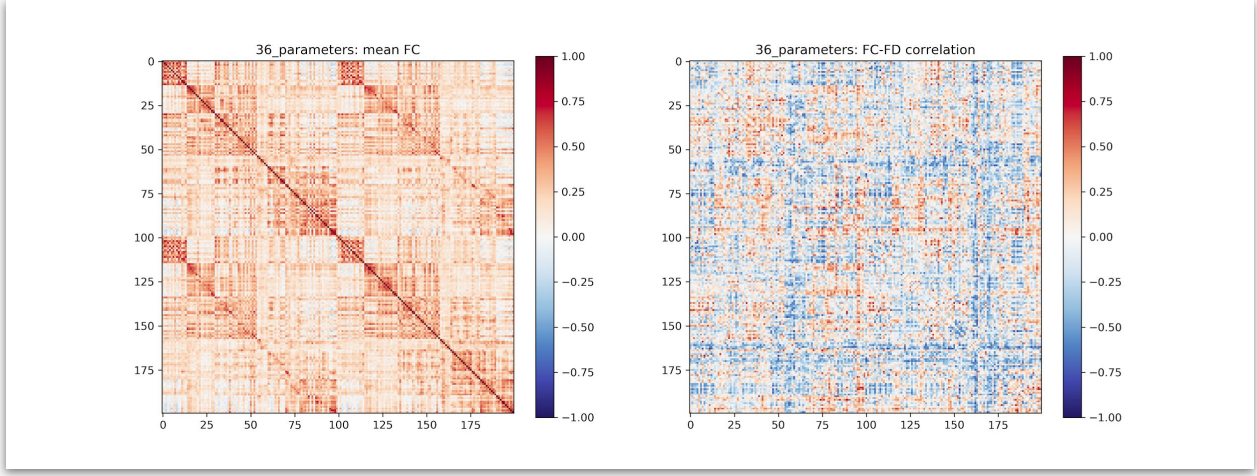

```
{
  "name": "36_parameters_gs",
  "description": "",
  "confounds":
  {
    "wm":
      {"temp_deriv": "True",
       "quad_terms": "True"},
    "csf":
      {"temp_deriv": "True",
       "quad_terms": "True"},
    "gs":
      {"temp_deriv": "True",
       "quad_terms": "True"},
    "motion":
      {"temp_deriv": "True",
       "quad_terms": "True"},
    "acompcor": "False"
  },
  "aroma": "False",
  "spikes":
    {"fd_th": 0.5,
     "dvars_th": 3},
  "filter":
    {"low_pass": 0.08,
     "high_pass": 0.008},
  "detrend": "True",
  "standardize": "True"
}
```



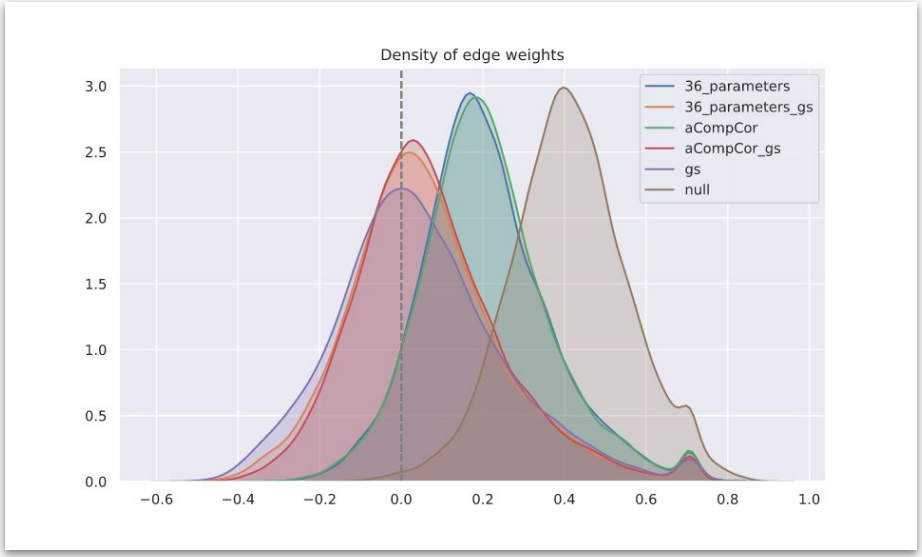
```
{
  "name": "aCompCor",
  "description": "",
  "confounds":
  {
    "wm": "False",
    "csf": "False",
    "gs": "False",
    "motion":
      {"temp_deriv": "True",
       "quad_terms": "True"},
    "acompcor": "True"
  },
  "aroma": "False",
  "spikes":
    {"fd_th": 0.5,
     "dvars_th": 3},
  "filter":
    {"low_pass": 0.08,
     "high_pass": 0.008},
  "detrend": "True",
  "standardize": "True"
}
```

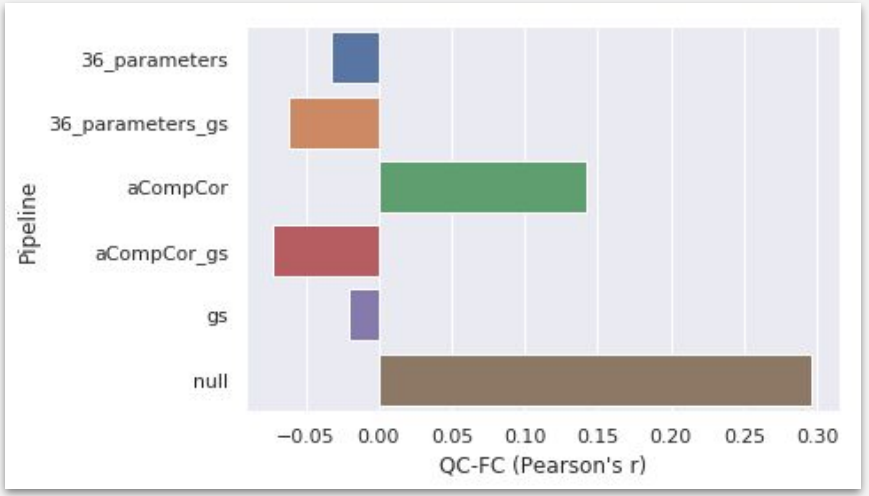
Output

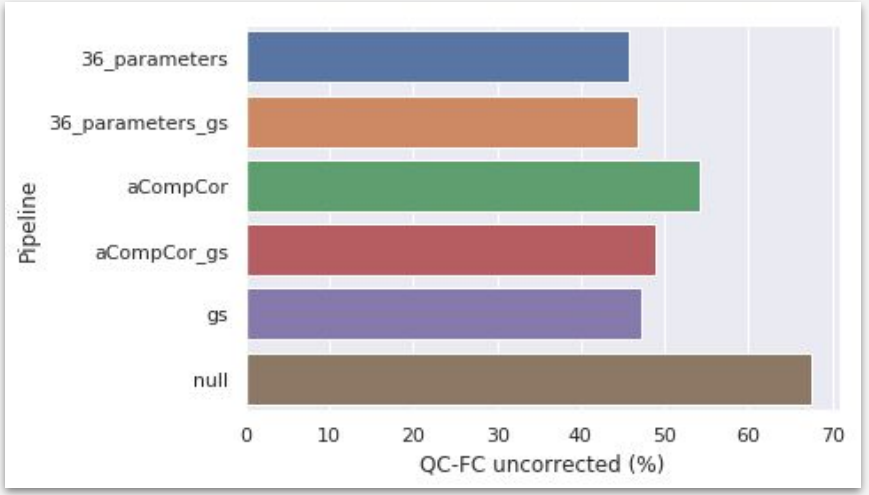

null: mean FC
null: FC-FD correlation
0
25
50
75
100
125
150
175
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00

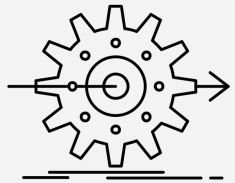

36_parameters: mean FC
36_parameters: FC-FD correlation
0
25
50
75
100
125
150
175
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00

Output


Density of edge weights
36_parameters
36_parameters_gs
aCompCor
aCompCor_gs
gs
null
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
0.8
1.0


Pipeline
36_parameters
36_parameters_gs
aCompCor
aCompCor_gs
gs
null
−0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
QC-FC (Pearson's r)


Pipeline
36_parameters
36_parameters_gs
aCompCor
aCompCor_gs
gs
null
0
10
20
30
40
50
60
70
QC-FC uncorrected (%)

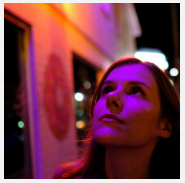


KEEP CALM AND

fMRIDenoise

https://github.com/nbraingroup/fmridenoise

Contributors:



Karolina Finc

Kamil Bonna

Mateusz Chojnowski

You

Acknowledgments:

Russ Poldrack
Oscar Esteban
Rastko Ciric
Włodzisław Duch