

This software provides code to accompany:

Covariance in protein multiple sequence alignments using groups of columns as the fundamental unit for computation - (submitted)

You will need

(1) a recent version of Java (at least 1.6)  
(<http://www.oracle.com/technetwork/java/index.html>)

(2) The McBasc algorithm and COBS algorithm has a requirement for the file Maxhom\_McLachlan.metric. This file should be in the subdirectory "data" where you unzipped the distribution zip file.

(3) There is a file in the src directory of the distribution called Energetics.properties. This file needs to be in a directory in your classpath and needs to be edited so that it points to the correct place on your hard drive

(4) You'll need to edit the Energetics.properties file so that the following lines are defined:

```
# this can be downloaded from
#ftp://ftp.sanger.ac.uk/pub/databases/Pfam/current_release/
# alternatively, run scripts.WriteTruncatedPfamAlignment that will produce a
#file that has only the alignments that COBS will be run over
# (That have >200 sequences, less than 2000 and a matching PDB file).
#FULL_PFAM_PATH=D:\\Pfam\\Pfam-A.full
FULL_PFAM_PATH=c:\\temp\\pfamTruncated.txt.gz

# where the COBS code is installed
COBS_HOME_DIRECTORY=d:\\KyleCleanroom

# A directory to hold PDB files
# PDB_DIR=d:\\pdbDir

# this file is included in the distribution
PDB_PFAM_CHAIN=D:\\git\\cobs\\cobs\\pdbToPfamForCobsViaBlast.txt.gz

# these are where the result files will be held
COBS_CLEANROOM=D:\\COBS_OUT
```

The pfam families that are mapped in our paper are in a file called pdbToPfamForCobsViaBlast.txt.gz included in the distribution. You should set PDB\_PFAM\_CHAIN in the properties file above to point to this file.

(5) Once this has been done if you run

java scripts.DownloadPDBFiles

from the cobs directory in where you downloaded the code, the PDB files that are needed will be downloaded from the PDB database.

(6) Once the PDB files that have been installed, the next step is to generate pairwise (one-D) scores from McBASC. This can be done with

```
java cobsScripts.WriteOneDScores
```

Within the “COBS\_CLEANROOM” directory there will be created a “results” sub-directory and then a “oneD” directory. The results for pairwise McBASC will be put in this directory. (By uncommenting the appropriate lines in WriteOneDScores.main(), oneD scores for ConservationSum, MICovariance and a random control can be generated as needed).

(7) After the oneD scores have been generated, run

```
java cobsScripts.WriteScores
```

For each protein family the following files will be placed in the results directory within COBS\_CLEANROOM

AverageAbsMcBASC.txt.gz — the average from the absolute value of McBASC

AverageAbsMcBASC\_PNormalInitial.txt.gz — the average from the absolute value of McBASCp

AverageConservationSum.txt.gz — The average from conservation sum

AverageConservationSum\_PNormalInitial.txt.gz — The average from conservation sum pnormalized

AverageMI.txt.gz — The average from MI

2OG-FeII\_Oxy\_5\_AverageMI\_PNormalInitial.txt.gz — The average from MI pnormalized

2OG-FeII\_Oxy\_5\_AverageMcBASC.txt.gz — The average McBASC score

2OG-FeII\_Oxy\_5\_AverageMcBASC\_PNormalInitial.txt.gz — The average McBASC p normalized

2OG-FeII\_Oxy\_5\_Averagerandom.txt.gz — A control with scores sampled from the uniform distribution

2OG-FeII\_Oxy\_5\_COBS\_UNCORRECTED.txt.gz — The cobs score.

Note that the normalization in the above files is applied at the pair of column level not the GOC level. So for example, MI scores are generated and then Mlp scores are formed based on phylogenetic correction for each pair of columns and then the average

is taken of the Mlp scores. In principle, phylogenetic correction could also be applied at the GOC level. This is done in the next step.

(8) To generate ROC curves, start by combining all of the scores across each protein family into single files for each algorithm. This is accomplished by:

```
java cobsScripts.AbsoluteScoreVsAverageDistance
```

In the “bigSummaries” folder in COBS\_OUT there will be 4 different files for each algorithm.

For example for McBASC:

`bigAverageMI.txt` – Results from average MI with no  
phylogenetic correction

`bigAverageMI_PNormalInitial.txt` – Results from averaging Mlp scores  
applied at the pair of column level.

`bigAverageMI_normedLate.txt` – Results from averaging uncorrected MI and then  
applying phylogenetic correction at the level of GOC.

`bigAverageMI_PNormalInitial_normedLate.txt` – Results from averging Mlp  
and then again applying phylogenetic correction at the level GOC.

Note that since COBS is only applied at the average level, there are only 2 files for COBS:

`bigCOBS_UNCORRECTED.txt`

`bigCOBS_UNCORRECTED_normedLate.txt`

since COBS doesn't take an average of pairs of columns, the phylogenetic correction cannot be applied prior to taking the average.

(9) Finally to generate ROC curves run:

```
java cobsScripts.RocOnBigTable
```