Getting started with DivNet

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Vignette Info

This vignette will lead you through

- loading the package
- the syntax needed for DivNet to run
- interpreting the output
- inference using DivNet

If there is something that you would like explained please feel free to request it!

Loading the package and data

Download the latest version of the package from github.

```r
### Run the first two lines at home! ####
# install.packages("devtools")
# devtools::install_github("adw96/DivNet")
library(DivNet)
```

Amy loathes dealing with the CRAN moderators, so for the foreseeable future, this package will be available via github only. Bryan is a good sport though, so it may go up there at some point.

Running DivNet

We're going to create a fake mini dataset to illustrate the syntax. If you want to learn about the phyloseq syntax, check out the phyloseq vignette.

The first argument in the syntax is a matrix or data frame containing the matrix of taxa abundances. The samples must be listed in the rows, and the taxa must be listed through the columns, like this:

```r
set.seed(1)
my_counts <- matrix(rpois(30, lambda=10), nrow = 6)
rownames(my_counts) <- paste("Sample", 1:6, sep = "")
colnames(my_counts) <- paste("Taxon", 1:5, sep = "")

my_counts
```

```
##         Taxon1 Taxon2 Taxon3 Taxon4 Taxon5
## Sample1      8     11      8     12      8
## Sample2     10      9     10     10     11
## Sample3      7     14      7      3     14
## Sample4     11     11     12     11      9
## Sample5     14      8     11     13     11
## Sample6     12      2     12      7      9
```

Note that this is for 6 samples with 5 taxa.

Estimating diversity is then as simple as running the following:

```r
estimated_diversities <- divnet(my_counts)
```

```r
estimated_diversities
```

```
## $shannon
## Sample1 Sample2 Sample3 Sample4 Sample5 Sample6
## 1.60432 1.60432 1.60432 1.60432 1.60432 1.60432
##
## $simpson
##  Sample1  Sample2  Sample3  Sample4  Sample5  Sample6
## 0.202027 0.202027 0.202027 0.202027 0.202027 0.202027
##
## $`bray-curtis`
##         Sample1 Sample2 Sample3 Sample4 Sample5 Sample6
## Sample1       0       0       0       0       0       0
## Sample2       0       0       0       0       0       0
## Sample3       0       0       0       0       0       0
## Sample4       0       0       0       0       0       0
## Sample5       0       0       0       0       0       0
## Sample6       0       0       0       0       0       0
##
## $euclidean
##         Sample1 Sample2 Sample3 Sample4 Sample5 Sample6
## Sample1       0       0       0       0       0       0
## Sample2       0       0       0       0       0       0
## Sample3       0       0       0       0       0       0
## Sample4       0       0       0       0       0       0
## Sample5       0       0       0       0       0       0
## Sample6       0       0       0       0       0       0
##
## $`shannon-variance`
##     Sample1     Sample2     Sample3     Sample4     Sample5     Sample6
## 0.000365547 0.000365547 0.000365547 0.000365547 0.000365547 0.000365547
##
## $`simpson-variance`
##     Sample1     Sample2     Sample3     Sample4     Sample5     Sample6
## 6.16577e-05 6.16577e-05 6.16577e-05 6.16577e-05 6.16577e-05 6.16577e-05
##
## $`bray-curtis-variance`
##         Sample1 Sample2 Sample3 Sample4 Sample5 Sample6
## Sample1       0       0       0       0       0       0
## Sample2       0       0       0       0       0       0
## Sample3       0       0       0       0       0       0
## Sample4       0       0       0       0       0       0
## Sample5       0       0       0       0       0       0
## Sample6       0       0       0       0       0       0
##
## $`euclidean-variance`
##         Sample1 Sample2 Sample3 Sample4 Sample5 Sample6
## Sample1       0       0       0       0       0       0
## Sample2       0       0       0       0       0       0
## Sample3       0       0       0       0       0       0
## Sample4       0       0       0       0       0       0
## Sample5       0       0       0       0       0       0
```

```
## Sample6       0        0        0        0        0        0
```

Speeding up DivNet

If you have multiple cores on your computer, you can run one of the commutationally intense steps of the algorithm in parallel by specifying the number of cores you want to use:

```
estimated_diversities <- divnet(my_counts, ncores = 4)
```

```
## Warning: executing %dopar% sequentially: no parallel backend registered
```

Running DivNet with covariates

We're going to create a fake mini dataset to illustrate the abundance table + covariates syntax. Suppose that the first 3 observations belong to one group (e.g., untreated) and the second 3 observations belong to another group (e.g., treated). Our covariate matrix would then look like this:

```
my_covariate <- cbind(1, rep(c(0,1), each = 3))
my_covariate
```

```
##      [,1] [,2]
## [1,]    1    0
## [2,]    1    0
## [3,]    1    0
## [4,]    1    1
## [5,]    1    1
## [6,]    1    1
```

Alternatively, if you had a vector specifying the groups, you could turn it into this matrix in the following way

```
tmt <- rep(c("untreated", "treated"), each = 3)
my_covariate <- model.matrix( ~., data = as.data.frame(tmt))
```

This matrix becomes the second argument to DivNet

```
estimated_diversities_tmt <- divnet(my_counts,
                                    X = my_covariate,
                                    ncores = 4)
```

```
estimated_diversities_tmt
```

```
## $shannon
##  Sample1  Sample2  Sample3  Sample4  Sample5  Sample6 
## 1.595874 1.595874 1.595874 1.601034 1.601034 1.601034 
## 
## $simpson
##   Sample1   Sample2   Sample3   Sample4   Sample5   Sample6 
## 0.2054879 0.2054879 0.2054879 0.2033367 0.2033367 0.2033367 
## 
## $`bray-curtis`
##            Sample1    Sample2    Sample3    Sample4    Sample5    Sample6
## Sample1 0.00000000 0.00000000 0.00000000 0.08343132 0.08343132 0.08343132
## Sample2 0.00000000 0.00000000 0.00000000 0.08343132 0.08343132 0.08343132
## Sample3 0.00000000 0.00000000 0.00000000 0.08343132 0.08343132 0.08343132
## Sample4 0.08343132 0.08343132 0.08343132 0.00000000 0.00000000 0.00000000
## Sample5 0.08343132 0.08343132 0.08343132 0.00000000 0.00000000 0.00000000
```

```
## Sample6 0.08343132 0.08343132 0.08343132 0.00000000 0.00000000 0.00000000
##
## $euclidean
##           Sample1   Sample2   Sample3   Sample4   Sample5   Sample6
## Sample1 0.0000000 0.0000000 0.0000000 0.0954554 0.0954554 0.0954554
## Sample2 0.0000000 0.0000000 0.0000000 0.0954554 0.0954554 0.0954554
## Sample3 0.0000000 0.0000000 0.0000000 0.0954554 0.0954554 0.0954554
## Sample4 0.0954554 0.0954554 0.0954554 0.0000000 0.0000000 0.0000000
## Sample5 0.0954554 0.0954554 0.0954554 0.0000000 0.0000000 0.0000000
## Sample6 0.0954554 0.0954554 0.0954554 0.0000000 0.0000000 0.0000000
##
## $`shannon-variance`
##      Sample1      Sample2      Sample3      Sample4      Sample5
## 0.0016108071 0.0016108071 0.0016108071 0.0002967177 0.0002967177
##      Sample6
## 0.0002967177
##
## $`simpson-variance`
##      Sample1      Sample2      Sample3      Sample4      Sample5
## 2.514551e-04 2.514551e-04 2.514551e-04 4.195189e-05 4.195189e-05
##      Sample6
## 4.195189e-05
##
## $`bray-curtis-variance`
##              Sample1      Sample2      Sample3      Sample4      Sample5
## Sample1 0.0000000000 0.0000000000 0.0000000000 0.0009686296 0.0009686296
## Sample2 0.0000000000 0.0000000000 0.0000000000 0.0009686296 0.0009686296
## Sample3 0.0000000000 0.0000000000 0.0000000000 0.0009686296 0.0009686296
## Sample4 0.0009686296 0.0009686296 0.0009686296 0.0000000000 0.0000000000
## Sample5 0.0009686296 0.0009686296 0.0009686296 0.0000000000 0.0000000000
## Sample6 0.0009686296 0.0009686296 0.0009686296 0.0000000000 0.0000000000
##              Sample6
## Sample1 0.0009686296
## Sample2 0.0009686296
## Sample3 0.0009686296
## Sample4 0.0000000000
## Sample5 0.0000000000
## Sample6 0.0000000000
##
## $`euclidean-variance`
##              Sample1      Sample2      Sample3      Sample4      Sample5
## Sample1 0.0000000000 0.0000000000 0.0000000000 0.0007026497 0.0007026497
## Sample2 0.0000000000 0.0000000000 0.0000000000 0.0007026497 0.0007026497
## Sample3 0.0000000000 0.0000000000 0.0000000000 0.0007026497 0.0007026497
## Sample4 0.0007026497 0.0007026497 0.0007026497 0.0000000000 0.0000000000
## Sample5 0.0007026497 0.0007026497 0.0007026497 0.0000000000 0.0000000000
## Sample6 0.0007026497 0.0007026497 0.0007026497 0.0000000000 0.0000000000
##              Sample6
## Sample1 0.0007026497
## Sample2 0.0007026497
## Sample3 0.0007026497
## Sample4 0.0000000000
## Sample5 0.0000000000
## Sample6 0.0000000000
```

Interpretation

Coming soon