

# Package ‘MMiRKAT’

September 29, 2016

**Type** Package

**Title** Multivariate Microbiome Regression-based Kernel Association Test (MMiRKAT)

**Version** 1.0

**Date** 2016-09-29

**Imports** CompQuadForm, vegan

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**Description** This package tests the association between microbiome community composition and multiple outcomes of interest via the kernel machine regression framework.

**License** GPL (>=2)

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D2K *Distance to Kernel*

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## Description

This function transfer a distance matrix to a kernel matrix

## Usage

D2K(D)

## Arguments

D A distance matrix

**Details**

This function transfers a distance matrix  $D$  to a kernel matrix  $K$  by  $K = -(I - ee'/n)D^2(I - ee'/n)/2$ , where  $I$  is the identity matrix,  $e$  is the column vector of all ones, and  $D^2$  is the element wise matrix square.

**Value**

A kernel matrix of the same dimension as the original distance matrix

**References**

Zhao et al. (2015). Testing in microbiome profiling studies with MiRKAT, the Microbiome Regression-based Kernel Association Test (MiRKAT). *The American Journal of Human Genetics*, 96(5): 797-807

**Examples**

```
library(vegan)
n=200
m=500
OTU=matrix(runif(n*m,0,1),n,m)
D=as.matrix(vegdist(OTU, method="bray"))
D2K(D)
```

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MMiRKAT

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*Multivariate Microbiome Regression-based Kernel Association Test*


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**Description**

This function tests the association between microbiome community composition and multiple outcomes

**Usage**

```
MMiRKAT(Y, X = NULL, K)
```

**Arguments**

Y	Outcome matrix, each row is a sample and each column is an outcome variable
X	Covariate matrix, which is adjusted for testing association between outcomes and microbiome composition
K	Microbiome kernel matrix

**Details**

The function tests the association between overall microbiome composition and multiple outcomes using the kernel machine regression framework

**Value**

A p-value for the testing of association between overall microbiome composition and multiple outcomes after adjusting for the effects of covariates

**References**

- Zhao et al. (2015). Testing in microbiome profiling studies with MiRKAT, the Microbiome Regression-based Kernel Association Test (MiRKAT). *The American Journal of Human Genetics*, 96(5): 797-807
- Zhan, X., Tong, X., Zhao, N., Maity, A., Wu, M.C. and Chen, J. (2016). A small-sample multivariate kernel machine test for microbiome association studies. Technical Report.

**Examples**

```
library(vegan)
library(CompQuadForm)
n=200
p=10
Y=matrix(rnorm(n*p,0,1),n,p)
m=500
OTU=matrix(runif(n*m,0,1),n,m)
D=as.matrix(vegdist(OTU, method="bray"))
K.BC=D2K(D)
MMiRKAT(Y,X=NULL,K.BC)
```

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