

# Package ‘PCAmatchR’

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**Title** Match Cases to Controls Based on Genotype Principal Components

**Version** 0.3.0

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**Description** Matches cases to controls based on genotype principal components (PC).

In order to produce better results, matches are based on the weighted distance of PCs where the weights are equal to the % variance explained by that PC. A weighted Mahalanobis distance metric (Kidd et al. (1987) <DOI:10.1016/0031-3203(87)90066-5>) is used to determine matches.

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**URL** <https://github.com/machiela-lab/PCAmatchR>

**BugReports** <https://github.com/machiela-lab/PCAmatchR/issues>

**Encoding** UTF-8

**LazyData** true

**Depends** R (>= 2.10)

**Suggests** optmatch, testthat, knitr, rmarkdown

**VignetteBuilder** knitr

**RoxygenNote** 7.1.1

**NeedsCompilation** no

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**Repository** CRAN

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eigenvalues_1000G	<i>First 20 eigenvalues of 2504 individuals from the 1000 Genome Project</i>
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**Description**

A sample dataset containing the first 20 eigenvalues calculated from 2504 individuals in the Phase 3 data release of the 1000 Genomes Project. The principal component analysis was conducted using PLINK.

**Usage**

```
eigenvalues_1000G
```

**Format**

A data frame with 20 rows and 1 variable:

**eigen\_values** calculated eigenvalues

**Source**

Machiela Lab

**Examples**

```
eigenvalues_1000G
genome_values <- eigenvalues_1000G
values <- c(genome_values)$eigen_values
```

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eigenvalues_all_1000G	<i>All eigenvalues of 2504 individuals from the 1000 Genome Project</i>
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**Description**

A sample dataset containing all the eigenvalues calculated from 2504 individuals in the Phase 3 data release of the 1000 Genomes Project. The principal component analysis was conducted using PLINK.

**Usage**

```
eigenvalues_all_1000G
```

**Format**

A data frame with 2504 rows and 1 variable:

**eigen\_values** calculated eigenvalues

**Source**

Machiela Lab

**Examples**

```
eigenvalues_all_1000G
genome_values <- eigenvalues_all_1000G
values <- c(genome_values)$eigen_values
```

---

match\_maker

*Weighted matching of controls to cases using PCA results.*

---

**Description**

Weighted matching of controls to cases using PCA results.

**Usage**

```
match_maker(
  PC = NULL,
  eigen_value = NULL,
  data = NULL,
  ids = NULL,
  case_control = NULL,
  num_controls = 1,
  num_PCs = NULL,
  eigen_sum = NULL,
  exact_match = NULL,
  weight_dist = TRUE,
  weights = NULL
)
```

**Arguments**

PC	Individual level principal component.
eigen_value	Computed eigenvalue for each PC. Used as the numerator to calculate the percent variance explained by each PC.
data	Dataframe containing id and case/control status. Optionally includes covariate data for exact matching.

ids	The unique id variable contained in both "PC" and "data."
case_control	The case control status variable.
num_controls	The number of controls to match to each case. Default is 1:1 matching.
num_PCs	The total number of PCs calculated within the PCA. Can be used as the denominator to calculate the percent variance explained by each PC. Default is 1000.
eigen_sum	The sum of all possible eigenvalues within the PCA. Can be used as the denominator to calculate the percent variance explained by each PC.
exact_match	Optional variables contained in the dataframe on which to perform exact matching (i.e. sex, race, etc.).
weight_dist	When set to true, matches are produced based on PC weighted Mahalanobis distance. Default is TRUE.
weights	Optional user defined weights used to compute the weighted Mahalanobis distance metric.

### Value

A list of matches and weights.

### Examples

```
# Create PC data frame by subsetting provided example dataset
pcs <- as.data.frame(PCs_1000G[,c(1,5:24)])
# Create eigenvalues vector using example dataset
eigen_vals <- c(eigenvalues_1000G)$eigen_values
# Create full eigenvalues vector using example dataset
all_eigen_vals<- c(eigenvalues_all_1000G)$eigen_values
# Create Covariate data frame
cov_data <- PCs_1000G[,c(1:4)]
# Generate a case status variable using ESN 1000 Genome population
cov_data$case <- ifelse(cov_data$pop=="ESN", c(1), c(0))
# With 1 to 1 matching
if(!requireNamespace("optmatch", quietly = TRUE)){
  match_maker(PC = pcs,
              eigen_value = eigen_vals,
              data = cov_data,
              ids = c("sample"),
              case_control = c("case"),
              num_controls = 1,
              eigen_sum = sum(all_eigen_vals),
              weight_dist=TRUE
             )
}
```

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PCs_1000G	<i>First 20 principal components of 2504 individuals from the 1000 Genome Project</i>
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**Description**

A sample dataset containing information about population, gender, and the first 20 principal components calculated from 2504 individuals in the Phase 3 data release of the 1000 Genomes Project. The principal component analysis was conducted using PLINK.

**Usage**

PCs\_1000G

**Format**

A data frame with 2504 rows and 24 variables:

**sample** sample ID number

**pop** three letter designation of 1000 Genomes reference population

**super\_pop** three letter designation of 1000 Genomes reference super population

**gender** gender of individual

**PC1** principal component 1

**PC2** principal component 2

**PC3** principal component 3

**PC4** principal component 4

**PC5** principal component 5

**PC6** principal component 6

**PC7** principal component 7

**PC8** principal component 8

**PC9** principal component 9

**PC10** principal component 10

**PC11** principal component 11

**PC12** principal component 12

**PC13** principal component 13

**PC14** principal component 14

**PC15** principal component 15

**PC16** principal component 16

**PC17** principal component 17

**PC18** principal component 18

**PC19** principal component 19

**PC20** principal component 20

**Source**

<https://www.internationalgenome.org>

**Examples**

```
head(PCs_1000G)
genome_PC <- PCs_1000G
# Create PCs
  PC <- as.data.frame(genome_PC[,c(1,5:24)])
head(PC)
```

---

plot\_maker

*Function to plot matches from match\_maker output*

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**Description**

Function to plot matches from match\_maker output

**Usage**

```
plot_maker(
  data = NULL,
  x_var = NULL,
  y_var = NULL,
  case_control = NULL,
  line = T,
  ...
)
```

**Arguments**

data	match_maker output
x_var	Principal component 1
y_var	Principal component 2
case_control	Case or control status
line	draw line
...	Arguments passed to plot

**Value**

None

**Examples**

```
# run match_maker()
# Create PC data frame by subsetting provided example dataset
pcs <- as.data.frame(PCs_1000G[,c(1,5:24)])
# Create eigenvalues vector using example dataset
eigen_vals <- c(eigenvalues_1000G)$eigen_values
# Create full eigenvalues vector using example dataset
all_eigen_vals<- c(eigenvalues_all_1000G)$eigen_values
# Create Covariate data frame
cov_data <- PCs_1000G[,c(1:4)]
# Generate a case status variable using ESN 1000 Genome population
cov_data$case <- ifelse(cov_data$pop=="ESN", c(1), c(0))
# With 1 to 1 matching
library(optmatch)
match_maker_output<- match_maker(PC = pcs,
                                eigen_value = eigen_vals,
                                data = cov_data,
                                ids = c("sample"),
                                case_control = c("case"),
                                num_controls = 1,
                                eigen_sum = sum(all_eigen_vals),
                                weight_dist=TRUE
                                )

# run plot_maker()
plot_maker(data=match_maker_output,
           x_var="PC1",
           y_var="PC2",
           case_control="case",
           line=TRUE)
```

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