

# Package ‘KraljicMatrix’

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**Type** Package

**Title** A Quantified Implementation of the Kraljic Matrix

**Version** 0.2.0

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**Description** Implements a quantified approach to the Kraljic Matrix (Kraljic, 1983, <<https://hbr.org/1983/09/purchasing-must-become-supply-management>>) for strategically analyzing a firm’s purchasing portfolio. It combines multi-objective decision analysis to measure purchasing characteristics and uses this information to place products and services within the Kraljic Matrix.

**URL** <https://github.com/AFIT-R/KraljicMatrix>

**BugReports** <https://github.com/AFIT-R/KraljicMatrix/issues>

**License** MIT + file LICENSE

**Encoding** UTF-8

**LazyData** true

**Depends** R (>= 2.10)

**Imports** ggplot2, dplyr, tibble, magrittr

**Suggests** knitr, rmarkdown, testthat

**VignetteBuilder** knitr

**RoxygenNote** 6.0.1

**NeedsCompilation** no

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geom_frontier	<i>Plotting the Pareto Optimal Frontier</i>
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### Description

The frontier geom is used to overlay the efficient frontier on a scatterplot.

### Usage

```
geom_frontier(mapping = NULL, data = NULL, position = "identity",
  direction = "vh", na.rm = FALSE, show.legend = NA, inherit.aes = TRUE,
  ...)
```

```
stat_frontier(mapping = NULL, data = NULL, geom = "step",
  position = "identity", direction = "vh", na.rm = FALSE,
  show.legend = NA, inherit.aes = TRUE, quadrant = "top.right", ...)
```

### Arguments

mapping	Set of aesthetic mappings created by <code>aes</code> or <code>aes_</code> . If specified and <code>inherit.aes = TRUE</code> (the default), it is combined with the default mapping at the top level of the plot. You must supply mapping if there is no plot mapping.
data	The data to be displayed in this layer.
position	Position adjustment, either as a string, or the result of a call to a position adjustment function.
direction	Direction of stairs: 'vh' for vertical then horizontal, or 'hv' for horizontal then vertical.
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.

show.legend	Logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes.
inherit.aes	If FALSE, overrides the default aesthetics, rather than combining with them. This is most useful for helper functions that define both data and aesthetics and shouldn't inherit behaviour from the default plot specification, e.g. borders.
...	Other arguments passed on to layer. These are often aesthetics, used to set an aesthetic to a fixed value, like color = "red" or size = 3. They may also be parameters to the paired geom/stat.
geom	Use to override the default connection between geom_frontier and stat_frontier.
quadrant	See <a href="#">get_frontier</a> .

## Examples

```
## Not run:

# default will find the efficient front in top right quadrant
ggplot(mtcars, aes(mpg, wt)) +
  geom_point() +
  geom_frontier()

# change the direction of the steps
ggplot(mtcars, aes(mpg, wt)) +
  geom_point() +
  geom_frontier(direction = 'hv')

# use quadrant parameter to change how you define the efficient frontier
ggplot(airquality, aes(Ozone, Temp)) +
  geom_point() +
  geom_frontier(quadrant = 'top.left')

ggplot(airquality, aes(Ozone, Temp)) +
  geom_point() +
  geom_frontier(quadrant = 'bottom.right')

## End(Not run)
```

---

get\_frontier

*Compute the Pareto Optimal Frontier*

---

## Description

Extract the points that make up the Pareto frontier from a set of data.

## Usage

```
get_frontier(data, x, y, quadrant = c("top.right", "bottom.right",
  "bottom.left", "top.left"), decreasing = TRUE)
```

**Arguments**

data	A data frame.
x	A numeric vector.
y	A numeric vector.
quadrant	Character string specifying which quadrant the frontier should appear in. Default is "top.right".
decreasing	Logical value indicating whether the data returned is in decreasing or ascending order (ordered by x and then y). Default is decreasing order.

**Value**

A data frame containing the data points that make up the efficient frontier.

**See Also**

[geom\\_frontier](#) for plotting the Pareto front

**Examples**

```
# default will find the Pareto optimal observations in top right quadrant
get_frontier(mtcars, mpg, wt)

# the output can be in descending or ascending order
get_frontier(mtcars, mpg, wt, decreasing = FALSE)

# use quadrant parameter to change how you define the efficient frontier
get_frontier(airquality, Ozone, Temp, quadrant = 'top.left')

get_frontier(airquality, Ozone, Temp, quadrant = 'bottom.right')
```

---

kraljic\_matrix

*Kraljic matrix plotting function*

---

**Description**

kraljic\_matrix plots each product or service in the Kraljic purchasing matrix based on the attribute value score of x and y

**Usage**

```
kraljic_matrix(data, x, y)
```

**Arguments**

data	A data frame
x	Numeric vector of values
y	Numeric vector of values with compatible dimensions to x

**Value**

A Kraljic purchasing matrix plot

**See Also**

[SAVF\\_score](#) for computing the exponential single attribute value score for x and y

**Examples**

```
# Given the following \code{x} and \code{y} attribute values we can plot each
# product or service in the purchasing matrix:

# to add a new variable while preserving existing data
library(dplyr)

psc2 <- psc %>%
  mutate(x_SAVF_score = SAVF_score(x_attribute, 1, 5, .653),
         y_SAVF_score = SAVF_score(y_attribute, 1, 10, .7))

kraljic_matrix(psc2, x_SAVF_score, y_SAVF_score)
```

---

kraljic_quadrant	<i>Kraljic quadrant assignment function</i>
------------------	---

---

**Description**

kraljic\_quadrant assigns the Kraljic purchasing matrix quadrant based on the attribute value score of x and y

**Usage**

```
kraljic_quadrant(x, y)
```

**Arguments**

x	Numeric vector of values
y	Numeric vector of values with compatible dimensions to x

**Value**

A vector of the same length as x and y with the relevant Kraljic quadrant name

**See Also**

[SAVF\\_score](#) for computing the exponential single attribute value score for x and y

**Examples**

```
# Given the following \code{x} and \code{y} attribute values we can determine
# which quadrant each product or service falls in:

# to add a new variable while preserving existing data
library(dplyr)

psc2 <- psc %>%
  mutate(x_SAVF_score = SAVF_score(x_attribute, 1, 5, .653),
         y_SAVF_score = SAVF_score(y_attribute, 1, 10, .7))

psc2 %>%
  mutate(quadrant = kraljic_quadrant(x_SAVF_score, y_SAVF_score))
```

---

MAVF\_score

*Multi-attribute value function*


---

**Description**

MAVF\_score computes the multi-attribute value score of x and y given their respective weights

**Usage**

```
MAVF_score(x, y, x_wt, y_wt)
```

**Arguments**

x	Numeric vector of values
y	Numeric vector of values with compatible dimensions to x
x_wt	Swing weight for x
y_wt	Swing weight for y

**Value**

A vector of the same length as x and y with the multi-attribute value scores

**See Also**

[MAVF\\_sensitivity](#) to perform sensitivity analysis with a range of x and y swing weights  
[SAVF\\_score](#) for computing the exponential single attribute value score

**Examples**

```
# Given the following \code{x} and \code{y} attribute values with \code{x} and
# \code{y} swing weight values of 0.65 and 0.35 respectively, we can compute
# the multi-attribute utility score:

x_attribute <- c(0.92, 0.79, 1.00, 0.39, 0.68, 0.55, 0.73, 0.76, 1.00, 0.74)
y_attribute <- c(0.52, 0.19, 0.62, 1.00, 0.55, 0.52, 0.53, 0.46, 0.61, 0.84)

MAVF_score(x_attribute, y_attribute, x_wt = .65, y_wt = .35)
```

---

MAVF_sensitivity	<i>Multi-attribute value function sensitivity analysis</i>
------------------	--

---

**Description**

MAVF\_sensitivity computes summary statistics for multi-attribute value scores of x and y given a range of swing weights for each attribute

**Usage**

```
MAVF_sensitivity(data, x, y, x_wt_min, x_wt_max, y_wt_min, y_wt_max)
```

**Arguments**

data	A data frame
x	Variable from data frame to represent x attribute values
y	Variable from data frame to represent y attribute values
x_wt_min	Lower bound anchor point for x attribute swing weight
x_wt_max	Upper bound anchor point for x attribute swing weight
y_wt_min	Lower bound anchor point for y attribute swing weight
y_wt_max	Upper bound anchor point for y attribute swing weight

**Details**

The sensitivity analysis performs a Monte Carlo simulation with 1000 trials for each product or service (row). Each trial randomly selects a weight from a uniform distribution between the lower and upper bound weight parameters and calculates the multi-attribute utility score. From these trials, summary statistics for each product or service (row) are calculated and reported for the final output.

**Value**

A data frame with added variables consisting of sensitivity analysis summary statistics for each product or service (row).

**See Also**

[MAVF\\_score](#) for computing the multi-attribute value score of x and y given their respective weights

[SAVF\\_score](#) for computing the exponential single attribute value score

**Examples**

```
# Given the following data frame that contains \code{x} and \code{y} attribute
# values for each product or service contract, we can compute how the range of
# swing weights for each \code{x} and \code{y} attribute influences the multi-
# attribute value score.

df <- data.frame(contract = 1:10,
  x_attribute = c(0.92, 0.79, 1.00, 0.39, 0.68, 0.55, 0.73, 0.76, 1.00, 0.74),
  y_attribute = c(0.52, 0.19, 0.62, 1.00, 0.55, 0.52, 0.53, 0.46, 0.61, 0.84))

MAVF_sensitivity(df, x_attribute, y_attribute, .55, .75, .25, .45)
```

---

psc

*Product and service contracts*

---

**Description**

A dataset containing a single value score for the x attribute (i.e. supply risk) and y attribute (i.e. profit impact) of 200 product and service contracts (PSC). The variables are as follows:

**Usage**

```
psc
```

**Format**

A tibble with 200 rows and 3 variables:

**PSC** Contract identifier for each product and service

**x\_attribute** x attribute score, from 1 (worst) to 5 (best) in .01 increments

**y\_attribute** y attribute score, from 1 (worst) to 10 (best) in .01 increments



---

`SAVF_plot`*Plot the single attribute value curve*

---

**Description**

SAVF\_plot plots the single attribute value curve along with the subject matter desired values for comparison

**Usage**

```
SAVF_plot(desired_x, desired_v, x_low, x_high, rho)
```

**Arguments**

desired_x	Elicited input x value(s)
desired_v	Elicited value score related to elicited input value(s)
x_low	Lower bound anchor point (can be different than $\min(x)$ )
x_high	Upper bound anchor point (can be different than $\max(x)$ )
rho	Exponential constant for the value function

**Value**

A plot that visualizes the single attribute value curve along with the subject matter desired values for comparison

**See Also**

[SAVF\\_plot\\_rho\\_error](#) for plotting the rho squared error terms

[SAVF\\_score](#) for computing the exponential single attribute value score

**Examples**

```
# Given the single attribute x is bounded between 1 and 5 and the subject matter experts  
# prefer x values of 3, 4, & 5 provide a utility score of .75, .90 & 1.0 respectively,  
# the preferred rho is 0.54. We can visualize this value function:
```

```
SAVF_plot(desired_x = c(3, 4, 5),  
          desired_v = c(.75, .9, 1),  
          x_low = 1,  
          x_high = 5,  
          rho = 0.54)
```

---

SAVF\_plot\_rho\_error     *Plot the rho squared error terms*

---

### Description

SAVF\_plot\_rho\_error plots the squared error terms for the rho search space to illustrate the preferred rho that minimizes the squared error between subject matter desired values and exponentially fitted scores

### Usage

```
SAVF_plot_rho_error(desired_x, desired_v, x_low, x_high, rho_low = 0,
                    rho_high = 1)
```

### Arguments

desired_x	Elicited input x value(s)
desired_v	Elicited value score related to elicited input value(s)
x_low	Lower bound anchor point (can be different than min(x))
x_high	Upper bound anchor point (can be different than max(x))
rho_low	Lower bound of the exponential constant search space for a best fit value function
rho_high	Upper bound of the exponential constant search space for a best fit value function

### Value

A plot that visualizes the squared error terms for the rho search space

### See Also

[SAVF\\_preferred\\_rho](#) for identifying the preferred rho value  
[SAVF\\_score](#) for computing the exponential single attribute value score

### Examples

```
# Given the single attribute x is bounded between 1 and 5 and the subject matter experts
# prefer x values of 3, 4, & 5 provide a utility score of .75, .90 & 1.0 respectively, we
# can visualize the error terms for rho values between 0-1:
```

```
SAVF_plot_rho_error(desired_x = c(3, 4, 5),
                    desired_v = c(.75, .9, 1),
                    x_low = 1,
                    x_high = 5,
                    rho_low = 0,
                    rho_high = 1)
```

---

SAVF\_preferred\_rho      *Identify preferred rho*

---

### Description

SAVF\_preferred\_rho computes the preferred rho that minimizes the squared error between subject matter input desired values and exponentially fitted scores

### Usage

```
SAVF_preferred_rho(desired_x, desired_v, x_low, x_high, rho_low = 0,
  rho_high = 1)
```

### Arguments

desired_x	Elicited input x value(s)
desired_v	Elicited value score related to elicited input value(s)
x_low	Lower bound anchor point (can be different than $\min(x)$ )
x_high	Upper bound anchor point (can be different than $\max(x)$ )
rho_low	Lower bound of the exponential constant search space for a best fit value function
rho_high	Upper bound of the exponential constant search space for a best fit value function

### Value

A single element vector that represents the rho value that best fits the exponential utility function to the desired inputs

### See Also

[SAVF\\_plot\\_rho\\_error](#) for plotting the rho squared error terms  
[SAVF\\_score](#) for computing the exponential single attribute value score

### Examples

```
# Given the single attribute x is bounded between 1 and 5 and the subject matter experts
# prefer x values of 3, 4, & 5 provide a utility score of .75, .90 & 1.0 respectively, we
# can search for a rho value between 0-1 that provides the best fit utility function:
```

```
SAVF_preferred_rho(desired_x = c(3, 4, 5),
  desired_v = c(.75, .9, 1),
  x_low = 1,
  x_high = 5,
  rho_low = 0,
  rho_high = 1)
```

---

SAVF\_score                      *Single attribute value function*

---

### Description

SAVF\_score computes the exponential single attribute value score of x

### Usage

```
SAVF_score(x, x_low, x_high, rho)
```

### Arguments

x	Numeric vector of values to score
x_low	Lower bound anchor point (can be different than $\min(x)$ )
x_high	Upper bound anchor point (can be different than $\max(x)$ )
rho	Exponential constant for the value function

### Value

A vector of the same length as x with the exponential single attribute value scores

### See Also

[SAVF\\_plot](#) for plotting single attribute scores

[SAVF\\_preferred\\_rho](#) for identifying the preferred rho

### Examples

```
# The single attribute x is bounded between 1 and 5 and follows an exponential
# utility curve with rho = .653

x <- runif(10, 1, 5)
x
## [1] 2.964853 1.963182 1.223949 1.562025 4.381467 2.286030 3.071066
## [8] 4.470875 3.920913 4.314907

SAVF_score(x, x_low = 1, x_high = 5, rho = .653)
## [1] 0.7800556 0.5038275 0.1468234 0.3315217 0.9605856 0.6131944 0.8001003
## [8] 0.9673124 0.9189685 0.9553165
```

**Description**

Like dplyr, KraljicMatrix also uses the pipe function, %>% to turn function composition into a series of imperative statements.

**Arguments**

lhs, rhs      An R object and a function to apply to it

**Examples**

```
# given the following \code{psc2} data set
psc2 <- dplyr::mutate(psc, x_SAVF_score = SAVF_score(x_attribute, 1, 5, .653),
                     y_SAVF_score = SAVF_score(y_attribute, 1, 10, .7))

# you can use the pipe operator to re-write the following:
kraljic_matrix(psc2, x_SAVF_score, y_SAVF_score)

# as
psc2 %>% kraljic_matrix(x_SAVF_score, y_SAVF_score)
```

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