

Factor Attribution Module Parameters

1. Function Description

1.1 Solve Pure Factor Returns: processFactor

```
def processFactor(j, q, p, Aeq, beq, retVec, lb, ub)
```

Input:

Parameter	Description
j	Style factor
q	Number of style factors
p	Number of industry factors
Aeq	Contains all factor exposure matrices, with dimensions $(1+p+q) \times n$
beq	Contains all factor exposures, with dimensions $1 \times (1+p+q)$
lb	Lower bound: ensures that the weight coefficients are non-negative
ub	Upper bound: no constraint is applied in this problem
retVec	Stock return vector $1 \times n$

Output: return `f_j` for pure factor `j`

1.2 Pure Factor Portfolio Estimation: pureFactorReturn

```
def pureFactorReturn(dateList, bench, market, styleExpos, industryExpos)
```

Input:

Parameter	Description
dateList	Backtesting period (list of trading days)
bench	Market benchmark information
market	Daily individual stock returns
styleExpos	Style factor exposure matrix table
industryExpos	Industry factor exposure matrix table

Output: pure factor portfolio returns and all factor exposure matrices

Note:

Internally, this function uses `peach` and `each` to parallelize computation across trading days and style factors, respectively, improving computation speed.

1.3 Active Return Attribution: `performanceAttribution`

```
def performanceAttribution(dateList, own, exposTb, purefactorTb)
```

Input:

Parameter	Description
dateList	Backtesting period (list of trading days)
own	Individual stock position weights
exposTb	Table of all factor exposure matrices
purefactorTb	Pure factor portfolio returns

Output: factor contribution residual table, and active factor exposure and portfolio return table

Note:

Internally, this function uses `peach` to parallelize computation across trading days, improving computation speed.

1.4 Active Risk Attribution: `riskAttribution`

```
def riskAttribution(dateList, purefactorTb, factorAttResTb, activeExposReturnTb, windowSize)
```

Input:

Parameter	Description
dateList	Backtesting period (list of trading days)
purefactorTb	Pure factor portfolio returns
factorAttResTb	Factor contribution residual table
activeExposReturnTb	Active factor exposure and portfolio return table
windowSize	Volatility window size

Output: factor risk attribution table

Note:

Internally, this function uses `each` to parallelize computation across style factors, improving computation speed.

1.5 Overall Attribution: attributionFunc

```
def attributionFunc(startDate, endDate, bench, own, market, styleExpos, industryExpos,
windowSize, standard=false)
```

Input:

Parameter	Description
startDate, endDate	Backtesting time range
bench	Market benchmark information
own	Individual stock position weights
market	Daily individual stock returns
styleExpos	Style factor exposure matrix table
industryExpos	Industry factor exposure matrix table
windowSize	Volatility window size
standard	Whether to apply z-score standardization to style factors

Output: a dictionary containing the pure factor returns table, factor contribution residuals table, and active risk attribution table

2. Parameter Structure

2.1 bench — Market Benchmark Information

A table containing market information for the stock portfolio.

Provides basic information for each stock, including market weights, used to calculate portfolio return metrics.

This table must include the following columns:

Column Name	Data Type	Description
date	DATE	Date
symbol	STRING	Stock symbol
weight	DOUBLE	Market weight

2.2 own — Position Weight Table

A table containing position information for the stock portfolio.

Provides basic information for each stock, including position weights, used to calculate portfolio return metrics.

This table must include the following columns:

Column Name	Data Type	Description
date	DATE	Date
symbol	STRING	Stock symbol
weight	DOUBLE	Position Weight

2.3 market — Stock Returns Table

A table containing return information for the stock portfolio.

Provides basic information for each stock, including stock returns, for calculating portfolio return metrics.

This table must include the following columns:

Column Name	Data Type	Description
date	DATE	Date
symbol	STRING	Stock symbol
return	DOUBLE	Stock return

2.4 styleExpos — Style Factor Exposure Table

A table containing style factor exposure information for calculating portfolio return metrics.

This table must include the following columns:

Column Name	Data Type	Description
date	DATE	Date
symbol	STRING	Stock symbol
style_**	DOUBLE	Factor exposure values, with q columns in total

2.5 industryExpos — Industry Factor Exposure Table

A table containing industry factor exposure information for calculating portfolio return metrics.

This table must include the following columns:

Column Name	Data Type	Description
date	DATE	Date
symbol	STRING	Stock symbol
industry_**	INT	Industry exposure values, with p columns in total. For each stock, exactly one exposure column is 1, and all others are 0.

2.6 windowSize — Window Length

Type: INT

Specifies the window length for calculating standard deviations and correlation coefficients in active risk attribution.

2.7 standard — Whether to Standardize

Type: BOOL

Specifies whether to apply z-score standardization to the style factor exposure table.

3. Final Result Description

The output is a **dict** containing three tables with keys for factor returns, active return attribution, and active risk attribution.