# **Building Diversified Portfolios Using Hierarchical Risk Parity Approach**

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10/28/2019

**Abstract:**

In this project, we want to implement and test the Hierarchical Risk Parity (HRP) approach on portfolio construction proposed by Marcos Lopez de Prado in his paper [*Building Diversified Portfolios that Outperform Out-of-Sample*](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2708678). Portfolios with higher risk-adjusted returns are expected to be constructed through HRP compared to traditional methods.

**Algorithm Introduction:**

HRP applies modern mathematics to build a diversified portfolio based on the information contained in the covariance matrix. It does not require the invertibility of the covariance matrix and it can compute a portfolio on an ill-degenerated or even a singular covariance matrix.

The HRP algorithm works in three stages:

1. **Tree clustering:** group similar investments into clusters based on their correlation matrix. Having a hierarchical structure helps us to improve stability issues of quadratic optimizers when inverting the covariance matrix.
2. **Quasi-diagonalization:** reorganize the covariance matrix so similar investments will be placed together. This matrix diagonalization allows us to distribute weights optimally following an inverse-variance allocation.
3. **Recursive bisection:** distribute the allocation through recursive bisection based on cluster covariance.

**Data required:**

We plan to use constituent stocks in S&P 100 index as our sample data from Bloomberg.

**Reference:**

Prado, M. L. D. (2016). Building Diversified Portfolios that Outperform Out of Sample. The Journal of Portfolio Management, 42(4), 59–69. doi: 10.3905/jpm.2016.42.4.059