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Topic: Weekly report (6/10-6/16) – wrap up "Rglpk" optimization

In this week, I implemented the "Rglpk" method. This is a linear programming problem solver, I used it to solve the excepted shortfall optimization.

The excepted shortfall is the mean of loss greater than certain threshold, usually 5% quantile of historical return. Even though it seems like a statistic of historical data, we can transform it into a linear equation form which combined VaR and upper limitation of VaR:

In above equation, is number of observations, aka the length of historical data; is the weight vector; and is the historical data matrix. Since we introduced new variables to optimization equation, we need to set constraints to this new variable. Assume vector . Then we know and . The constraints of weight vector are determined by portfolio constraints. Then in the general linear equation, we have which , and constraint matrix A according to portfolio constraints.

After implemented algorithm, I ran several tests on the new optimization. The test dataset, dim , comes from real stock return (with pmm method datapoint imputation to replace NA value). I compared mean return, ES, ES ratio and running time for five method and got the results as following.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| method | time (s) | mean | ES | Ratio |
| DEoptim | 27.53 | 0 | 0.07 | 0.02 |
| random | 85.91 | 0 | 0.15 | 0.01 |
| pso | 52.69 | 0.01 | 0.99 | 0.01 |
| GenSA | 136.78 | 0 | 1.11 | 0 |
| Rglpk | 6.86 | 0 | 0.1 | 0.02 |

We can see that the Rglpk and DEoptim gave same highest ratio with similar ES and mean. However, DEoptim spent half minute to find the optimized weight while Rglpk only needs 7 seconds. Beside this sample test, I did several test, and found: the Rglpk always gives highest ES Ratio with or without other method; the mean running time for optimization of 10 years historical data on 20 stocks is around 5 seconds; Rglpk needs 5 minutes to optimize 10 years historical data on 1500 stocks while other methods can not process such big dataset.