LUCENA RESEARCH
MACHINE LEARNING TECHNOLOGY
FOR THE STRATEGIC INVESTOR

FINE-TUNE YOUR PORTFOLIO WITH
OPTIMIZER

Fine-tune your portfolio for optimal performance using a scientifically proven approach to balancing risk and return.

About The QuantDesk® Optimizer

The QuantDesk® Optimizer recommends how to allocate your holdings according to your investment style and risk tolerance. Lucena's optimizer enhances the traditional Mean Variance Optimization (MVO) with additional features such as: Minimum and maximum allocation constraints and optional alpha inputs including Lucena's Forecaster or your own forecasts. When used in conjunction with our backtester, the optimizer can be applied to the historical composition of assets in your strategy.

How It Works

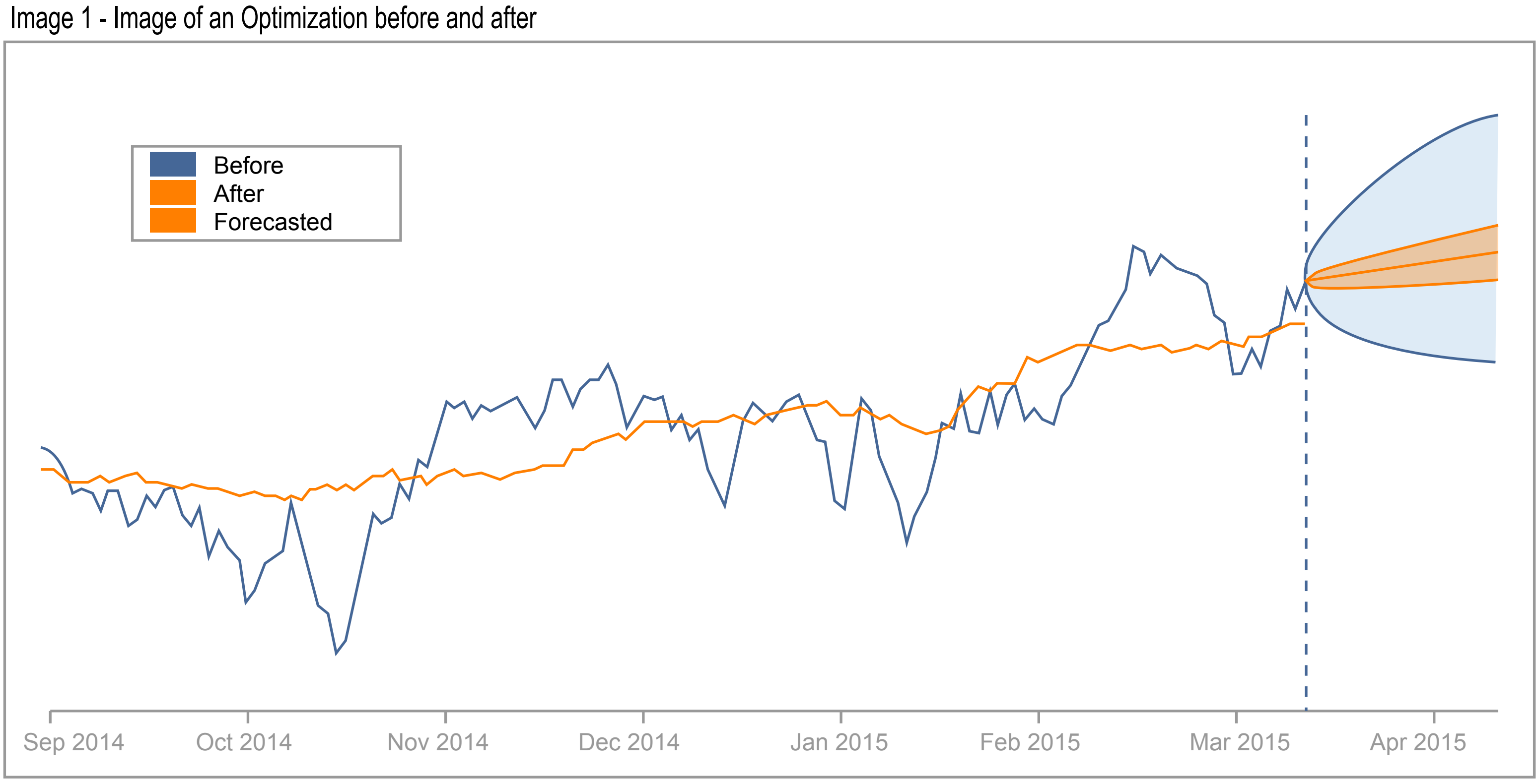
You can apply the optimizer to your portfolio in three easy steps:

1. **Load Your Portfolio:**
It's easy! You can add your portfolio by manually entering your holdings and positions size. Alternatively, you can upload a CSV file, or even connect directly to your brokerage account.

2. **Set Your Optimization Settings:**
Enter min/max constraints, risk tolerance, and one of the available alpha inputs: Historical return, forecast return, or your own sentiment.

3. **Click Optimize and Inspect the Results:**
QuantDesk® provides a tabular and graphical comparison of the pre- and post-optimized portfolio. It is easy to make adjustments and re-run the optimizer. QuantDesk® even provides the transactions needed to transition from your portfolio's old state to the optimized allocation.

Image 1 - Image of an Optimization before and after



Long/Short portfolios? Yes, the QuantDesk® Optimizer supports long only, short only and long/short portfolios. You can even adjust your maximum net exposure or net beta exposure.

Can you backtest? Yes, QuantDesk® comes with a comprehensive market simulation and performance report for an accurate out of sample assessment.

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Other Options and Features

Lucena's Optimizer includes several options and features that enable you to fine-tune your Optimization strategy so that it is most suitable to your investment style and risk tolerance:

Backtesting: Test the Optimizer's efficacy over time and out of sample by turning back time and simulating decisions based only on data available at the time an investment decision would have been made.

Alpha Inputs: You can choose between 3 sources of alpha inputs:

1. **Historical return:** The optimizer assumes future returns will match historical returns.
2. **Price forecaster:** This option is unique to Lucena. The Optimizer can leverage our Machine-Learning-based price projections as the alpha input to our optimizer.
3. **User sentiment:** You can use your own price projections based on your own research.

Include/exclude constituents: You can exclude individual constituents from the optimization. This will force the Optimizer to allocate to other assets in consideration of these fixed holdings.

Min/max allocation constraints: You can set minimum or maximum allocation restriction per position.

Risk goals: 10 risk levels to choose from, ranging from most conservative to most aggressive.

Efficient Frontier visualization: View volatility/return chart and assess your portfolio's position with respect to Markowitz's efficient frontier.

Image 2 - Easy graphical representation of portfolio state before and after optimization.

Attribute	Before	After
Sharpe	1.04	2.77
Volatility	0.35%	0.19%
Lookback Return	5.87%	8.91%
Change $	$10857.42	$12460.14
Change %	0.49%	0.56%
Projected	$2,213,854.36	$2,218,753.44
Created	12/20/14 5:12 PM	
Last Modified	3/5/15 7:04 AM	

Pre-optimization and post optimization comparison view based on in-sample performance.

Improved metrics (Sharpe, Total Return, Volatility) are highlighted if improved by optimization

Image 3 - Efficient Frontier placement before and after optimization as well as the individual constituents.

Easy to use UI to enable configuration based on user's preferences.

MVO's Efficient Frontier with demarkation of before optimization of portfolio and individual constituents and the entire portfolio post optimization.

Attribute	Before	After
Sharpe	1.67	5.95
Volatility	0.37%	0.08%
Lookback Return	4.86%	3.90%
Change $	$2569.68	$1631.04
Change %	0.82%	0.52%
Projected	$316,748.70	$316,205.92
Created	7/15/14 9:08 PM	
Last Modified	3/23/15 10:08 PM	

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