**Course Overview**

* Module 1: Intermediate Data Mining. Building your portfolio database.  Running Performance & Risk Analytics over a 4700 large stock database. Adding technical indicators to the database.
* Module 2: Fundamental Stock Analysis in R.  Running a selection model based on Fundamentals, building screeners and capturing the outcomes in powerful visuals and tables.
* Module 3: Option Pricing & Option Backtesting in R. Back-testing plain vanilla option hedging strategies on portfolios over multi-period timeframes including re-balancing.
* Module 4:  The Efficient Frontier, back-testing the Efficient Frontier, and implementing the Black-Litterman model. Efficient Frontier with own moment functions.
* Module 5: Introduction to Machine Learning for Finance.

**Module 1: Building & Analyzing your Portfolio Database.  Setting up a Dashboard**

**Summary: This module is completely focused on creating your portfolio database efficiently and executing Performance and Risk Analytics on the database. Technical Indicators are calculated for all 4700 stocks. Based on the information Dashboards will be created.**

**Session 1: Building Portfolio DataBase**

* Importing the data from public databases.
* Creating one large database without losing oversight
* Categorizing the data according to MarketCap, Volume & Liquidity
* Calculating Risk metrics for all stocks and adding to the database
* Calculating Technical Indicators and adding to the database
* Running your reports overnight with a Batch File & Windows task scheduler

**Session 2: Risk & Portfolio Interactive Dashboards**

* Introduction to RMD files.
* Quick look at Interactive Graphics, plotly and highcharter packages
* Foundation of flexdashboard package
  + Creating a daily market summary dashboard incorporating World Indices, FX Rates, Interest Rates and selected ETF’s.
  + Running a dashboard for your portfolio
  + Introduction to Shiny (Creating an Interactive tool for the 4700 Stock dataset)

# Module 2: Fundamental Stock Analysis with R.  Dashboards continued

**Summary:** This module is a combination of learning Fundamental Stock Analysis within R, creating overview tables for Sectors, stock score-cards based on Fundamentals, and plotting the results in easy to interpret graphics. Therefore learning to work with packages such as dplyr for Data Manipulation, further extending your knowledge of ggplot2 and plotly for graphics and working with large Data Sets.

# Session 1:  Fundamentals for one Stock

* Building a summary of the Macro-Economic Environment, looking at GDP, Inflation, FX Rates, Interest Rates and Productivity Numbers
* Data Manipulation of Balance-sheet, Cash-Flow & Income Statement numbers
  + Calculating P/E, P/B, Free Cash Flow per Share, ROE, ROA, Debt/Equity, Current Ratio, Quick Ratio, Gross Profit Margins, Buy-Backs etc.
  + Putting it all together in one overview. Plotting the results over time.

# Session 2: Fundamentals Screening for Sectors & Indices

* Creating a score card based on Sector comparison
* Building a screener for fast initial stock selection
* Incorporating own models by creating functions in R
  + Exploring the Discounted Free Cash Cash Flow model

**Module 3: Option Pricing & Back-Testing Option Strategies**

**Summary:** This module is a great way to further one’s understanding of options, getting to grips with Volatility Surfaces, simulate impact of option strategies under different stress scenarios, and conduct option volume analysis based on public data.

**Session 1: Black & Scholes in R**

* Quick introduction to Black & Scholes with R
* Importing Option Data
  + Downloading Option Data from Yahoo
  + Accessing option daily volume through options clearing
  + Importing Monthly Volume Statistics from CBOE
* Calculating the volatility smile from Option Data across tenors
  + Creating an overview of volatility smiles for 50 Stocks
* Creating Sensitivity Analysis for all greeks based on ITM-ness
* Running a simple Monte Carlo for Option MTM
* Exploring the currently available packages for pricing American Options, Asian Options and exploring stochastic volatility.

**Session 2: Backtesting Option Strategies**

* Historical Analysis of Volatility Surface movements in Time
* Laying down the foundation for Option Backtesting
  + Looking at the change in Time Value
  + Looking at the change in Vol surface when rolling down the surface
  + Analyzing the moment of rolling over your hedge
* Back-testing implemented
  + Writing functions required for back testing

# Module 4: Efficient Frontier & Black-Litterman in R

**Summary:** This module provides great insights into calculating the Efficient Frontier, based on different Risk measures, such as Std.Dev, VaR, CVaR and Drawdowns, understanding the impact of using varying historical time-windows as input, and analyzing the impact of different constraints. The module also focuses on built in functionality for back-testing the application of the Efficient Frontier over time including rebalancing of the Frontier. Incorporating one’s own moment function for the Efficient Frontier is also demonstrated. The module ends with the implementation of the Black-Litternman model in R.

**Session 1: Return & Risk Metrics**

* Calculating VaR, CVaR, Drawdowns and several risk ratios
* Calculating & Visualizing the Co-Variance & Correlation matrices
* Calculating & Plotting the Efficient Frontier based on varying constraints and different Risk Metrics, such as Variance, CVaR and Drawdowns. Calculations are done for
  + Dow Jones Industrial Average constituents
  + Selected portfolio of US based ETF’s

**Session 2: Backtesting the Efficient Frontier assumptions and constraints**

* Setting the parameters and assumptions for Back-Testing
* Initial basic backtest
* Analyzing the impact of varying input assumptions, such as
  + Historical time horizons used for estimating the Return & Risk metrics.
  + Rebalancing frequency
  + Smoothing parameters wrt Rebalancing

**Session 3: Implementation of Black-Litterman model**

**Module 5: Machine Learning for Finance**

**Summary:** This module is an introductory course to Machine Learning for Investment Analytics. An overview of Machine Learning is provided covering various algorithms. The course covers the split between Supervised and Unsupervised learning, the three categories of regression, classification and clustering and applies this to Investment Analytics.

# Session 1: Overview Machine Learning

* Understanding Supervised versus Unsupervised, Parametric and Non-parametric models, looking into Regression, Classification and Clustering
* Overview of Research on the topic of Machine Learning
* Introduction to Machine Learning packages in R

# Session 2: Applied Machine Learning for Finance

* Linear and Logistic Regression
* Lasso & Ridge Regression
* Support Vector Machines
* Decision Trees and Random Forest