HKUST FYP 2011-2012
Application of
Artificial Intelligence Algorithms
in Quantitative Finance

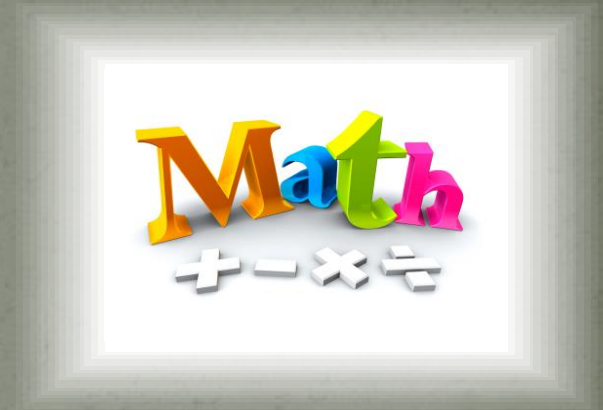Numerical Method Inc. Ltd.

URL: http://www.numericalmethod.com

Presented by Ken Yiu

Who are we?

- Numerical Method Inc. is a company specializing in mathematical modeling and algorithms, esp. in quantitative finance
  - Provide an easy-to-use, object-oriented and extensible API for numerical algorithms
- Research consulting in quantitative trading & program trading

What do we do?

Start with a vague trading intuition

Using mathematics, turn the idea into a quantitative model for analysis

Implement the model on computer systems for back-testing, refinement and systematic trading

AlgoQuant – *the* integrated trading research tool

Features

- historical data sources, Yahoo!, FX rates
- trading signal library
- strategy template
- in-sample strategy calibration
- out-sample back-testing
- performance analysis
- and many more…

SuanShu (算數) – *the* Java numerical library

Algebra

- matrix elementary operations, decomposition & factorization
- vector and vector space
- dense & sparse matrix solvers
- complex number
- continued fraction
- interval arithmetic

Analysis / Calculus

- polynomial & Jenkins-Traub
- root finding
- special functions
- univariate/multivariate differentiation
- finite difference
- numerical integration
- interpolation

Statistics

- OLS & logistic regression
- GLM regression & model selection
- signal processing & filters
- descriptive & ranking statistics
- linear random number generators
- various random distributions
- univariate/multivariate timeseries analysis
- hypothesis testing
- Brownian motion
- stochastic differentiation equations
- SDE integration
- cointegration
- Markov chain
- hidden Markov model

Optimization

- least P-th minmax optimization
- Nelder-Mead optimization
- unconstrained optimization
- univariate optimization
- and many more...

New Project

- *Objective*: To design and implement a Java library of common AI algorithms such as genetic algorithms, artificial neural networks, support vector machines, etc. for quantitative finance, esp. high frequency data

- *Scope & Deliverables*:
  - Easy-to-read & extensible implementation of the API
  - Comprehensive Javadoc documentation
  - Extensive JUnit testcases for proving the correctness of your code
  - Performance improvement by exploiting the power of multi-core CPUs and GPUs (if time permits)

Benefits

- Study AI basics using your FYP credits
  - Excellent opportunity for students who plan to do research in AI or get into finance

- Practice your Java programming skill

- Improve your object-oriented programming & API design skills

- Get a job offer if you are good
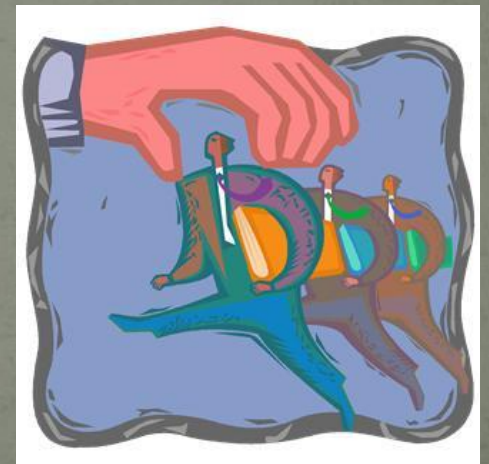
Requirements

- Group size: 2~4
- Interested in AI
- Strong self-learning capability
- Self-motivated & detail-oriented
- Proficient in Java and OO programming

Q & A