

## 2005 "Herbert Simon 系列講座 " 之五

### Genetic Programming in Computational Finance

主講人：Prof. Edward Tsang

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主辦單位：政治大學社會科學學院、經濟系、暨人工智慧經濟學研究中心

逢甲大學商學院、真理大學財金系、暨資管系

協辦單位：中華民國人工智慧學會

各位先進：

2005 "Herbert Simon 系列講座 " 之五 - Genetic Programming in Computational Finance ( **HSSS 2005, Series #5** ) 即將於 **11 月15 日至 11 月19 日** 在台北真理大學、政治大學及台中逢甲大學正式舉行，由國際知名學者英國埃塞克斯郡大學教授 Dr. Edward Tsang 主講！期待您撥冗參加！

"Herbert Simon 系列講座 " 乃為紀念 Herbert Simon 而設，Herbert Simon 為 1975 年電腦科學界中之殊榮 -- 杜林獎 (A. M. Turing Award) – 之得獎人暨 1978 年諾貝爾經濟學獎得主，並於 1993 年因對心理學的終生傑出貢獻而榮獲美國心理學會獎 (American Psychological Association's Award)，他率先於經濟學中建立「有限理性」的概念，並利用電腦演算來了解及測試「有限理性」的行為及決策模式，不但開啓了「行為經濟學」的大門，並為日後跨科際、跨學界的「計算智慧」奠定了先機。

計算智慧 (Computational Intelligence ) 為一系列專門技術之統稱，包含了類神經網路、模糊邏輯、演化計算等，且為計算經濟學與計算財務學中最重要的工具之一。在過去的十年間，計算智慧已被廣泛地應用在各類經濟與財務之模型、預測、與分析上。其中最顯著的應用便是在財務資料探勘 ( Financial Data Mining ) 與代理人基計算經濟 ( Agent-Based Computational Economics ) 的研究域領中。

講座學者簡介：

Dr. Edward Tsang 任教於英國埃塞克斯郡大學，電腦科學系 (Department of Computer Science, University of Essex)，是目前將遺傳規劃 (GP, genetic programming) 應用在財務市場有卓越成就的專家之一。Dr.

Tsang 是計算財務及經濟代理人中心(CCFEA, <http://www.cfea-labs.net>) 副主任。CCFEA 是跨學科的研究中心，把人工智慧方法用在財務及經濟學方面問題。已經取得許多單位的合作。教授在埃塞克斯郡大學建立並領導限制條件滿意和最優化研究群和計算財務研究群(Constraint Satisfaction and Optimisation Research Group and the Computational Finance Research Group)。他對人工智慧方法的研究興趣十分廣泛，包括啓發式的搜尋、計算財務、經濟代理人、限制條件最適化、組合最優化、排程、演化的計算以及自動化競價。都是目前熱門的研究課題。Dr. Tsang 的演講，將會對台灣計算財務學及社會科學之研究，帶來莫大的幫助，本次系列演講，我們十分榮幸能邀請到 Dr. Tsang。

講座議程：

**主題:** Genetic Programming in Computational Finance

場次	時間	地點	講題
1	11/15 (二) 1:30pm – 3:30pm	真理大學 管理學院十樓演講廳	GP in Computational Finance, Overview
2	11/16 (三) 1:30pm – 3:30pm	真理大學 管理學院十樓演講廳	EDDIE for Financial Forecasting
3	11/16 (三) 7:00pm – 10:00pm	政治大學 綜合院館 271034 室	EDDIE in Arbitrage
4	11/17 (四) 2:00pm – 4:30pm	逢甲大學 商學大樓 804B 室	GP in Automated Bargaining
5	11/19 (六) 2:00pm – 5:00pm	政治大學 綜合院館 271034 室	GP in Artificial Markets

課程大綱：

### **Genetic Programming in Computational Finance**

#### Lecture 1 - GP in Computational Finance, Overview

- What is Genetic Programming?
- What is Computational Finance?
- Why is genetic programming useful for computational finance?
- Overview of GP applications in computational finance
  - Financial forecasting
  - Automated bargaining
  - Artificial markets

## Lecture 2 - EDDIE for financial forecasting

- Financial forecasting, the research agenda
- Basic financial forecasting (collaboration with Korczak)
- EDDIE: a genetic programming forecasting tool (architecture)
- Data preparation
- How to assess results?
- Experimental results
- Using constraints to guide the search

## Lecture 3 - EDDIE in arbitrage

- What is financial arbitrage?
- How can EDDIE help to find arbitrage opportunities?
- EDDIE-Arb, specialized EDDIE for arbitrage (system architecture)
- Data preparation
- Experimental results
- Business opportunities

## Lecture 4 - GP in automated bargaining

- What is automated bargaining? (the simple bargaining game)
- Why study automated bargaining?
- Bargaining in game theory (Rubinstein 82 bargaining model)
- Why should one use GP in bargaining? (Approximating subgame equilibrium)
- One population or two? (co-evolution)
- Constrained fitness function
- Uncertainty
- Outside options

## Lecture 5 - GP in Artificial Markets

- Why study artificial market? (The wind-tunnel thesis)
- Artificial market with GP agents (the AI-ECON approach)
- Co-evolution (the business school approach)
- Understanding real markets through studying artificial markets
- Exhibiting stylized facts

內容涵蓋如下：

## 1. Financial Prediction

- RPCL competitive learning based piecewise linear prediction
- Extended radial basis functions and Adaptive EM algorithm for its ML learning
- Prediction by Extended radial basis functions
- Mixture of expert model and Adaptive EM algorithm for its ML learning
- Prediction by mixture of expert model
- ARCH and GRACH models for prediction
- Finite mixture of ARCH and GRACH models

## 2. Portfolio Management

- Portfolio Expected Return and Portfolio Variance
- Standard Markowian Portfolio Optimization
- Sharpe's ratio and Adaptive Portfolio Management
- New Sharpe-Ratio-Related Methods for Portfolio Selection
- Traditional risk vs. Downside risk
- Improved Portfolio Sharpe Ratio Maximization with Diversification
- Adaptive Portfolio Management in help of mixture of expert models

## 3. Arbitrage Pricing Theory

- Capital Asset Pricing Model vs. Arbitrage Pricing Theory
- Three Types of APT Implementation
- Factor analysis and APT Implementation
- Rotation Indeterminacy and Incapability of Factor analysis for implementing APT
- Temporal Factor Analysis (TFA) and its suitability for implementing APT
- TFA based APT for Prediction
- TFA based APT for Adaptive Portfolio Management

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