Innovative Teaching and Learning
http://doi.org/10.4208/itl.20230105

Vol. 5, No. 1, pp. 73-93
June 2023

Innovative Teaching and Learning of Quantum Finance and Intelligent Trading Strategies

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Abstract

Hitherto it has been a real challenge to integrate innovations in advanced quantum computing and AI to supply a practical, intelligent program trading system. Particularly challenging to the financial technology community is quantum finance, which is based on modern technologies that draw upon quantum theory and quantum anharmonic oscillation. There are numerous hybrid economic forecasts with the combination of deep network and various AI technologies recommended with the growth in AI innovation in the past decades. In this paper, we demonstrate how higher education has addressed this critical subject area, namely the development of high-level, cutting-edge AI related, computer technology in the area of financial trading. State of the art AI innovations, including deep networks, fuzzy logic, genetic algorithms and chaos theory are incorporated into MetaTrader platform to design cutting-edge and functional AI-based program trading workshops providing students with hand-on experiences of exactly how to apply such innovation to the real-life economic market and also how to plan for a future career in the growing professional area of AI-fintech.

Keywords: quantum finance, AI-based financial forecast, intelligent trading strategies, innovative teaching and learning method, MetaTrader system

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Introduction

Quantum Finance (QF) is an interdisciplinary subject applying quantum-theory to economics and finance. Quantitative methods in finance are long established. The most well-known, explicitly mathematical approach used in finance was established by Bachelier (1870–1946) in his PhD thesis. Théorie de la Spéculation (Bachelier, 1900) proposed a mathematical model to financial markets as Brownian-motions. This approach then eventually leads to other quantitative methods (statistical methods, Black-Scholes/PDEs, Econophysics) and more recently in the 1990s to Quantum Finance.

The initial published work on Econophysics—An Introduction to Econophysics: Correlations and Complexity in Finance was written by Mantegna and Stanley (1999). They presented clearly how stochastic dynamics, self-similarity and scaling phenomena can be applied to model financial markets. After that, numerous R&D projects on Econophysics and quantitative finance have been conducted, resulting in various financial applications including derivative pricing (De Spiegeleer et al., 2018), financial forecast (Faria & Verona, 2021), risk management (Cont, 2009), and portfolio analysis (Bauder et al., 2021).

From the very beginning, statistical physics has been a mainstream Econophysics concept and energetic R&D initiatives have been designed to foster quantum theory (now known as Quantum Finance) by applying Feynman-path-integral and quantum-anharmonic-oscillator to analyze financial markets such as stock markets.

The main motivation for the application of quantum physics and quantum field theory into finance is threefold: (a) current research reveals the existence of quantum phenomena such as wave-particle duality (Lee, 2019a) and quantum-wave phenomena in financial markets (Ataullah et al., 2009; Shi, 2006); (b) the feasibility to model various financial phenomena, instruments and markets by the adoption of various quantum physic and related models (Baaquie, 2004); (c) and the feasibility to integrate various AI models and technologies to implement intelligent financial forecast and trading systems (Lee, 2019a, 2020; Qiu et al., 2021).

A recent example of QF R&D is Quantum Finance (Baaquie, 2004) which examined the application of Feynman's path-integral model to US interest rate modeling. Professor Baaquie is also the first scholar to consolidate Quantum Finance into a new