The Doctoral School of Engineering and Science

PhD Research

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MBA (USA), MSc in Computer Science (UK)
Algorithmic trading/strategies advancements through computational intelligence by exploiting and integrating financial technical analysis, fundamental (micro-macro)/economical/events analysis and statistics:

The case of US stocks (NYSE, NASDAQ) and Foreign Exchange Markets.
Main Characteristics of This PhD Research

The purpose is to benefit by both academy and companies/institutions/investors, build their research skills to improve their intellectual capabilities and complex investment issues for generating innovative ideas, leading financial/investment institutions to their organizations' superior competencies and performance.

It may be interested in the following sectors:

- Private Bankers and Wealth Managers.
- Portfolio and Asset Managers.
- Hedge-Mutual Fund Managers.
- Investments Analysts and Advisors.
- Trading Risk Analysts.
- Private Investors and individual experienced investors.
Main Characteristics of This PhD Research

- Using the latest Microsoft Software Technology (SQL Server 2012, C# and C++, Parallel Programming, PLINQ)
- Very large data Set (200 Gb, billions of historical rows)
- It combines different and many methods of hybrid computing technologies (Advance Statistics, Machine Learning, Data Mining)
- Strategies developed in short term investment horizon starting from ONE Minute duration (High Frequency Trading – HFT) - extending to several days.
- Optimization across multi time frames (1min to 1 day – bar chart)
Why this Research is different from Previous

- Integrates many different technologies (Classical and AI).
- Adaptation and specialization in the way of applying in Markets. Each instrument (stock, future, forex, etc) has different behavior.
- It brings together Fundamental Analysis (Micro & macro), Technical Analysis, Intermarket Analyst and Statistics.
- Prediction is always transforming into strategies understood by portfolio managers and quant traders.
- The outcome is not a specialized theoretical model but it is a knowledge based multi business model, embracing new perceptions, opportunities and new styles for the investment world.
Two Important Parts of this Research

1. The Concept of Artificial Intelligent Communities derived from Human Communities’ structure (Clouds of AI Communities)

LAYERS OF AI COMMUNITY

- **RAW DATA**
  - **RAW DATA**
  - **DERIVED DATA**
  - **Derived / Processed DATA**
  - **Governor, Decision, E-Knowledge**
- **LAYER No: 1**
- **LAYER No: 2**
- **LAYER No: 3**
  - **Committees of Neural Networks and Support Vector Machines (SVM)**
- **LAYER No: 4**
  - **Data Miner Classifiers**
- **LAYER No: 5**
  - **Presentation**
Two Important Parts of this Research

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- US Stocks Price 1 min Intraday Data (Time, Open, High, Low, Close, Volume)
- Major World Market Index (50 Indices) Price Data (1 min and 1 day bar)
- Futures 1 Min Intraday data
- Macro-indicators (Consumer Price Index, Gross Domestic Product, etc).
- Economical Events published by FOREX Economical Calendar
Two Important Parts of this Research

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- Financial Technical Indicators
- Fundamental Indicators such as Financial ratios.
- Statistical indicators (correlation, divergence, new indicators, etc)
- Cleaning Data (Out layers Detection)
- Transforming Data (FFT analysis)
Two Important Parts of this Research

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   TASK 1: Predict next 20 min stock price

   ……….

   TASK N: Predict next 4 days Volatility

2. Committees of Neural Networks and Support Vector Machines (SVM)

   Derived / Processed DATA

   Raw DATA

   Raw DATA

   Derived / Processed DATA

   Collaborative AI Process

   LAYER No: 3

   LAYER No: 2

   LAYER No: 1

   ANNs

   SVMs
Two Important Parts of this Research

1. The Concept of Artificial Intelligent Communities derived from Human Communities’ structure (Clouds of AI Communities)

- Evaluate Prediction of previous layer
- Apply proper classification data mining algorithms such as ADABOost
- Construct strategies
- Prepare e-Knowledge / Strategies for the next layer
Two Important Parts of this Research

1. The Concept of Artificial Intelligent Communities derived from Human Communities’ structure (Clouds of AI Communities)

   - Convert Knowledge into Trading Decision
   - And Decision is **TO TRADE** (either long or short) or **NOT TO TRADE**

   **LAYERS OF AI COMMUNITY**

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   - **DERIVED DATA**
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Two Important Parts of this Research

2. Knowledge Discovery: Hidden multi-dimension patterns


Template Grid Method using Thresholds to discover specific price pattern

Fig. 1. A $10 \times 10$ grid of weights used in Leigh, Purvis et al. (2002) to represent a variation of the bull flag charting pattern, which used price and trading volume as fitting values.
Two Important Parts of this Research

2. Knowledge Discovery: Hidden multi-dimension patterns

Expand research into Multi-Dimension Grid

- Dimensions, except instrument prices, include technical and statistical indicators as well as instrument prices of interrelated markets.

- The algorithm is designed to find unknown (hidden) patterns.
The involvement of fundamental and interrelated markets.

Complex integration of advanced hybrid technologies

The strategic level (transforms all financial predictions into high level strategies).

Adaptation and Specialization to markets

The huge data set

Business Orientated: Producing innovation (such as the community ANNs) to take competitive advantage in the market industry
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