

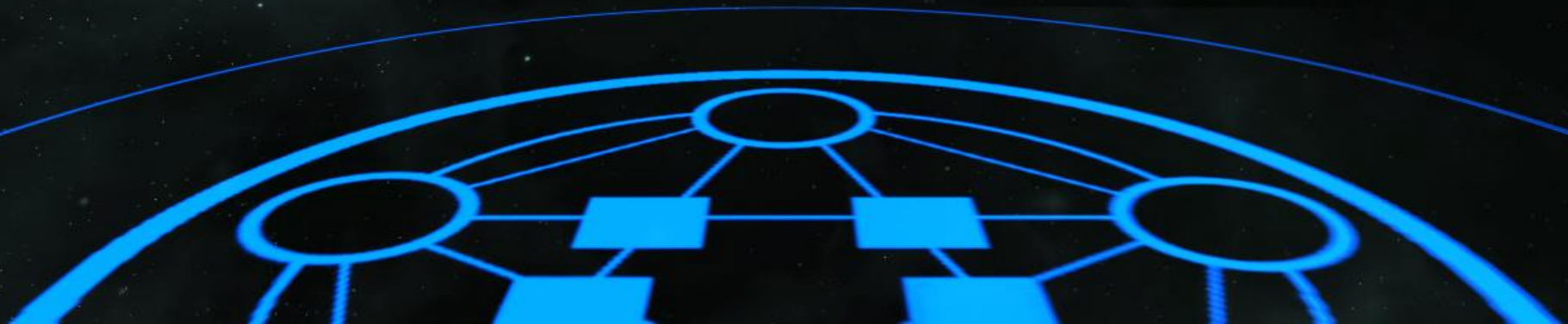


Very Deep Learning on Domino Effects with the Market Simulation Game WALEX

Talks given at UC Berkeley, Humboldt-Universität zu Berlin and Xiamen University

Jenher Jeng

PhD of Stat, UC Berkeley
Founder of WALEX.io



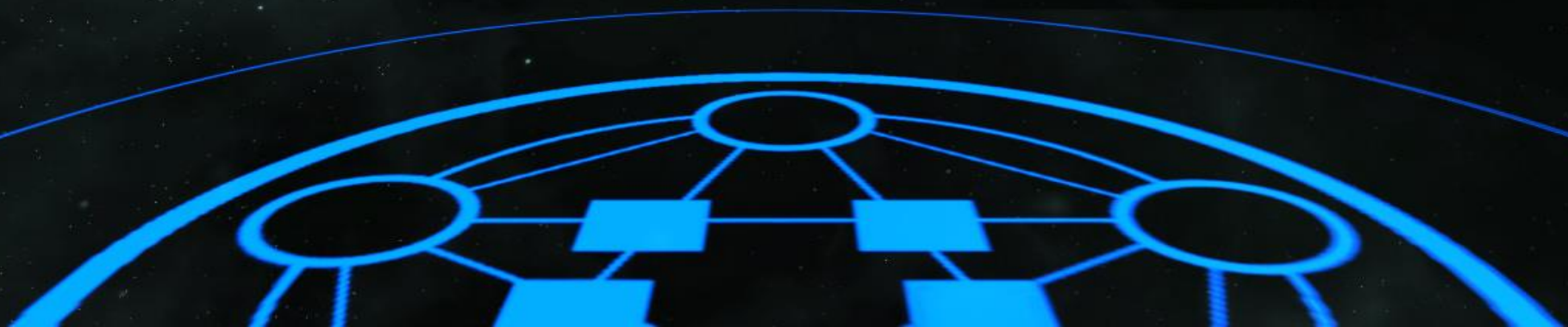


Some Simple Questions

What is the origin of the WALEX project?

How is it built by techniques of AI and KT?

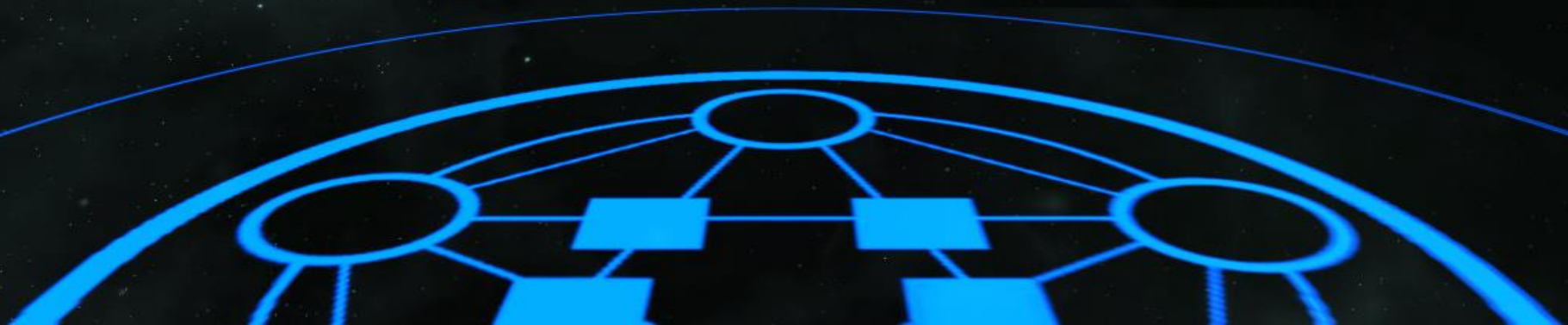
Why is it very important for education reforms?





The Origin of the WALEX Project

The Dilemma





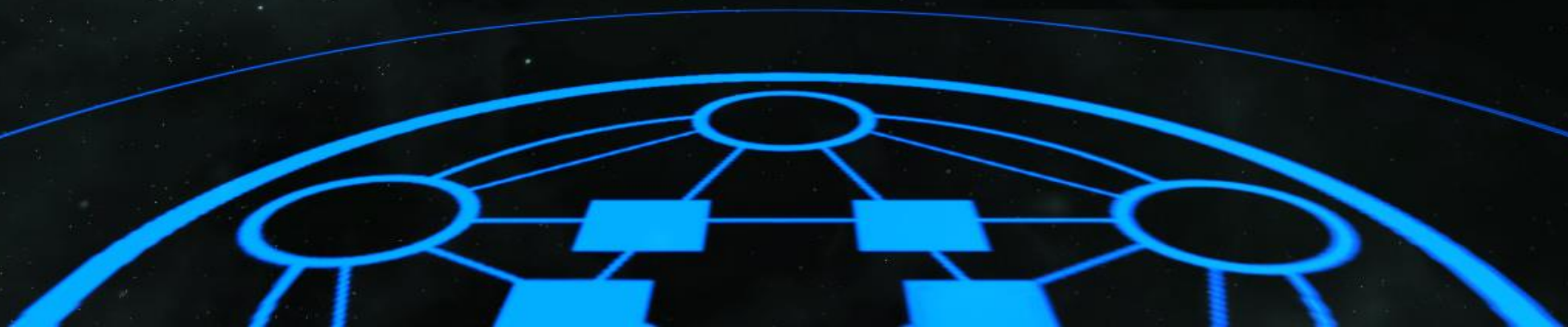
Artificial Intelligence

data – numbers, texts

analyze, and hopefully, comprehend

capital markets

the most complex dynamic systems in the world!





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US	Europe	Asia	FX	Rates	Futures	Crypto
Dow					27,222.97	3.12 0.01% ▲
S&P 500					2,995.11	10.69 0.36% ▲
Nasdaq					8,207.24	22.04 0.27% ▲
GlobalDow					3,090.72	3.34 0.11% ▲
Gold					1,447.40	24.10 1.69% ▲
Oil					55.63	-1.15 -2.03% ▼

S&P 500 Movers	(%)
PM	8.2 NFLX -10.3
KLAC	6.3 URI -7.9
UNP	5.9 GPC -4.5
ADS	4.8 MTB -4.5

Latest News ALL TIMES EASTERN

- 5:09p **BARRON'S** Here's How Poorly Netflix's Stock Performed Today
- 5:08p **MONEYISH** These 11 cities, states and countries will pay you to move there
- 5:06p **UPDATED** Microsoft earnings jump nearly 50% to destroy expectations, stock heads higher
- 5:02p Boeing to see \$5.6 billion hit on 737 Max groundings

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We've updated Watchlist! The changes include a new, responsive design featuring extended-hours data and more news. [Learn more.](#)

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Microsoft earnings jump nearly 50% to destroy expectations,

2:12 PM 7/18/2019




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LATEST NEWS | Earnings Watch | American Express | Schlumberger | United Health | Microsoft | Chewy | CrowdStrike | Cannabis Watch | Virtual Stock Exchange

Microsoft earnings jump nearly 50% to destroy expectations, stock heads higher



This gold-related ETF is crushing the stock market's gains in 2019 — and analysts say the metal has room to run

GDGX 4.28%▲ GCQ19 1.69%▲ DJIA 0.01%▲

- Gold settles at 6-year high, extends rally in electronic trading
- Silver rallies to its highest in over a year, plays 'catch up' to gold's gains

Boeing to see \$5.6 billion hit on 737 Max groundings
BA -2.28%▼

Trump says U.S. warship destroyed an Iranian drone


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https://www.marketwatch.com/story/why-financial-education-wont-solve-the-15-trillion-student-loan-crisis-2019-06-27?mod=personal-finance

Apps New Tab http://hbr.org/2014... Hulbert Interactive Breaking News Hea... Interactive Brokers Rainbow Arch - Tre... Page content doesn't... NCAA College Foot...

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Here's why America's \$1.5 trillion student-loan crisis has spiralled out of control

Published: July 6, 2019 7:25 a.m. ET


[f](#) [t](#) [in](#) [r](#) [e](#) [m](#)

Aa

Financial-education curricula were developed during a time when most workers could count on a paycheck at a stable job

By **JILLIAN BERMAN**
REPORTER

[t](#) [e](#)



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MarketWatch: Stock Market News | Here's why America's \$1.5 trillion

https://www.marketwatch.com/story/why-financial-education-wont-solve-the-15-trillion-student-loan-crisis-2019-06-27?mod=personal-finance

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The Treasury Department **recommended earlier this month** that colleges should require students to take financial-literacy courses and representatives from the Department of Education **told a group of financial-aid professionals** this week that the agency is planning to add robust financial literacy tools to **the app** students can use to apply for financial aid and manage their student loans.

*'Is the problem people are making bad financial **decisions** or is it they simply don't have enough money?'*

—Robert Kelchen a Seton Hall University professor who studies higher education finance

Type here to search

2:43 PM 7/18/2019



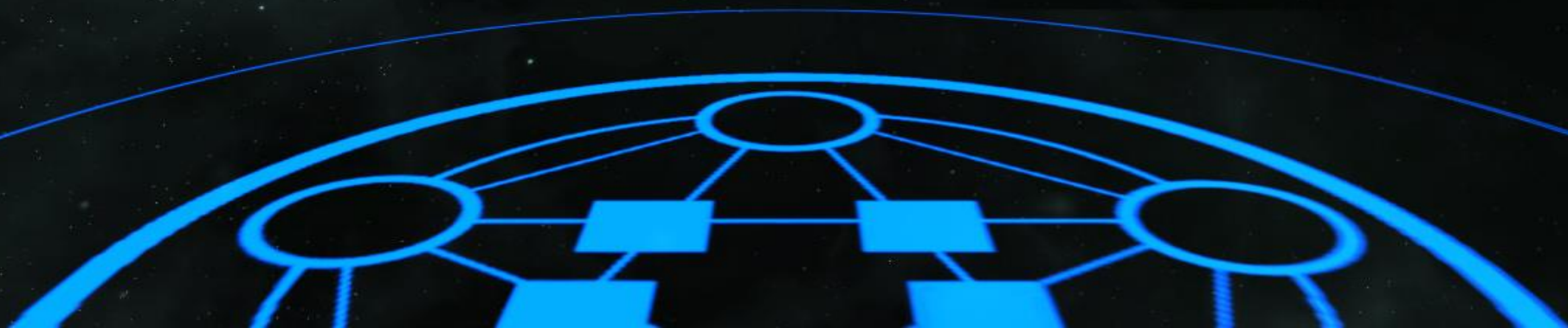
Stocks

too simple to understand

too complex to learn and teach

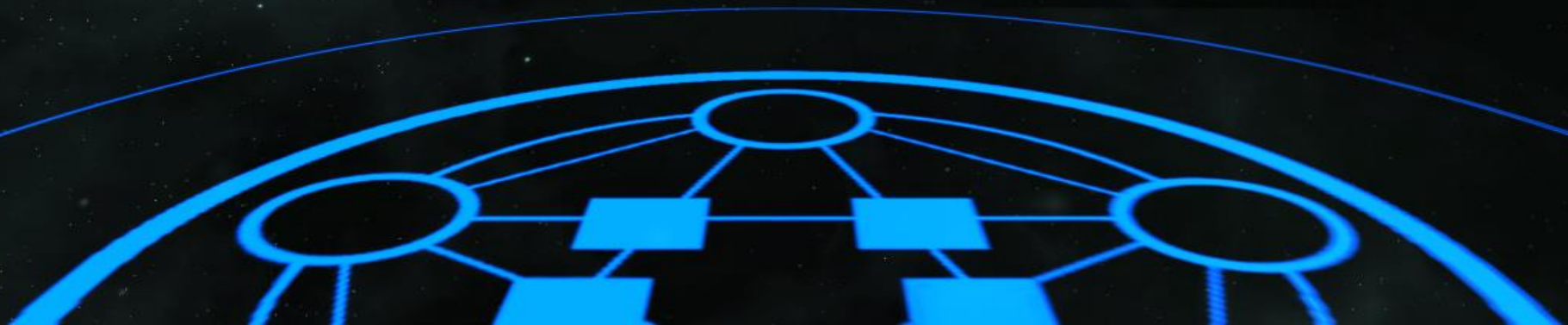
you can regard them as lottery tickets, or

**you can see entrepreneurship, economic conditions,
political interests, humanity (greed, fear, ...), ...
though these windows**





**We need assistance from AI
to make better decisions
by our own free will!**



Very Deep Learning on Domino Effects with the Market Simulation Game WALEX

CENTRAL Workshop: Machine Learning in Economics

Humboldt-Universität zu Berlin

17.05. - 18.05.2018 Berlin, Germany

Jenher Jeng

PhD of Statistics, UC Berkeley

CEO of WALEX COSMOS, HK

WALEX is a game system designed to simulate the capital market and train people to learn global dynamic asset allocation GDAA.

Domino effects, defined to describe long short-term memory (or even long-memory) properties of financial time series in a practical sense, can provide the key for machine learning algorithms to analyze capital markets' behaviors in much deeper insights and more structural perspectives.

In this talk, based on the game mechanism of WALEX in the domino-formation of critical historic market events, we present a framework of combining numerical signal-processing and text-mining techniques to train computer programs of intelligence augmentation to build an ambitious platform of macro/robo hybrid-advisory for personalized investment portfolios.

Michael Jordan Medium

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Michael Jordan [Follow](#)

Michael I. Jordan is a Professor in the Department of Electrical Engineering and Computer Sciences and the Department of Statistics at UC Berkeley.

Apr 18 · 16 min read



Photo credit: Peg Skorpinski

Artificial Intelligence—The Revolution Hasn't Happened Yet

TRIOLOGY OF CYBERNETIC REVOLUTION

- ❖ IA – INTELLIGENCE AUGMENTATION
- ❖ II – INTELLIGENCE INFRASTRUCTURE
- ❖ AI – ARTIFICIAL INTELLIGENCE



AlphaGo didn't even "know" it just beat the world's champion.

Complexity of Financial World

The screenshot displays a financial news website with a top navigation bar including 'SECTIONS', 'WATCHLIST', 'MarketWatch', 'SIGNUP', 'LOGIN', and 'SEARCH'. Below the navigation bar, there are several market data sections: 'US EUROPE ASIA FX RATES FUTURES CRYPTO', 'Dow' (25,317.41, -0.50%), 'S&P 500' (2,755.52, -0.43%), 'Nasdaq' (7,455.53, 0.26%), 'GlobalDow' (2,940.13, -0.26%), 'Gold' (1,227.00, 0.20%), and 'Oil' (57.25, 0.19%). A line chart shows market performance over time. Below the market data, there are several news articles and a chart titled 'Beware "dead cat bounce" in stocks, there's more pain ahead: Morgan Stanley'. The chart shows a line graph with a cat silhouette, illustrating market volatility. Other articles include 'Mortgage stocks fall in worst-ever day for the sector', 'Altria's earnings: Investors are hoping for news of a move into the cannabidiol market', 'Canada's pot party: Big gains, short supply, and stamps with no glue', 'Canada's Wilson: All the latest on the legal-marijuana business, from Canada and beyond', 'Trump says he will propose 10% tax cut for middle-income earners', 'Hurricane Wilma turns toward Mexico as a "potentially catastrophic" Category 5 storm', 'Jamie Lee Curtis just made "Halloween" box office history', 'Stocks close lower as investors brace for earnings deluge; tech buys', 'Elon Musk says his tunnel under L.A. will be open to the public on Dec. 10', 'The first thing the Mega Millions winner should do — according to the guy who runs the lottery', '3 ways to buy happiness (instead of a billion-dollar lottery ticket)', 'The shockingly poor odds of saving much of your Mega Millions lottery winnings', 'Not winning the Mega Millions could be the best thing that ever happens to you', 'AMC earnings: Trade wars could harm assault on indie ink earnings: What the chip maker can say to turn assuage doubts', 'Indie earnings: What the chip maker can say to turn assuage doubts', 'You're not wrong: A neighbor's ugly house', and 'Trump's "major" tax promise is a sign that'.

Natural Language Processing

- Event News
- Guru Commentaries
- Columns of Insight
- Social Media Tweets
- Fake News
- Institutional Ads

Structural Data Analysis

- Time Series of Asset Prices
- Corporate Balance Sheets
- Macro Economic Measures
- Social and Environmental Data
- Market Sentiment Indices


Complexity of Financial World

The next frontier in investing is 'quantamental' stock picking

Published: Oct 15, 2018 1:46 p.m. ET

f t in r e 24 Aa

A merger of computing power and human expertise is lowering costs and increasing gains



Peter Grundy

Natural Language Processing

- Event News
- Guru Commentaries
- Columns of Insight
- Social Media Tweets
- Fake News
- Institutional Ads

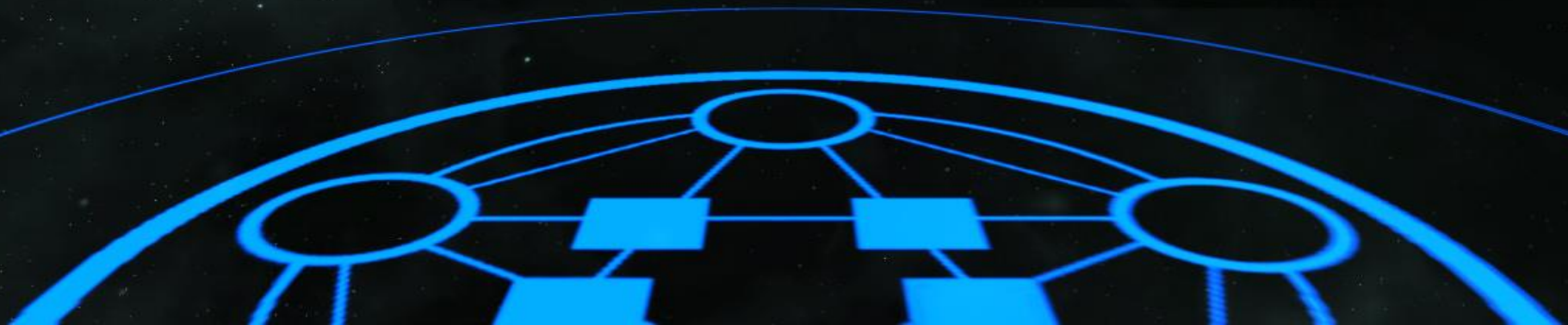
Structural Data Analysis

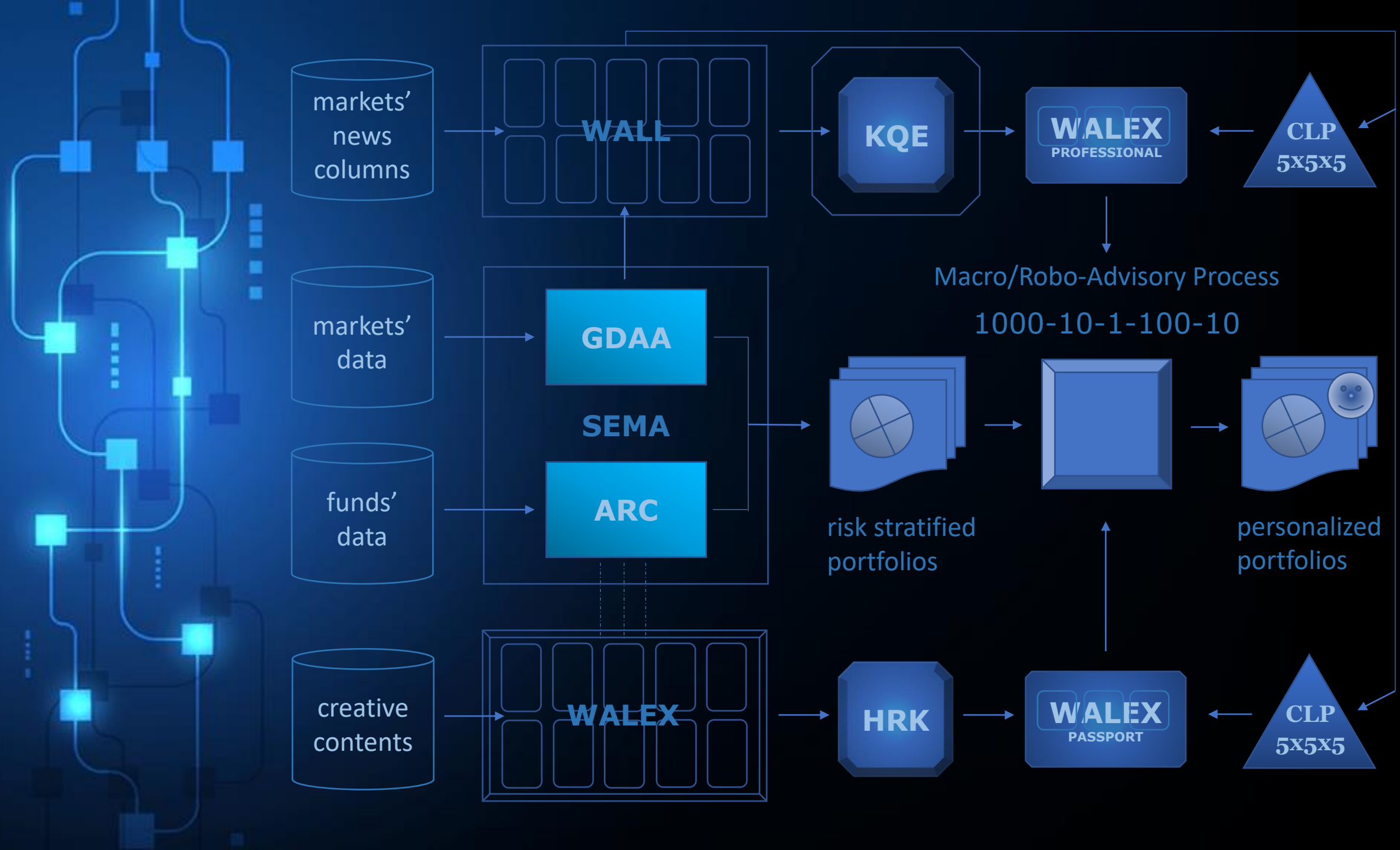
- Time Series of Asset Prices
- Corporate Balance Sheets
- Macro Economic Measures
- Social and Environmental Data
- Market Sentiment Indices



Building AI & KT (Knowledge Tech) for WALEX

The Architecture





Question/Goal ??

Can AI be developed to understand our world

via some kind of knowledge-formation trainings

rather than

just to do predictions or make decisions based on recognition of correlation patterns?

Question/Goal ??

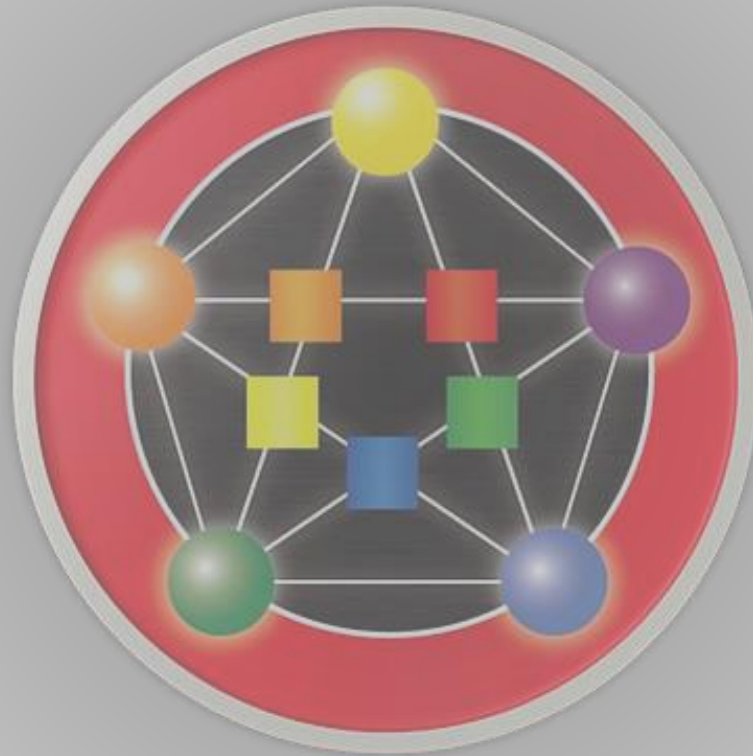
Can AI be developed to understand our world?

from pattern recognition to knowledge formation & perception

The Key :

Butterfly and Domino Effect of Events

The Macro Framework



Global Dynamic Asset Allocation

a framework to analyze how capital flows are driven by risk factors among asset classes

Market Asset Classes :

- **Stocks**, e.g. MSCI Stock Index
- **Bonds**, e.g. Putnam Income Fund - A
- **Currencies**, e.g. U.S. Dollar Index
- **Commodities**, e.g. S&P GSCI
- **Real Estates**, e.g. S&P Case-Shiller

Together, we can approach conservation laws of capital flows in statistical ensembles.



Market Risk Factors :

❑ Psychological

- Bias, Greed, Fear, Conscience, Rationality ...

❑ Economical

- S/D, Corp. Earnings, Jobs/Wages, Social Welfares ...

❑ Strategical

- Asset Management Strategies, Corporate M&A ...

❑ Geopolitical

- Regulations, International Affairs/Accords, Wars ...

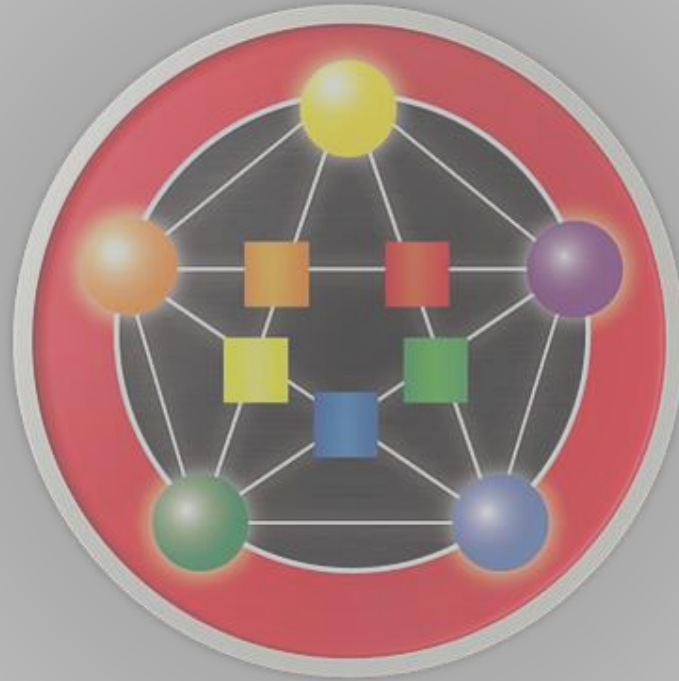
❑ Environmental

- Natural Disasters, Evolution, Discoveries ...

So, we have a structural approach to see how capital flows are driven by risk factors.



The Theoretical Backgrounds



Unstable Equilibrium / Trilogy of Systemic Risk

Market Participants :

- ❖ **Consumers/Investors**
- ❖ **Bankers/Brokers**
- ❖ **Fund managers**
- ❖ **Corporations/Lobbyists**
- ❖ **Politicians/Demagogues**
- ❖ **Environmental Groups**

There is an extremely complicated hierarchy of market players/manipulators/regulators.

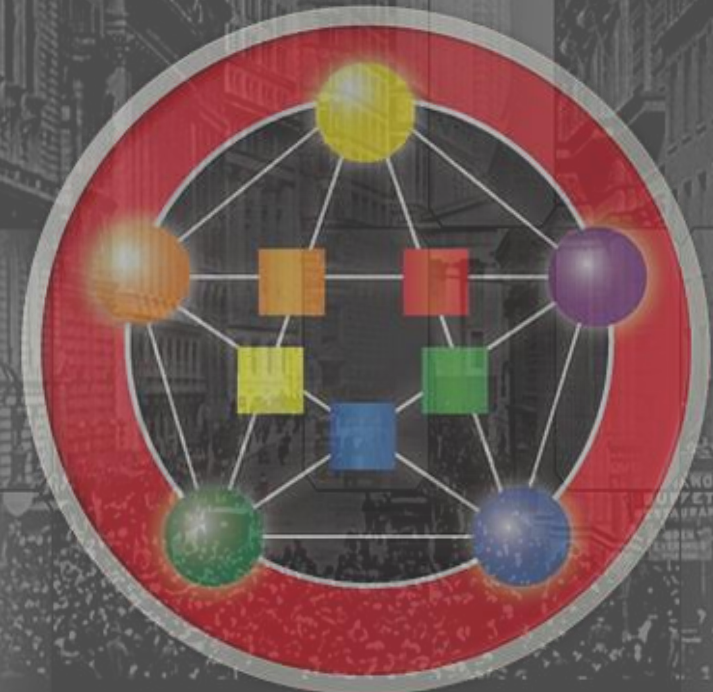


Some Perspectives of Market Dynamics:

Complexity (Nonlinearity/Nonstationarity)

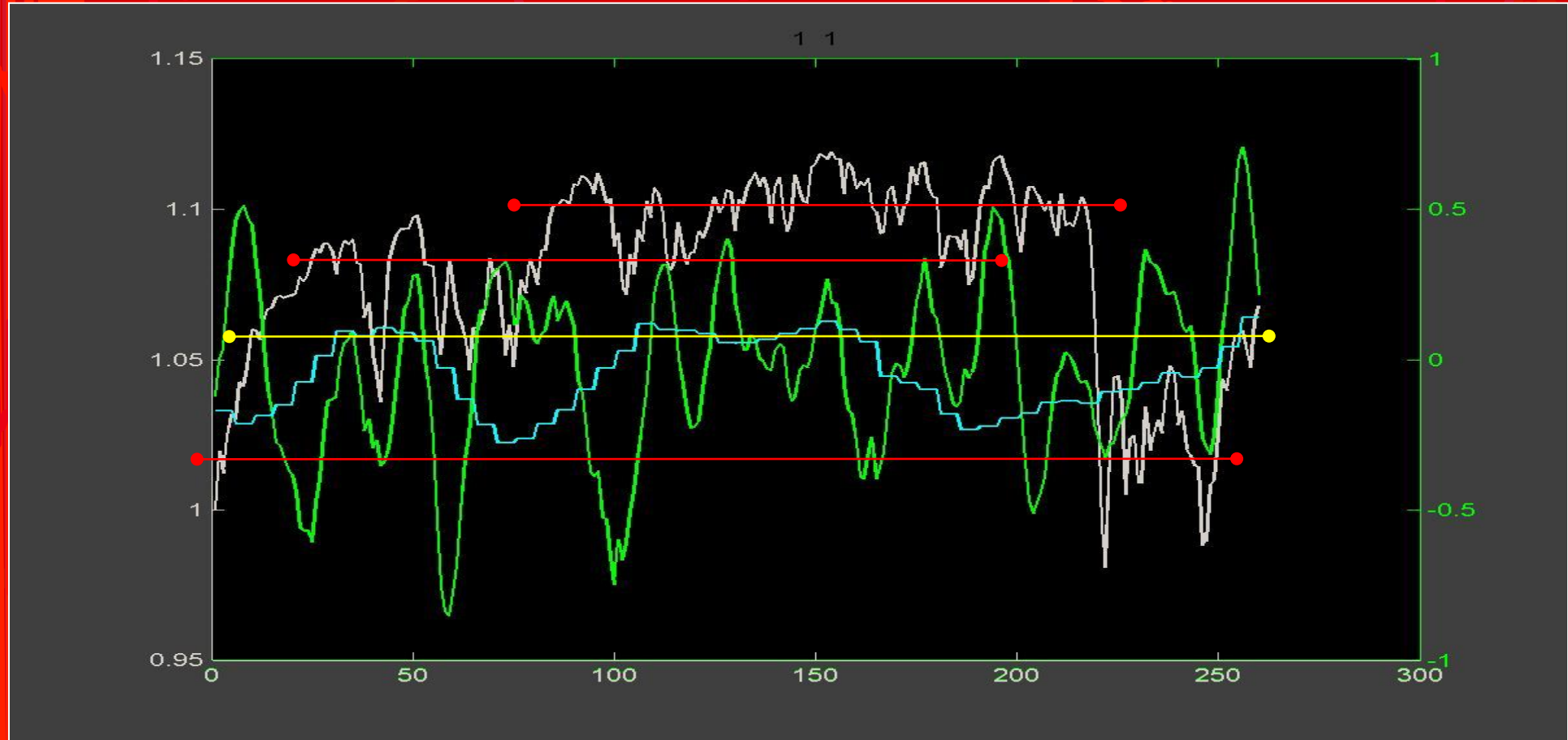
3D Challenge for Big Data: Dimensionality, Dependency, Divergence (Data Delusion)

- ❖ Trends, Cycles (MT/ST), Seasons, Turning-Points (Singularities), Shocks, Noises
- ❖ Games, Capital Flows, Butterflies, Dominos, Market Efficiency/Rationality
- ❖ **Unstable Equilibria, Market Instability/Volatility**
- ❖ Long-Memory, LSTM, Stochastic Processes,
- Back-Testing/Forward-Simulation
- ❖ Systemic Risk, Stress-Testing, Chaos



WALC

Unstable Equilibria & Market Instability



Talk given at Humboldt-Universität zu Berlin, 2010

Trilogy of Shifted/Transformed Systemic Risk

Market Risk

MR

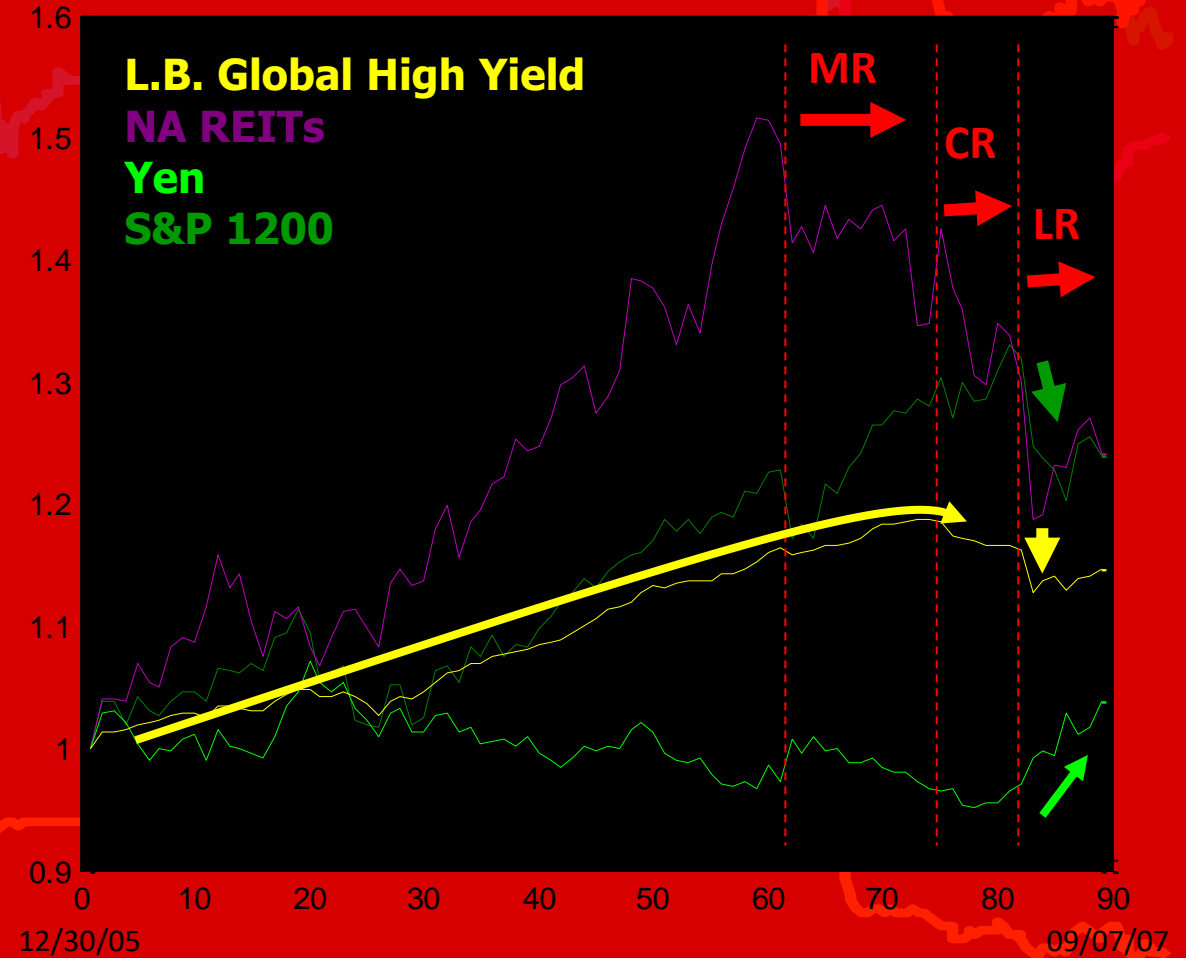
LR

Liquidity Risk

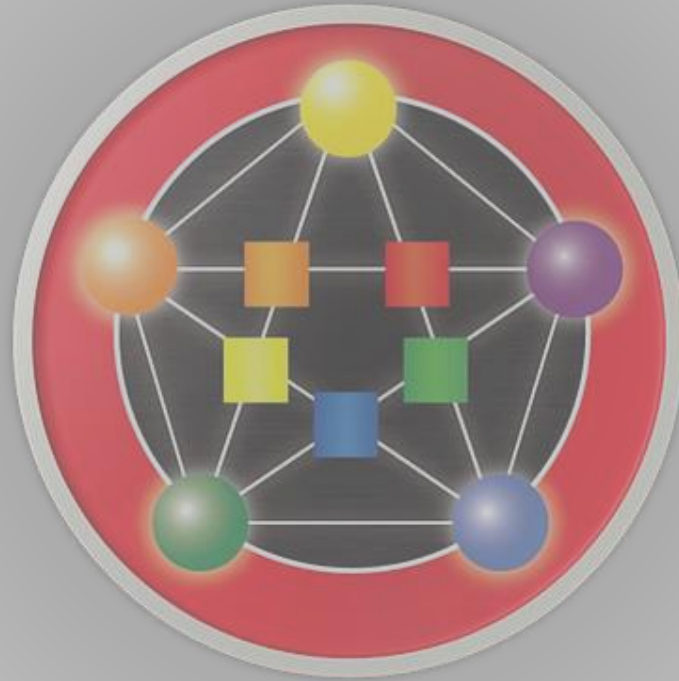
CR

Credit Risk

Wall Street keeps disrupting the financial world with innovation of derivatives.



The WALEX Architecture



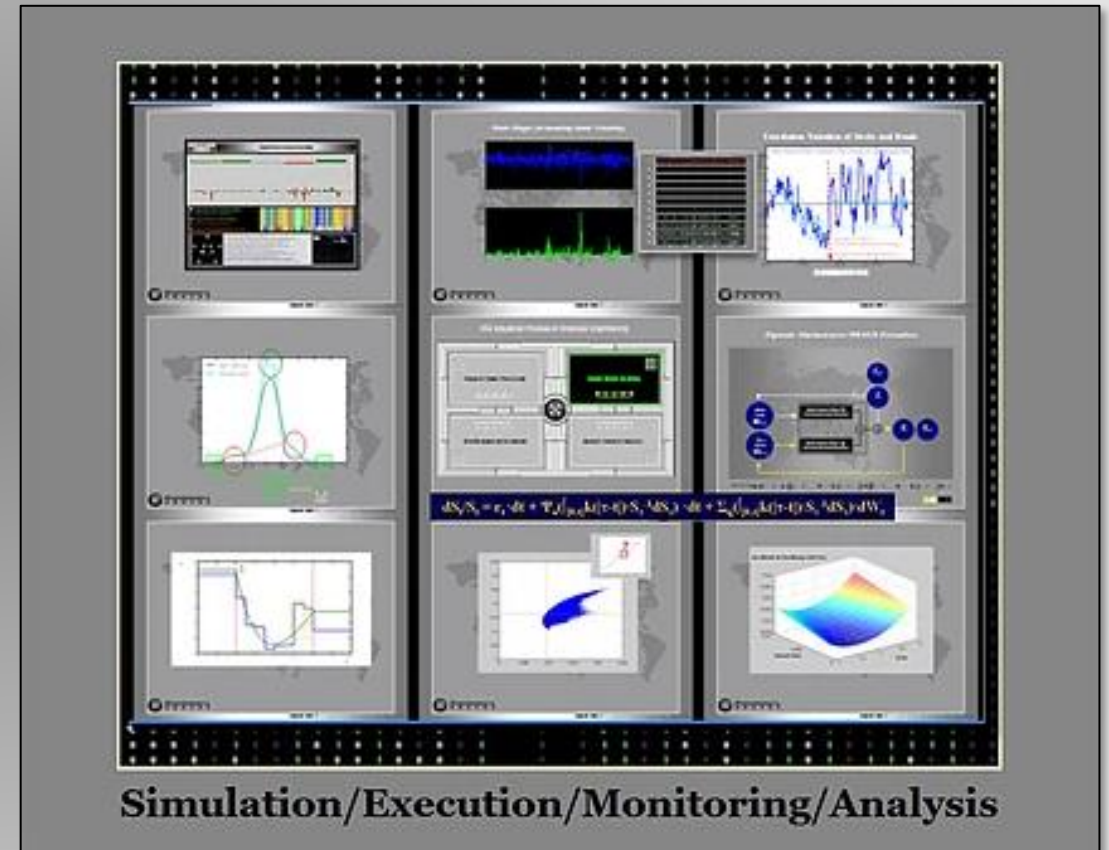
SEMA – Capital Flows / WALL – Market Events

AI COMPONENTS & PROCESS -

人工智能

COMPUTING FRAMEWORK / STATISTICAL MODEL / KNOWLEDGE BASE

SIGNAL PROCESSING / STATISTICAL MODELING / DYNAMIC ANALYSIS / DECISION MAKING



Lectures given at National Center for Theoretical Sciences & National Chiao Tung University, Taiwan 2004-2009

知識庫



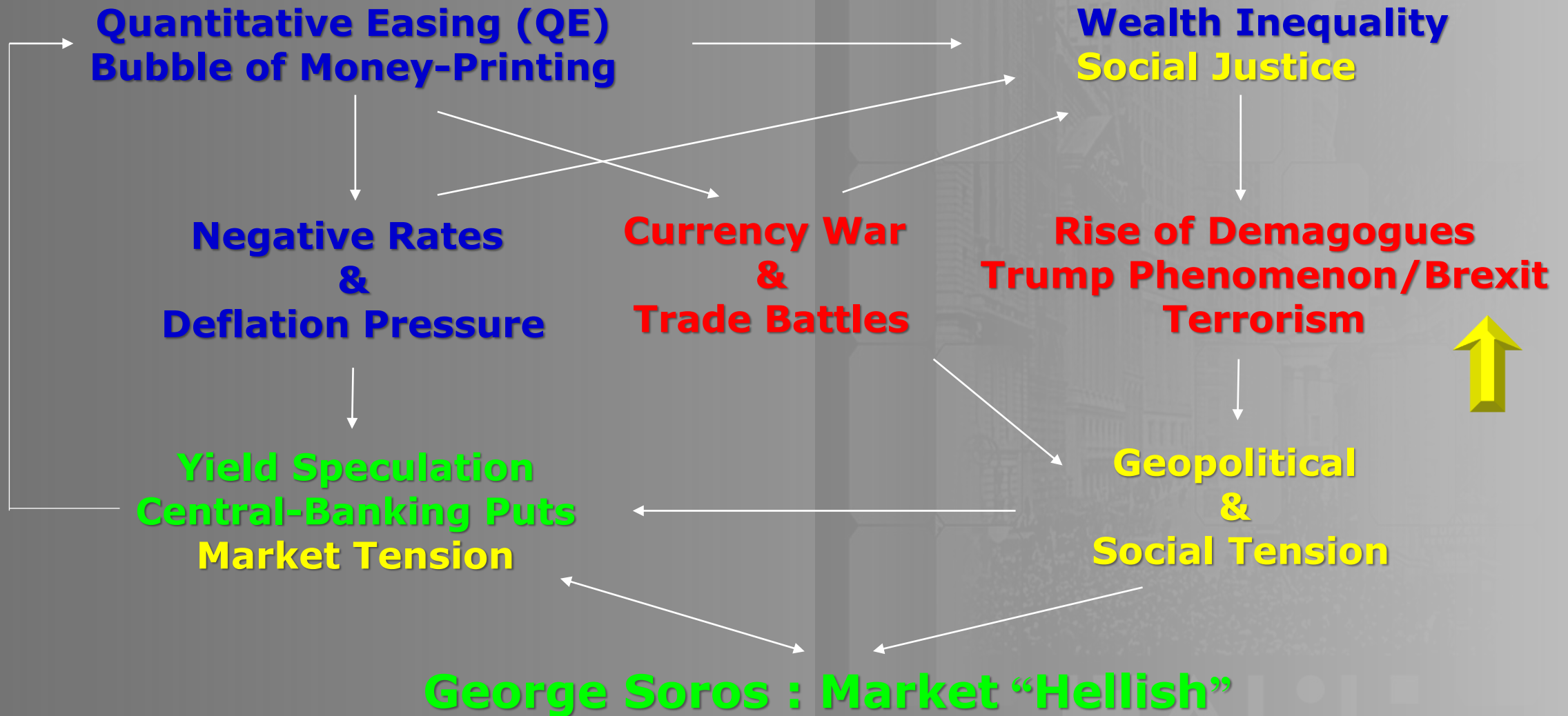
KNOWLEDGE BASE & KNOWLEDGE TECHNOLOGY

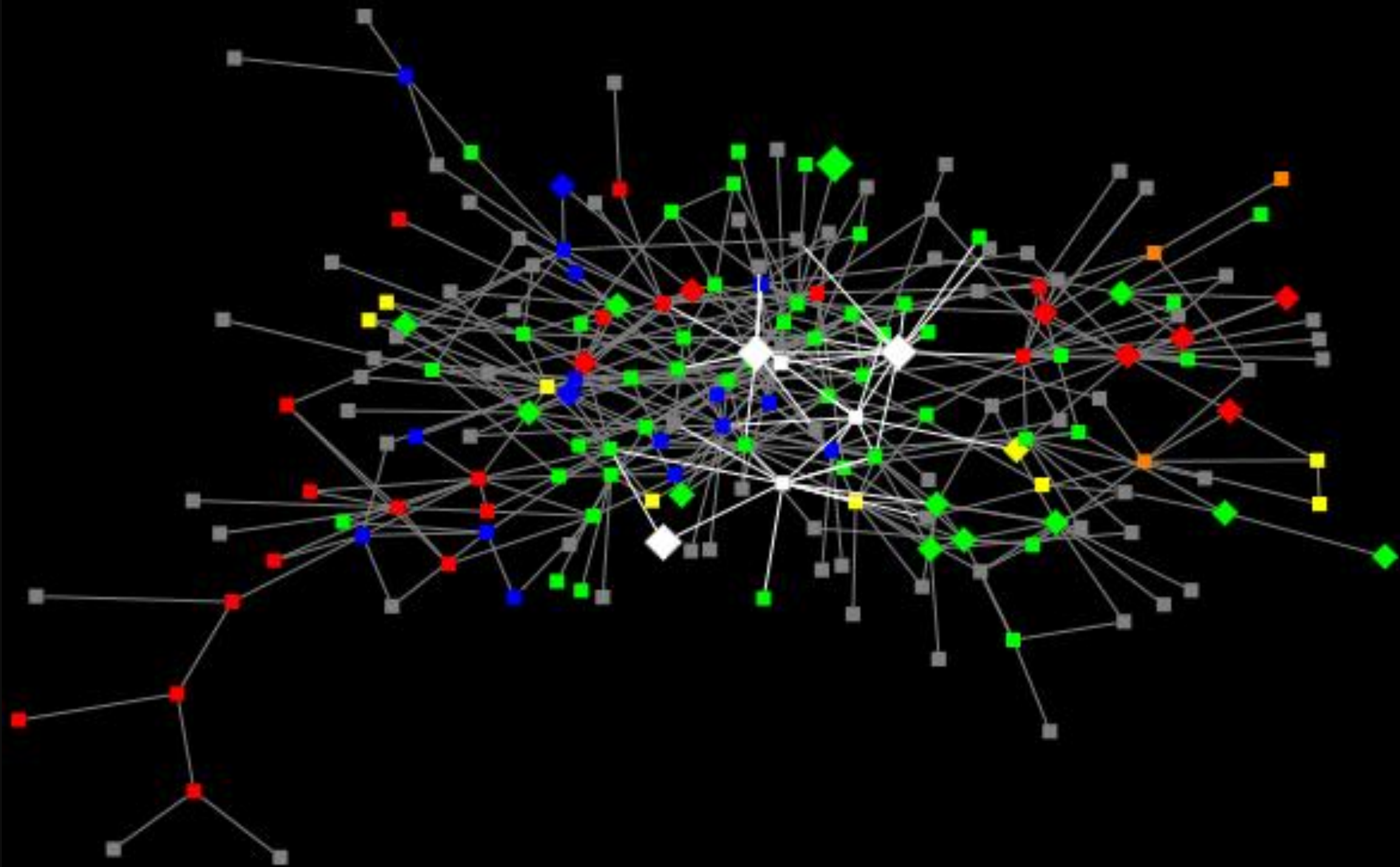


Words (Text-Mining) => Conceptual Phrases (Insight-Building) => Sentences (Natural Language Processing)

A Recent Example of *Macro Puzzles & Reflexivity*

Talk given at Xiamen University, China 06/2016

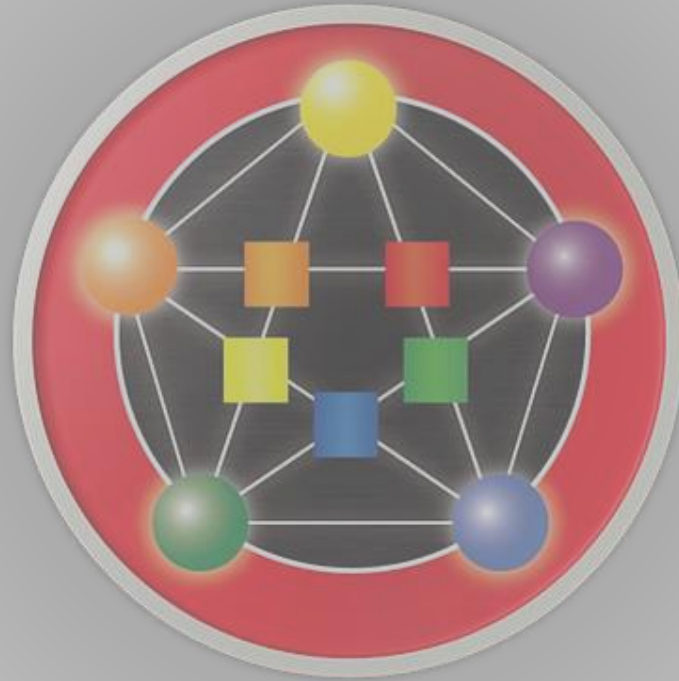






Talk given at Xiamen University, China 06/2016

The Domino Formation



Key from Information Tech to Knowledge Tech

Domino Formation

Broken Berlin Wall of Cold War T

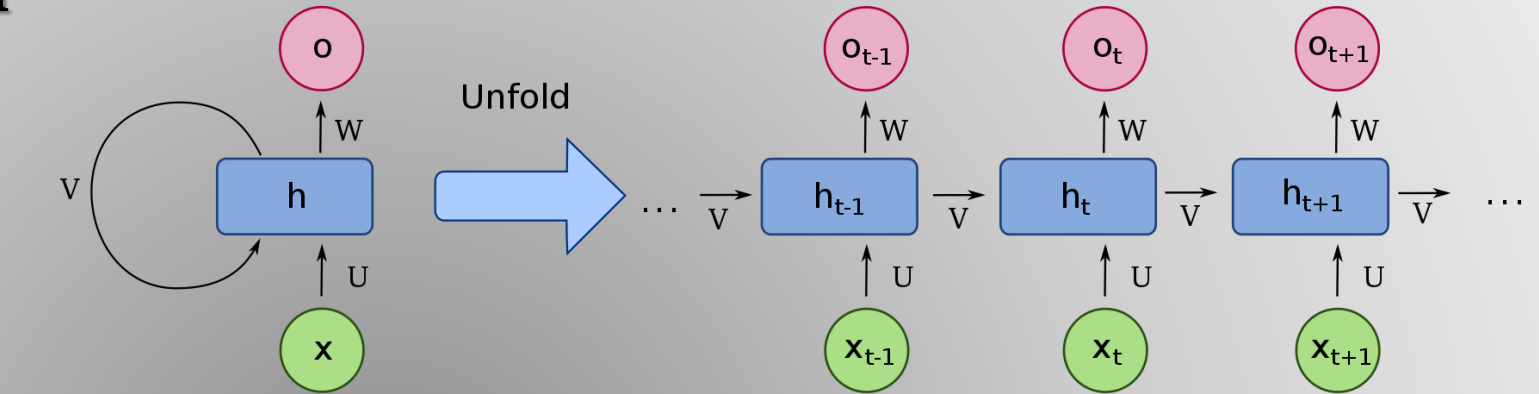


♥ T ♥ III 1989.11.09 III ♥ T ♥

The Berlin Wall, as the foremost frontier of capitalism/communism conflicts during the Cold War, was crushed by the global wave of open society.

S	B	X	C	R
+5	-4	+5	+4	+5

C-T-G-19891110-12-0001



Regarding the domino formation as a LSTM-RNN (Recurrent/Recursive Neural Network with Long Short-Term Memory Cells) :

input x
Text of Key Words

output o
Impact Factors

Key points :

- ❖ Classification of events into “good” or “bad”
- ❖ Domino effects as Long short-term memory time-series structure among a sequence of events
- ❖ Correlation matrix of impact factors resemble correlation of price returns of assets

KNOWLEDGE TECH WITH DOMINOES AS BUILDING BLOCKS



CONTENT IS KING ; AI IS QUEEN ; APPS ARE KNIGHTS

Systemic Risks



❖ 1974~1975-1979

❖ 1987~1989

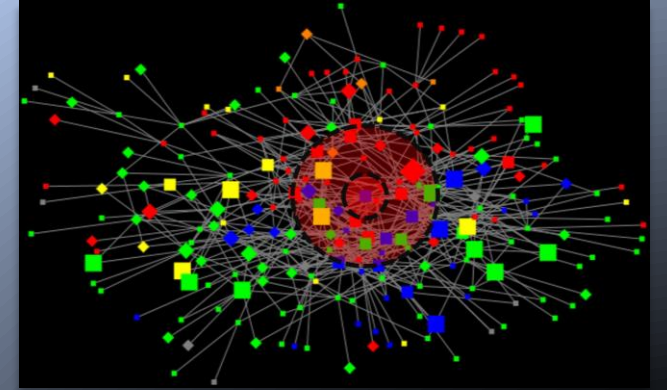
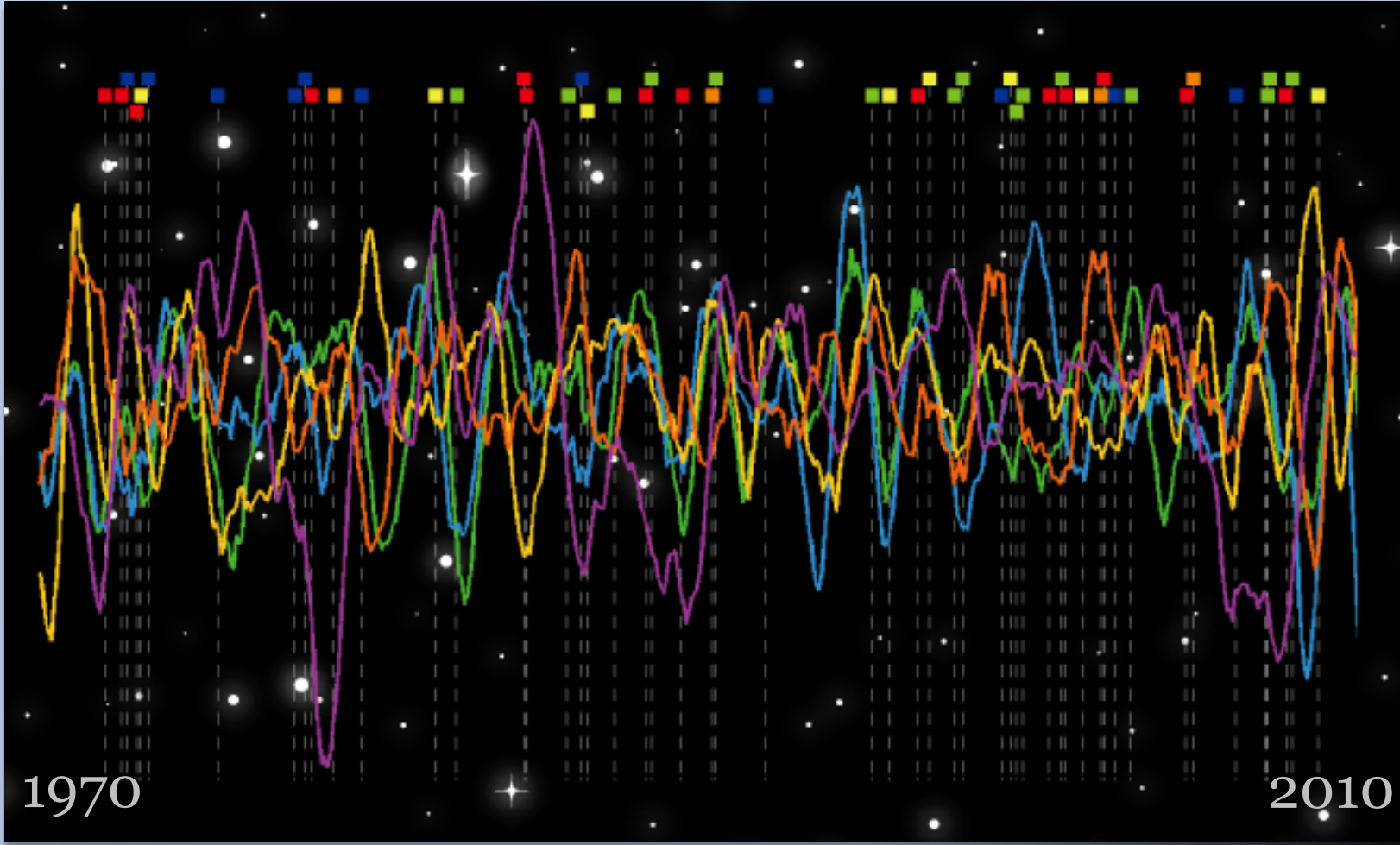
❖ 1997~1998

❖ 2000~2001-2003

❖ 2007~2008-2009

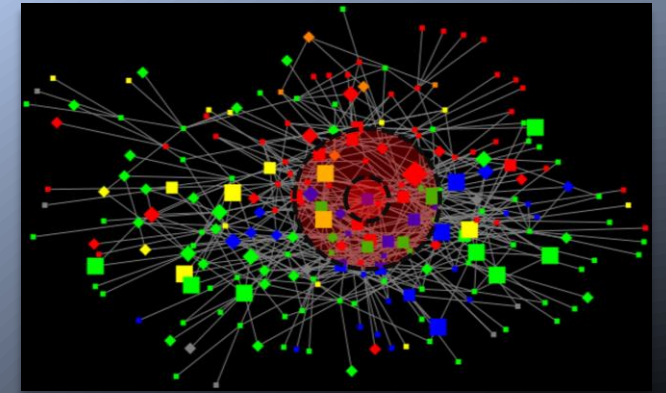
See how the world has been changing by monitoring how the financial trends and crises evolve along.

WFALEX



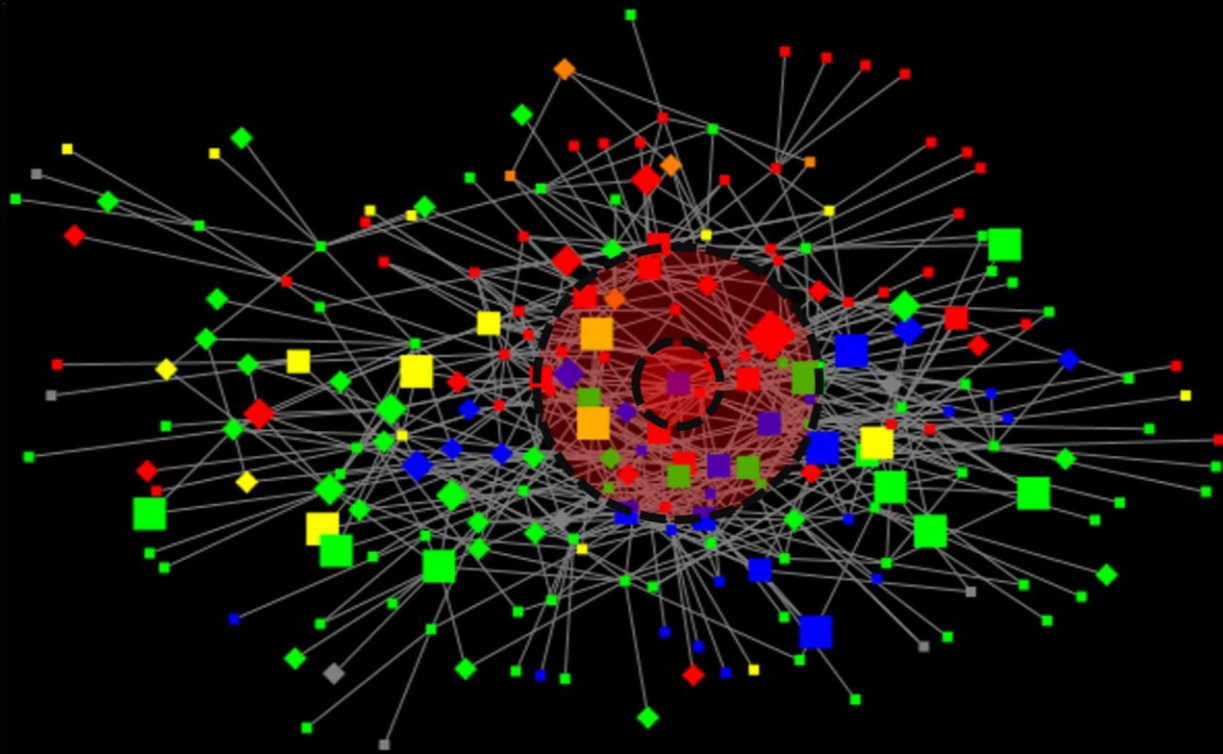
Dynamics of Capital Markets – Domino/Butterfly Effects

WFALEX



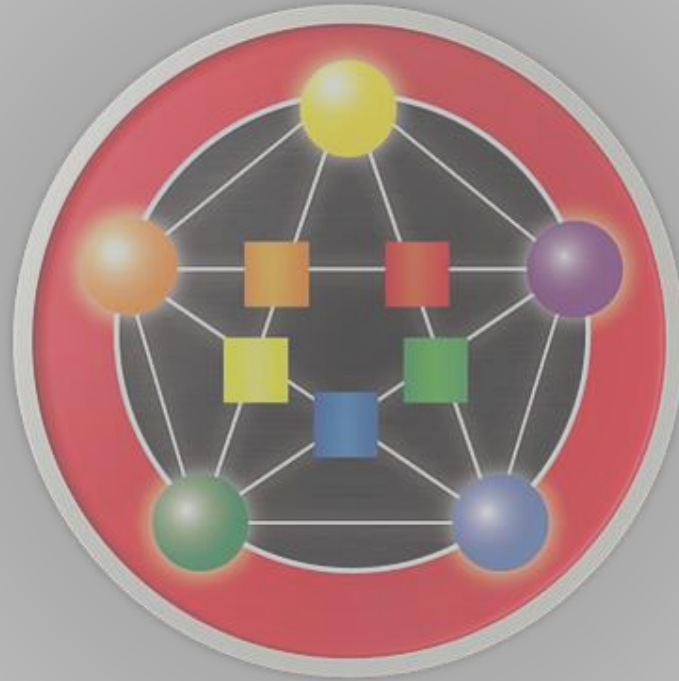
52 Principal Dominoes across **5** major financial crises

劇變年代中的關鍵骨牌



With the formation of dominoes as the building blocks of a capital-market knowledge-base, we can begin to train the AI to understand this world.

The VDL Blueprint of WALEX



Robo Advisory with Macro Knowledge Learning Platform

The VDL Domino Formation

$\aleph := \{n_\alpha : \text{any information in text about what happened in the world, } \alpha \in A\}$

The collection of all news available to influence the capital market, including silly tweets, fake news, ...

$\mathcal{E} := \{e_i : \text{an event defined by a title and a paragraph of description, } i \in I\}$

The index set I can be “date + number series”, e.g. 20180517-0001, 20180517-0002, ...

$\mathcal{D} := \{d_j : \text{a weekly representative domino as a critical event, } j \in J\}$

The index set J is constituted of poker characters and weekly Friday dates, e.g.

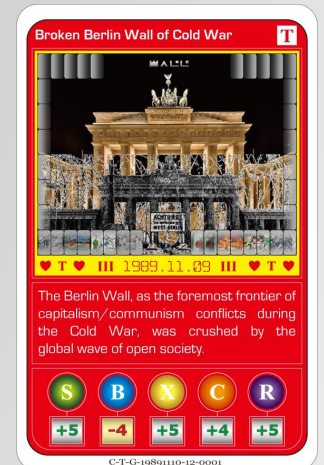
A-20180518, K-20180518, Q-20180518, J-20180518, T-20180518

$\mathcal{S} : \mathcal{E} \rightarrow \{A, K, Q, J, T, 0\}$

The selection operator labels an event as a domino of a special kind or not.

$\mathcal{Q} : \mathcal{D} \rightarrow \{-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5\}^5$

The impact operator assigns 5 impact factors to a domino for its influence on the 5 assets.



Macro/Robo-Advisory

Risk Factors → **Asset Allocation Weights**



Impact Factors

Supplementary Data Sets

Risk Management Strategies

Domino Effects along Paths

$$\mathcal{C} : \mathfrak{N} \times \mathfrak{D} \rightarrow \{0, 1\}$$

The domino-clue is a text-mining classifier to see whether a piece of news is related to a domino.

$$\mathfrak{N}_j := \{n_\alpha \in \mathfrak{N} : \mathcal{C}(n_\alpha, d_j) = 1\}$$

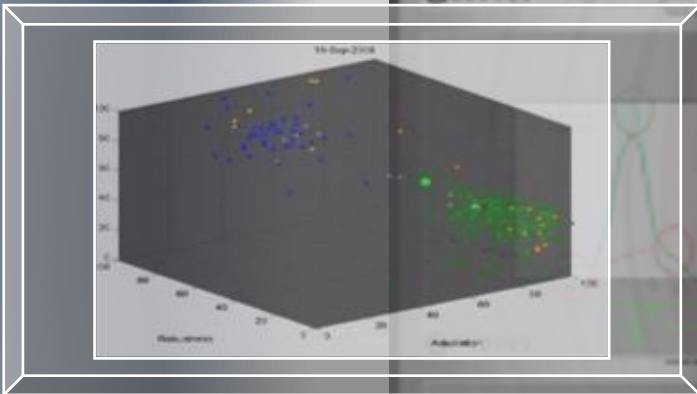
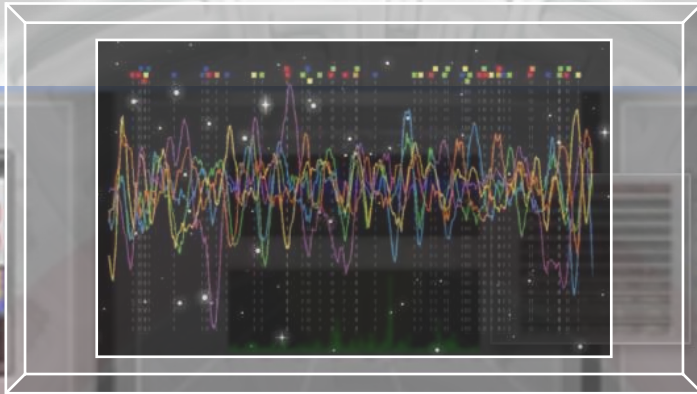
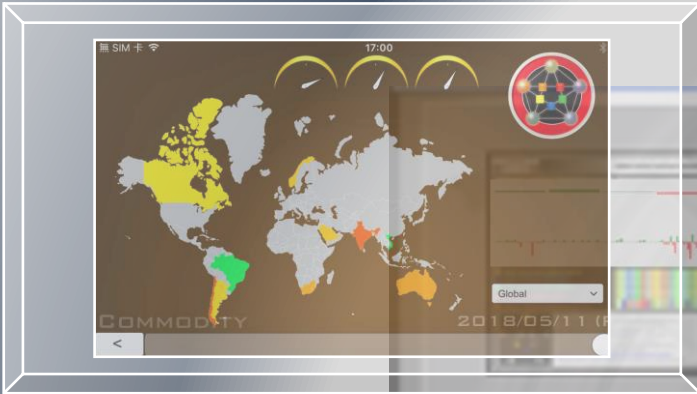
The clue of a domino is the set of all the information related to a domino.

$$\Gamma : 2^{\mathfrak{N}} \times 2^{\mathfrak{N}} \rightarrow \mathfrak{R}^+ ; \gamma_{jk} := \Gamma(\mathfrak{N}_j, \mathfrak{N}_k)$$

Two dominoes are related in a path if $\gamma_{jk} \geq \gamma_0$

Finally, the impact factors should be assigned so that

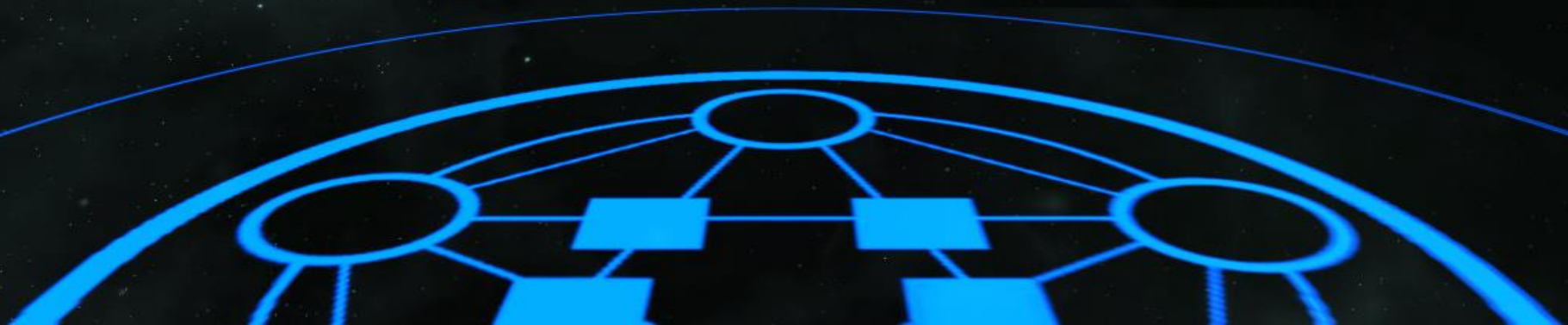
- ❖ We have reasonable propagation patterns of short-term dynamic correlation matrices in the long run.
- ❖ We can use their aggregation weights to do dynamic asset allocation along trends and across cycles.



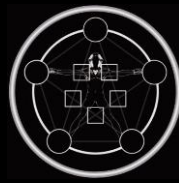


Education Reforms for “Better People, Better World”

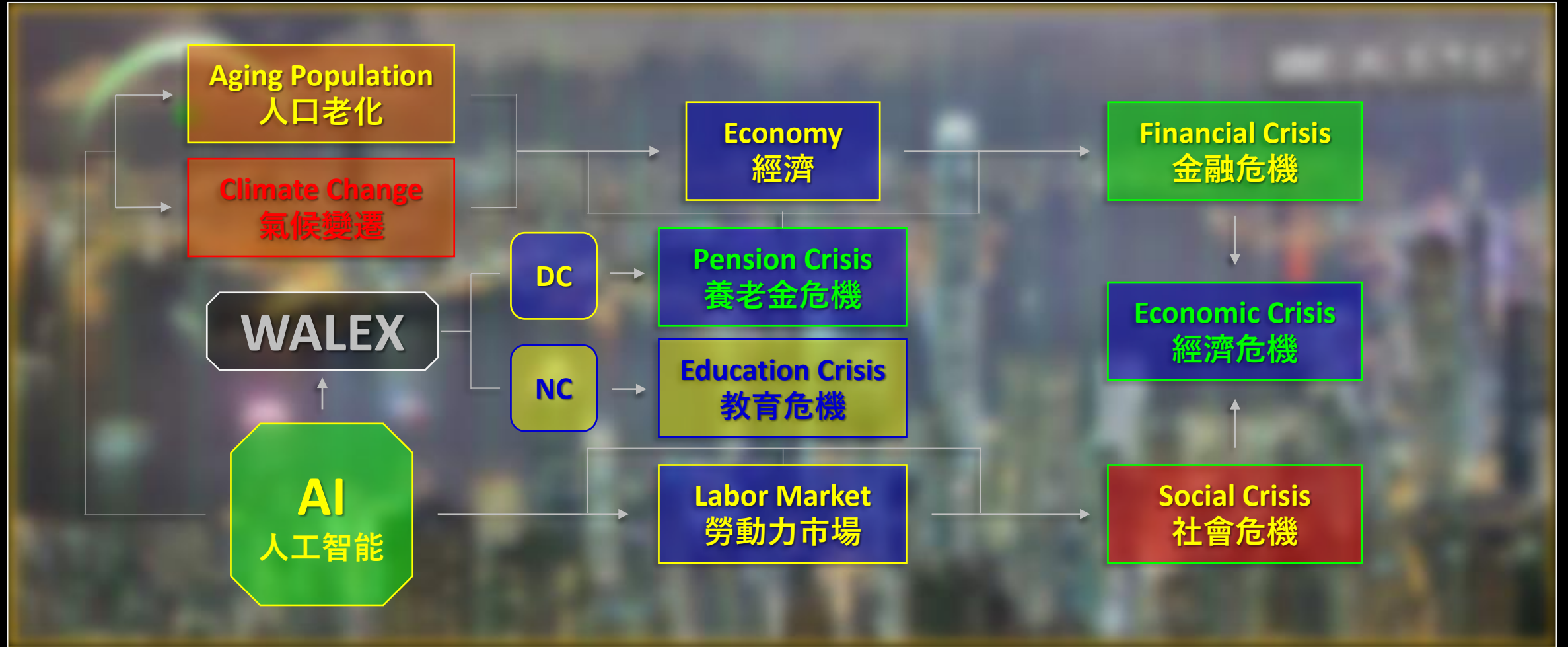
The Challenge



WALEX



STEAM FEAT



VISION & MISSION



WAFLE

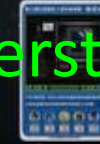
WAFLE ✦ DIAMOND CLASS

WALEX



Each domino is a window

to understand the world.



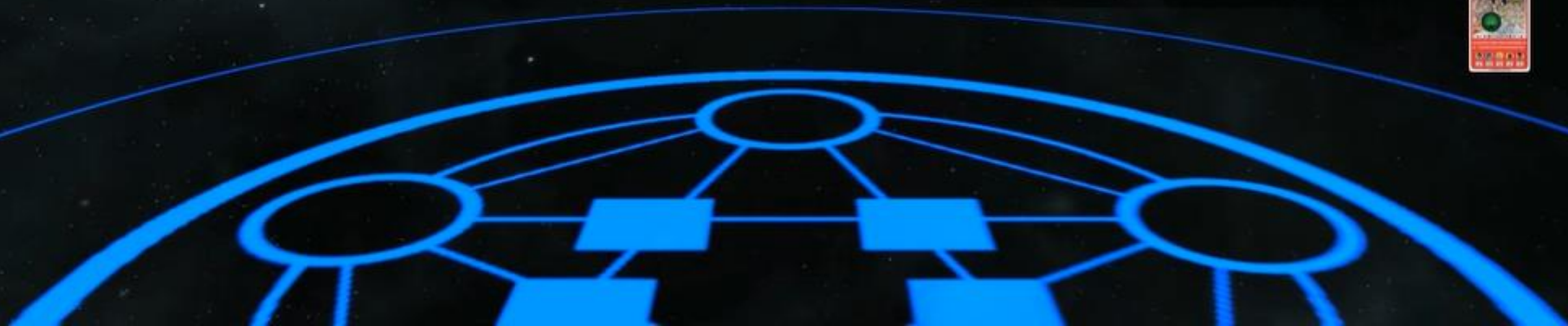
From the past to the future,
explore more possibilities.

A wonderful journey for you to
begin your realization by connecting



Life is full of many possibilities
where time is not a barrier.

It is a wonderful domain
that is so intriguing.





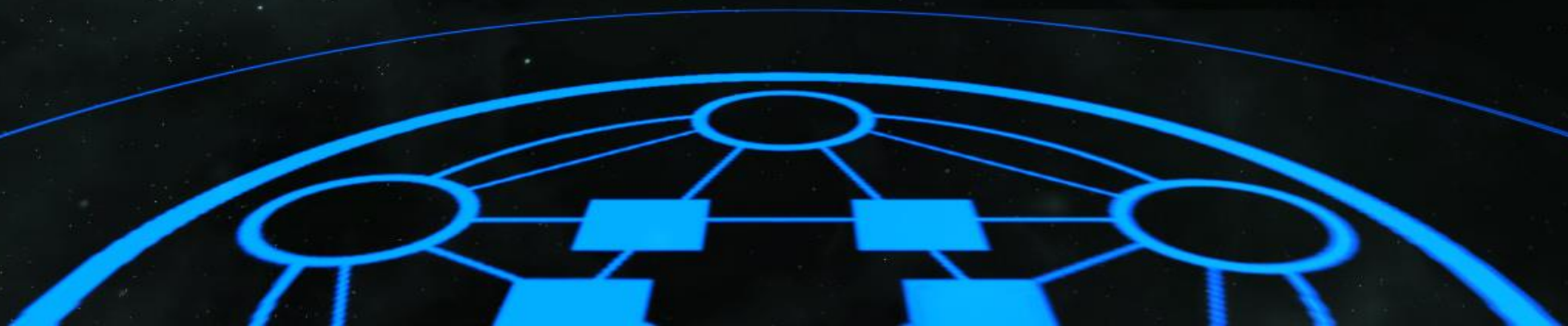
Capital Markets & World Evolving Factors

Capitalism/Technology

Energy/Information/Money

AI

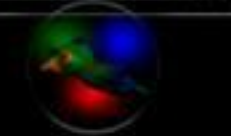
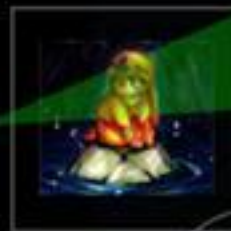
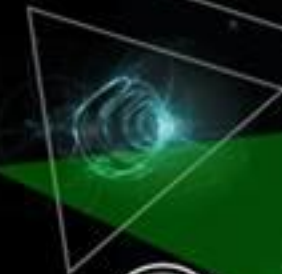
Universe/Multiverse



Rainbow Arch

瑰寶魔境

諾瓦漢超級Z世代營隊



WAFLEX

7 Features of Artificial Intelligence
for
Cybernetic Revolution

ISLEMMMA

- ❖ Interactive
- ❖ Learning
- ❖ Mechanism
- ❖ Simulation
- ❖ Execution
- ❖ Monitoring
- ❖ Analysis



时空世界的碎片拼图

*Nova's
Spacetime Puzzle*



思索過去 想像未來





WALEX **Berkeley**
Tournament 2019

LET THERE BE LIGHT

STEAM – Content is King ; AI is Queen ; Apps are Knights





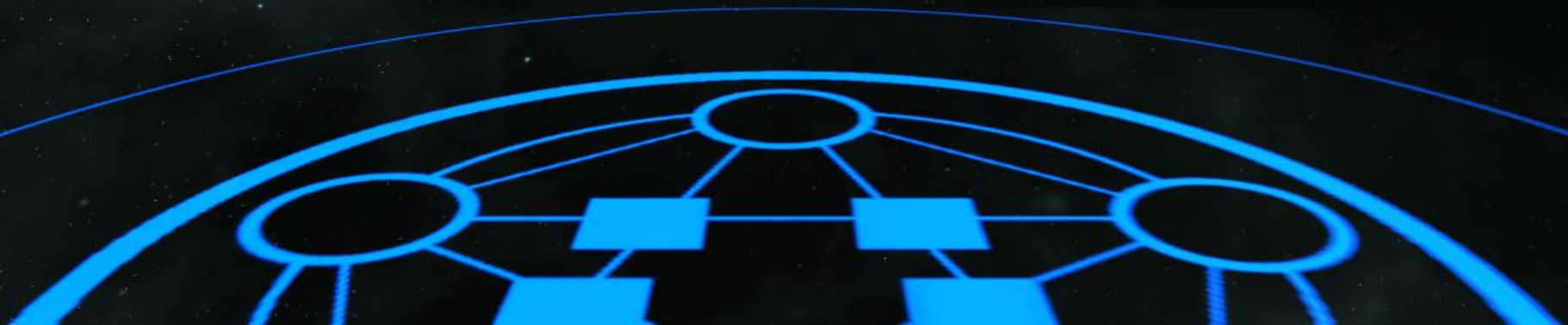
Treasure Wonderland

Experimental Novel Contents for

NLP – Natural Language processing

Knowledge Graph

Virtual Reality / Augmented Reality



WALEX

Progressive-Edutainment Series of Games



寓教於樂遊戲體系

金融戰略王

