Press Release

For General Release

Information Services International-Dentsu, Ltd.
Izumi Laboratory, School of Engineering, the University of Tokyo

ISID and the University of Tokyo Build a Cloud-Based Artificial Market Simulation Environment

Launch of Joint Research on Agent-Based Modeling (ABM) for the Financial Sector

Information Services International-Dentsu, Ltd. (Head Office: Minato-ku, Tokyo; President, CEO & COO: Ryoichi Nawa; hereinafter, "ISID"), and the Izumi Laboratory, School of Engineering, The University of Tokyo (hereinafter, "Izumi Laboratory"), have built a cloud-based simulation environment (hereinafter, "the system") for the artificial market[1] using agent-based modeling[2] (hereinafter, "ABM") in collaboration with Microsoft Japan Co., Ltd., Cloudera, Inc., and Simudyne Ltd. This is a groundbreaking attempt to enable simulations using ABM, which requires a large-scale parallel and distributed processing environment, in an open cloud environment. Going forward, ISID and the Izumi Laboratory will use this system to proceed with joint research on the application of ABM in market risk analysis and other areas of the financial sector.

Background and Aims

With rapid advancements in digitalization, market environments and consumption behaviors are becoming increasingly complex and diversified. In the financial sector in particular, rapid changes in global conditions, the rise of crypto assets and other developments are creating new factors and attracting new market participants that are affecting markets, making it difficult to accurately predict potential future developments using only traditional statistical methods.

ABM is a computer model that simulates the overall effects of actions and interactions among multiple autonomous agents (programs), a concept advanced by academic research as a method for reproducing and predicting complex global phenomena. Environments using ABM to virtually simulate financial markets and economic phenomena, in other words, by creating artificial markets, ABM is expected to be able to make predictions with a high degree of accuracy. ABM is already being used, mainly in Europe and the United States. However, simulations using ABM require enormous computer resources, hence it has not been put to practical use in Japan.

Under these circumstances, ISID and the Izumi Laboratory have now achieved a groundbreaking attempt to build an ABM simulation environment on an open cloud platform. Specifically, Cloudera CDH, Cloudera's parallel distributed processing technology, and Simudyne, an ABM simulation tool were mounted on the highly scalable enterprise grade Microsoft Azure cloud, then the interbank network model[3] developed by Izumi Laboratory was incorporated in an effort to greatly advance the application of ABM in the financial sector.
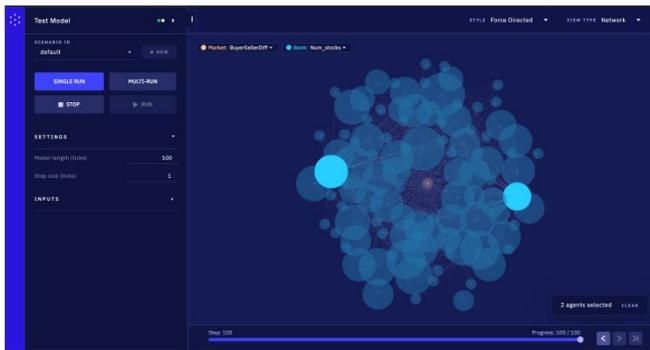
Screen showing the relationship between banks in a network diagram

Simulation results graph display screen

Roles of Each Party and Future Aims

ISID has numerous achievements in constructing large-scale systems in the financial sector, including algorithmic trading platforms and risk management simulations, and is involved in the construction of several systems using advanced cloud technologies. On this project, ISID constructed the entire system environment, from the building of infrastructure using Microsoft Azure and Cloudera CDH, to the introduction of Simudyne and interbank network model porting. Going forward, ISID plans to engage in technical verification and the development of service models for the practical application of this system.

Izumi Laboratory is engaged in research and development on foundational technologies for building behavioral models for humans as a group from real world data on various human behavioral interactions, and is promoting application in socioeconomic and artificial market simulations. On this project, Izumi Laboratory provided its proprietarily developed interbank network model. Going forward, Izumi Laboratory plans to use this system to conduct simulations involving linkage failures in interbank networks to verify the efficacy of ABM utilization in the financial sector, the results of which will be published in research papers.

Relevant Party and Collaborator Endorsements

Tsuyoshi Hirashima, ISID Executive Officer and General Manager of the Financial Industry Business Operations, commented on this project as follows.

"ISID expects to use the agent-based modeling being pioneered by Izumi Laboratory in the financial sector. In particular, we are able to leverage business know-how that is one of ISID's strengths and expand into market-related areas. In collaboration with Izumi Laboratory, we will work to contribute to the development of financial markets overall by expanding the possibilities for this technology."

Prof. Kiyoshi Izumi, School of Engineering, the University of Tokyo said, "Research on financial system design using ABM is highly expected by financial practitioners although it is still in its early stages. One of the problems in applying ABM is the difficulties to create simulation programs. The increase in research cases using this system, such as this trial, can promote the standardization and reuse of simulation programs. Then, the practicality of system design by ABM will be greatly enhanced."

Hiroshi Ando, General Manager of Partner Business Headquarters, Partner Business Headquarters,

Microsoft Japan, made the following comments.

"Microsoft Japan welcomes the launch of joint research by ISID and the University of Tokyo Izumi Laboratory for the purpose of applying agent-based modeling to the financial sector. We will support the ability to flexibly and securely build a robust simulation execution environment on Azure."

Dr. Richard L. Harmon, Managing Director of Financial Services at Cloudera states that "Cloudera believes the transformative research undertaken by the Izumi/Sakaji Laboratory at the University of Tokyo provides the ability for real advancements in both the theoretical advancement of ABM simulations as well as addressing significant changes facing the Japanese and Global Financial system. This partnership also shows the enormous potential for Cloud computing to accelerate the adoption of new approaches to address risk, economic and societal challenges in a way that has never been feasible before without the investment in very expensive supercomputing capabilities. We are very pleased to be working closely with all the partners involved and anticipate Prof Izumi's team will bring new insights into addressing several fundamental challenges facing our global financial system."

Simudyne's CEO, Justin Lyon said that "We are pleased that ISID and the University of Tokyo are using agent-based simulation in this ground breaking effort. It helps understand the emergent behaviour of financial market participants as they interact in a realistic environment. It is our hope that this effort will help Japan to continue to move beyond traditional methods and assumptions to further the understanding of financial markets."

(Reference)

About Microsoft Azure
Microsoft Azure is an open, flexible and secure enterprise level cloud computing platform provided by Microsoft. This platform supports IaaS and PaaS, and includes the latest cloud services such as AI and IoT.

About Cloudera CDH
Cloudera is an open source software distribution service provided by Cloudera, Inc., that includes Apache Hadoop and major open source projects.

About Simudyne
A simulation tool using agent-based modeling developed by Simudyne Ltd., a startup company established in London in 2016 with funding from Barclays.

Notes: 1. Agent-based modeling: A computer model that reproduces complex phenomena and is able to predict a large number of scenarios by simulating situations in which multiple agents (programs) are simultaneously active and interact with one another.
2. Artificial market: A financial market created virtually on a computer. Artificial markets enable the analysis of actual economic phenomena and verification of economic theories, with simulation results obtained from artificial markets used for decision-making support in actual financial markets.
3. Interbank network model: A model that uses a network structure to represent the relationships between multiple banks in order to clarify the lending relationships between interbank transactions.

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