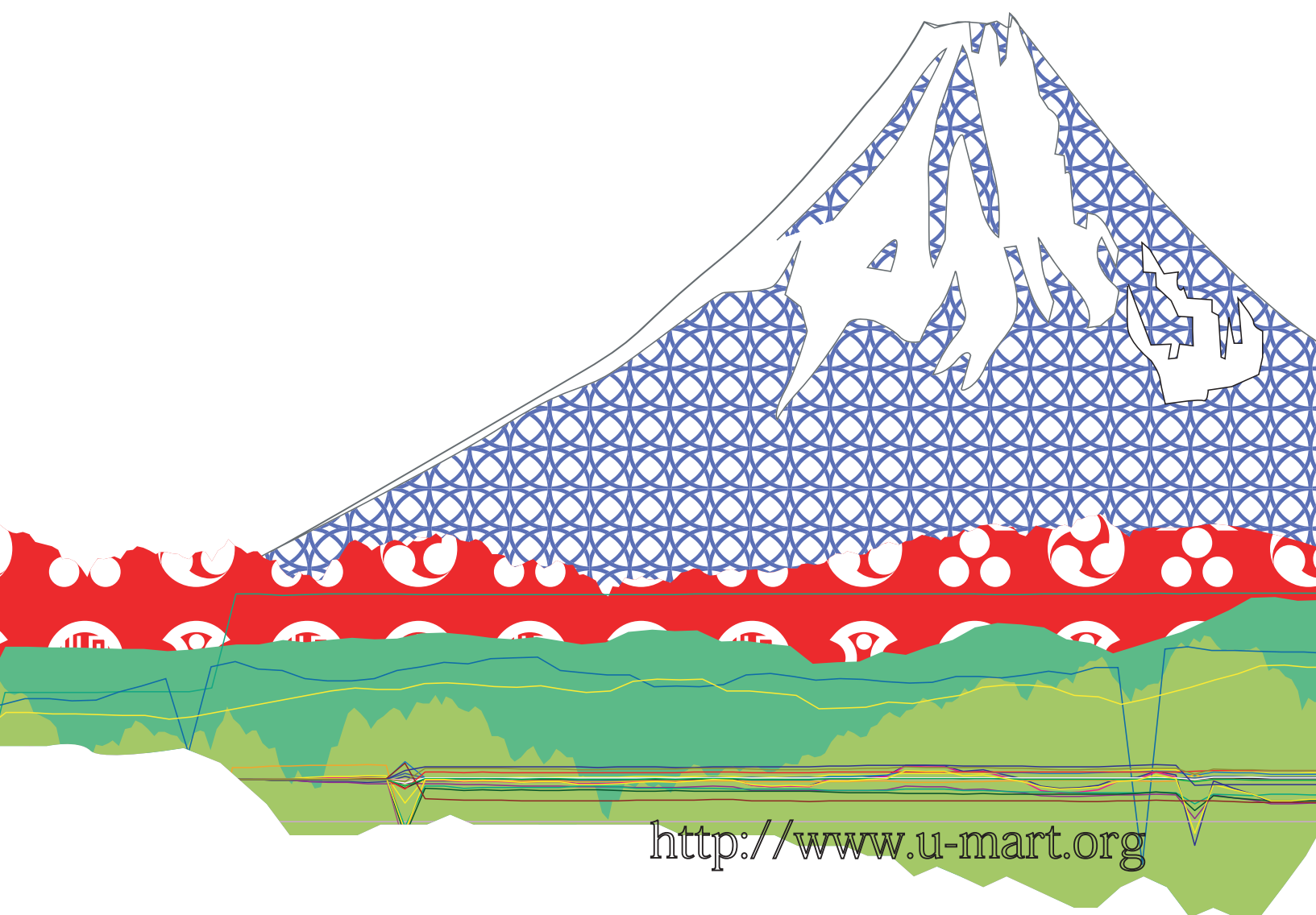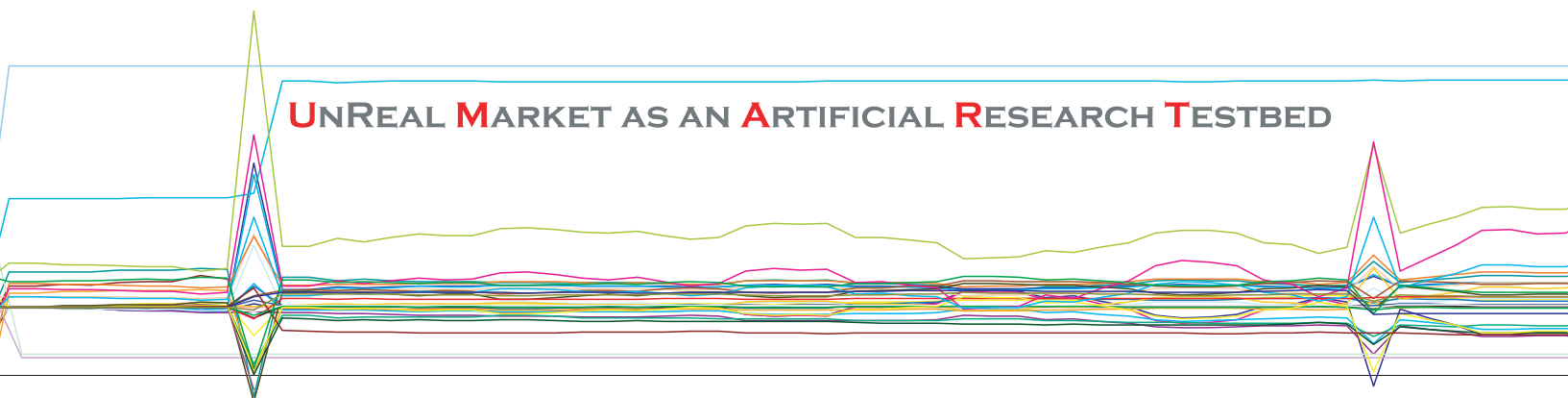# U-mart

UNREAL MARKET AS AN ARTIFICIAL RESEARCH TESTBED

http://www.u-mart.org

Project Leader

Yoshinori Shiozawa   (Osaka City University)

The purpose of our research is to show how economics research can benefit from the latest computer technology. Economics developed a great deal in the 20th century. Development was based mainly on mathematical methods. But this, in fact, is not an appropriate method of analyzing markets that change every hour and every day. In a stock market, prices constantly change depending on speculation. U-Mart, a man-made market, has been proposed in order to study such markets.

What sets U-Mart apart from other software that can virtually experience stock trading, is the price fluctuation according to selling and buying by actual participants. No such interaction can be found in experience-based software. In U-Mart, both people and computer programs (machine agents) can participate under identical conditions. The important "actuality" is that there is nothing wrong with participation by people. However, computer programs can implement fast-acting experiments with variously changing environmental conditions. These two advantages characterize U-Mart as a good system.

Although the U-Mart system is internationally appreciated for being at the forefront of market research, it is by no means limited to a small number of researchers. The whole system, including its source code, is open and distributed without charge. This really shows our philosophy which is to create and provide a common test bed for research into financial markets.

The Programers of U-Mart System
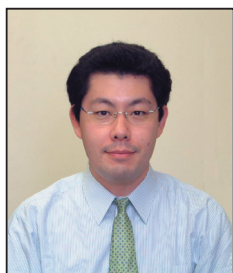
Hiroshi Sato (National Diffence Academy)

I mainly worked on the implementation of Version1 in U-Mart. In spite of using a system far beyond my competence,I think back fondly on barely being able to complete the system, thanks only to the agent-based simulation, and to the excitement of the people getting together there (not forgetting moving here and there for after-implementation maintenance). Version1 was rather rough, but the latest version is much more user-friendly, thanks to the help of both Mr. Ono and Mr. Mori. You really must give this system a try. Please send any requests or bug reports you may have to the following address. u-mart-query@u-mart.econ.kyoto-u.ac.jp

Isao Ono (Tokyo Institute of Technology)

In U-Mart, I was assigned to work on an engine and a part of GUI of Version2. Fortunately many people have used Version1, but it has problems which make it troublesome to install, to manage and to analyze data. Hence, Version2 was developed to make it more stable and easier to use. This,I think, is why the system was finished with a more user-friendly interface. The more people who use this system the easier it will be for me to carry out research into market trading and the more grateful I will be.
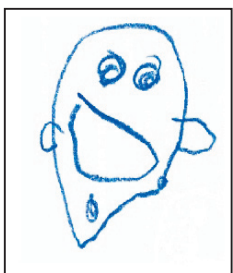
Maoki Mori (Osaka Prefecture University)

U-Mart was developed with a particular focus GUI. This was the first time for me to develop decent GUI programming; what was really hard was developing the interface part. I cannot tell you how many of my holidays vanished away thanks to a pile of improvement requests made by friends for each event... On each occasion, looking up into the fair skies, I would often embed a heartfelt complaint within the program as a comment.
If my beloved (or accursed!?) U-Mart system can be of service to the public, nothing would me make happier.
(P.S Please be kind with your bug reports!)

Activities and history of U-Mart Project

1998

August 21 — The 4th Sohatsu System Symposium(at Kazusa Academia Park) was held; Mr.Shiozawa was invited and had a lecture titled "Fukuzatsu-kei Yobanashi: Shinka Suru Keizai to Keizaigaku (A Talk about Complex Systems: Advencing Economy and Economics)." At the party aftrerwards, a vision of the artificial futures market was first discussed.

1999

March 27 — A proposal session "Sinka Suru Keizai no Jikkensitsu Sose no Tameni: Virtual Market no Sankagata Simulation (To Create Laboratory to Research Advancing Economy: Hands-on Simulation of Virtual Market)" was held and the concept of V-Mart (former U-Mart) was proposed.

Spring to Summer — U-Mart Project organized and its workshop launched.

Autumn — Specifications of U-Mart Program, as an artificial futures market, defined.

2000

March 25 to 26 — First version of U-Mart created and demonstrated at conference of Japan Association for Evolutionary Economics held in Tokyo.

August — First open experiment Pre U-Mart 2000 at Sohatsu System Symposium

2001

March 30 to 31 — U-Mart session, at conference of Japan Association for Evolutionary Economics in Fukuoka.

May 17 — At U-Mart seminar, we introduced U-Mart-related tools and demonstrated how to use it.

July 8 — At CASOS conference, Carnegie Mellon University, we proposed U-Mart demo and international open experiment.

August 25 — Domestic open experiment U-Mart 2001 at SICE Natsuno Gakko

2002

January 7 to 8 — Project members gathered at Shuzenji, Shizuoka Pref., to work out a research plan.

March 30 — A conference of Japan Association for Evolutionary Economics was held. At a U-Mart session, research results and educational achievements were reported.

June 22 — International open experiment UMIE 2002 (at CASOS)

July 26 to 30 — U-Mart Summer School at Suzukakedai Campus, Tokyo Institute of Technology

November 3 to 4 — SICE System Engineering Association's workshop (on 3rd), "Jinkosijyo Kenkyu no Genjyo to Tenkai (Current Circumstances of Artificial Market Research)" was held. During this workshop, U-Mart 2002 session was held.

2003

March 29 — U-Mart session at a conference of Japan Association for Evolutionary Economics in Tokyo

June 24 — International open experiment UMIE 2003 (at NAACOS)

July 31 to August 4 — U-Mart Summer School at Kyoto University

August 27 — Domestic open laboratory U-Mart 2003 (at ISAGA)

2004

March 29 — U-Mart session at a conference of JAFEE

May27 to 28 — International open experiment UMIE 2004(at AESCS)

September 13 ro 17 — U-Mart Summer School at Hakodadte Future University

October 2 — Domestic open experiment U-Mart2004(at autumn conference of JAFEE)

December 14 to 17 — Presentation about U-Mart(at ICEES 2004)

2005

January 17 to 18 — Presentation about U-Mart(at Hakodate Mirai University)

March 4 — SOCE(at Tokyo Institute of Techonology)

March 26 to 28 — U-Mart session at a conference of JAFEE

July 9 to 13 — AESCS'05 at Tokyo Institute of Techonology

August 3 to 7 — U-Mart Summer School at Campus Plaza Kyoto

September 12 — Domestic open experiment U-Mart 2005 and international open experiment UMIE 2005 (at Kyoto University)

What is U-Mart?

・Artificial futures market with an underlying asset J30

・Artificial market in which both machine and human agents are allowed to coexist, and a set of tools of it

Purposes of U-Mart

・Provide a common test bed for academic investigations

・To be an equivalent of RoboCup in the economics world, conduct domestic and international open experiments

・Provide a common test bed for academic investigations

・Provide a courseware for training

Virtual Futures Market, U-Mart
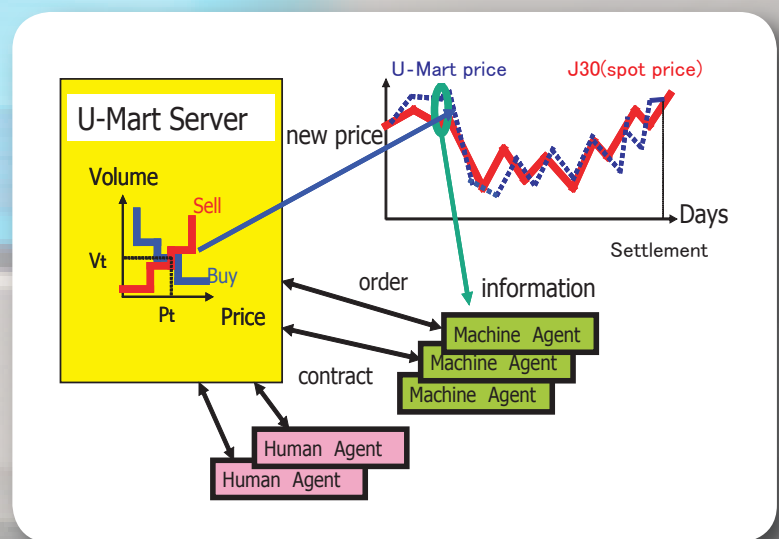
Virtual Markets attract attention of economists, engineers and computer scientists as a novel research topic. The U-Mart Project is a forum for interdisciplinary research using virtual markets. The organizing committee of the U-Mart has developed a virtual market simulator of a futures market of an existing stock index, demonstrated it in several academic conferences, and carried out virtual market experiments using it involving participants (human traders/software agents) all over Japan via the internet. The U-Mart simulator is a system that participant traders access to the U-Mart servers via the internet, and its salient feature is that the U-Mart system enables hybrid simulation involving both human traders and the software trading agents.

From the viewpoint of ECONOMICS, to design virtual markets and to carry out simulation using them help understanding of

(1) behaviors of human in trading security,

(2) behaviors of the emerging market, and institutional devices to control them.

From the viewpoint of COMPUTER SCIENCE, they contribute to

(3) study of evolution, learning, collective intelligence through developing software trading agents.

Further, the U-Mart Project aims at the Third Mode of Study as alternative to Theory and Experiments in Social Sciences through interdisciplinary activity of education and research.Currently, the artificial futures market, developed for study purpose, is also being used as a courseware for programming practice or market analysis at universities. At the same time, while providing many esperimental data and opportunities for investment program collections, we have held open experiments to provide many researchers from various fields with discussion opportunities.

U-Mart Project activities

U-Mart Project activities are roughly categorized into three types: research, event, and educational. These three types are inseparably tied.

Research As one of Japan's top artificial market research projects, many researchers join this project and do various activities. The major objective of this project is to design a financial market system. More specifically, we hope to establish market control methods by controlling the extent and scope of information disclosure with elements such as circuit breakers including commission rate and price movement limits, market maker, indicative price calculation methods, and changes in information update intervals. We measure information value and information tradeoffs (e.g. liquidity or stability) to do basic research to use information disclosure timing and scope as market control parameters.Now I am focusing on analysis of "a thin board market" and the development of a market maker aimed at a solution.
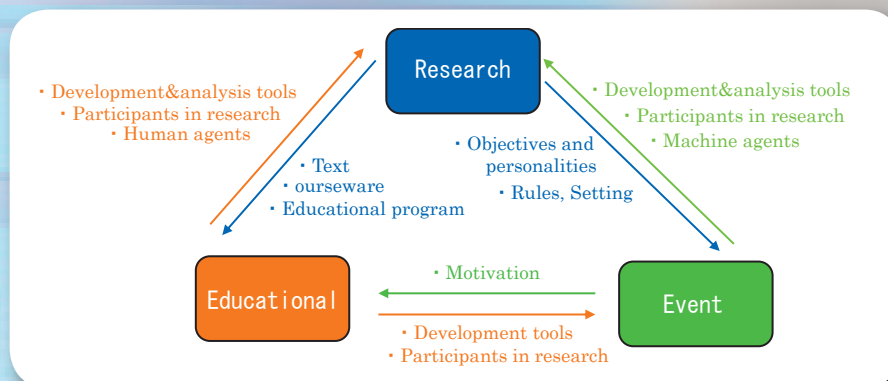
Educational U-Mart System is used as an excellent courseware for engineering and economics. Engineering educational institutions use the U-Mart system for programming practices. Also the investment program is very useful for practice because it can actually be operated, is open to set objectives from very simple algorithms to sophisticated learning algorithms, and motivates students by providing opportunities for competitions and other events (open experiments).

Event Experiments open to the public inviting public machine agents and human agents, and related discussions inviting experts from various fields are categorized as event activities. In recent years, UMIE 20xx series international open experiments and U-Mart20xx series domestic open experiments are periodically held. Also, we have special or tutorial sessions at international and domestic conferences hosted by NAACSOS, ISAGA, Japan Association for Evolutional Economics, and Information Processing Society of Japan. At each event, we collect and report the results of U-Mart research as well as provide experts from various fields with discussion opportunities by having panel discussions.

Relationship among three types activities

These three types of activities are inseparably tied. Part of their relationships is shown in the above figure. Machine agents invited to open experiments are necessary to increase the diversity of agent sets used for research. The diversity motivates researchers from various fields to have symposiums and workshops to gather and it serves as a springboard for another open experiment or joint research. The set of tools developed for educational purposes are used for research and events. Many machine agents have been developed through educational courses and have contributed to agent sets used for further research. More economics students join U-Mart as human agents, and more experiment opportunities are given. Also, the students have proposed GUI improvement ideas and have contributed to help develop new tools used for event activities. As more open experiments are held, more problems must be resolved using the artificial market are found as well as logs to be analyzed. Also as the research progressed more, purposes of open experiments have become clearer, and rules & systems have changed.

Overview of U-Mart System Version 2.0

The U-Mart System contains tools to be used for connecting human and machine agents via LAN or Internet at the same time for trading, and set of tools used for practicing transactions and developing machine agent with user's own PC. There are five main tools. All tools have almost the same look & feel, and can share parts and machine agents each other

Network tools

Human Agent Trading Terminal

Human Agent Trading Terminal: A tool necessary for a human agent to join trading. It sends orders and shows a variety of information from the server.

The U-Mart System is an artificial futures market in which human and machine agents connect each other at the same time and trade via LAN or Internet. There are three tools to be used to implement this market.
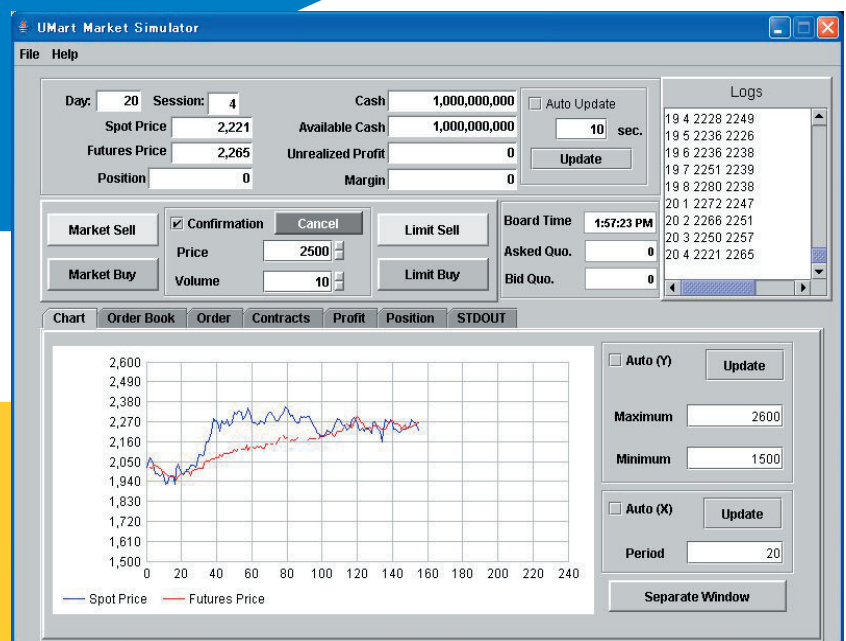
Market Simulator

It is used for learning the outline of U-Mart trading or for practice when a user tries to join the market as a human agent. This tool has the same look & feel as the Human Agent Trading Terminal for network. You can compete with a built-in machine agent.

Standalon machinetools

These are tools to be used for futures trade practice with the user's own PC or for machine agent development.

Market Server

It is the core of the U-Mart System. It acts as a marketing tool (i.e. calculate total sum of orders to realize the trade) and as an agent's asset management tool. It sends various data including market conditions, individual agent's asset quality, and ordering trends via network. Also you can view these data using this tool.

Machine Agent Adapter

It works for communication functions of a machine agent that only includes strategic parts. Machine agents use this tool to join in trades from client PCs.

U-Mart: Market Server

File Help

| Day: | 14 | Spot Price | 2,213 | ☐ Auto Update | 10 sec. |
| Session: | 2 | Futures Price | 2,219 | Update | |

| Info | Chart | Order Book | Contracts | Profit | Position | Exchange Info | STDOUT |

	MemberID	Sell	Buy	TotalSell	TotalBuy	Cash	UnrealizedProfit	Margin
M	AntiTrendStrategy1	0	0	691	504	894,504,000	-49,396,000	56,100,000
M	AntiTrendStrategy2	13	0	868	903	990,673,000	-2,727,000	6,600,000
M	DayTradeStrategy1	0	0	447	191	888,191,000	-35,009,000	76,800,000
M	DayTradeStrategy2	0	0	475	168	866,013,000	-41,887,000	92,100,000
M	MovingAverageStrategy	0	0	61	4	975,644,000	-7,256,000	17,100,000
M	RandomStrategy	0	0	741	555	886,665,000	-57,535,000	55,800,000
M	RsiStrategy	0	34	536	343	894,972,000	-57,328,000	47,700,000
M	SFSpreadStrategy1	0	0	266	475	1,000,377,000	63,077,000	62,700,000
M	SFSpreadStrategy2	0	0	216	473	965,375,000	42,475,000	77,100,000
M	SMovingAverageStrategy1	0	0	59	55	996,465,000	-2,335,000	1,200,000
M	SMovingAverageStrategy2	0	0	16	47	997,899,000	7,199,000	9,300,000
M	SMovingAverageStrategy3	0	0	46	72	996,730,000	4,530,000	7,800,000
M	SRandomStrategy0000	0	0	570	657	1,010,604,000	36,704,000	26,100,000
M	SRandomStrategy0001	37	0	389	680	958,705,000	34,905,000	76,200,000
M	SRandomStrategy0002	0	0	403	656	968,329,000	44,229,000	75,900,000
M	SRsiStrategy1	0	0	142	44	944,028,000	-26,572,000	29,400,000
M	SRsiStrategy2	0	0	86	47	979,001,000	-9,299,000	11,700,000
M	SRsiStrategy3	0	0	22	40	989,722,000	-4,878,000	5,400,000
M	TrendStrategy	0	16	840	960	1,020,303,000	61,103,000	40,800,000
H	h1	0	0	0	0	1,000,000,000	0	0
H	h2	0	0	0	0	1,000,000,000	0	0
H	h3	0	0	0	0	1,000,000,000	0	0
H	h4	0	0	0	0	1,000,000,000	0	0
H	h5	0	0	0	0	1,000,000,000	0	0
H	h6	0	0	0	0	1,000,000,000	0	0
H	h7	0	0	0	0	1,000,000,000	0	0
H	h8	0	0	0	0	1,000,000,000	0	0
H	h9	0	0	0	0	1,000,000,000	0	0
H	h10	0	0	0	0	1,000,000,000	0	0

Machine Agent Viewer

It is used to let the user's self-made agent compete with a built-in machine agent within the user's own PC. You can use it to trace the self-made agent's asset conditions and orders stepwise to check if it behaves as expected or you find any unexpected conditions.

The Results of U-Mart

It was the dawn of the U-Mart project, at the exhibit experiment of U-Mart2001 held in August 2001, when a full-scale experiment by human agents was carried out. Stock prices suddenly came tumbling down without any warning. It sent a shock wave throughout the experiment site which had been quiet until that moment because of serious trading. There were screams and shouts like "What's going on!?" or "Buy! Buying order!", and the cry of "Bankrupt" could heard from all around. Tracing the source of the problem later, it was found that some people had wrongly input order numbers and order prices. We thought that this was just one particular case because the system was still immature and the input operation was confusing. But there was no real cash movement, and we accepted this case as merely an amusing story.

But on November 30, 2001, three month after the experiment, an important piece of news made headlines. The UBS Investment Bank was said to have sent in orders for a "sell-off of 610,000 stocks at 16 yen" instead of a "sell-off of 16 stocks at 610,000 yen", towards stocks in Dentsu, Inc. which was listed on the first section of the Tokyo Stock Exchange that day. It was expected to cost approximately 600,000 yen at first, but because of this order it nosedived to 405,000 yen, after it cost 420,000 yen. Then at the end of that day, it showed a volatility that the price went up to 470,000 yen. The "amusing story" which had occurred during the experiment, had just occurred not just as an amusement but for real. It is said that UBS Investment Bank incurred an estimated 10 billion yen loss due to this case.

Afterwards, we tried to establish an early warning system to prevent similar cases from occurring again. Also we reworked the GUI part of the system in order to avoid inputting errors by including some default values in advance, adding other confirmation screens and devising different coloration and an allocation of windows. However, similar mistakes occurred every time the experiment was carried out. As records of public experiment featured in the latter part of this pamphlet show, similar volatility occurs almost every time in the series U-Mart200x which include human agent participants. In the real world, a continuous stream of similar cases also occurs. J:COM Corporation, joined the market on January 8, 2006, it transpired that delivery was impossible because of heavy selling which was 40 times the outstanding stock volume of 610,000 stocks at 1 yen. At this time, the stock market plunge across the board, including the first section of the Tokyo Stock Exchange, was giving rise to rumors that the management, not only of Mizuho Securities that sent in an order but also of Mizuho Corporate Bank, as a parental corporation of Mizuho Securities, was in danger.

2.   A try it and see (Yak-ko, in Japanese) study

U-Mart is an experimental tool for multi-agent simulation (a computer simulation by machine agents) and for gaming simulation (a gaming simulation by human agents). The word "simulation" appearing in both is translated as "Mogi-Jikken", in Japanese. Simulation describes an experiment that "waits and sees how it works making agents take certain actions in the unrealistic (virtual) world". We often face "try it and see (Yak-ko, in Japanese)" criticism when studying simulation. But it is nothing more than "when we try this, this is what happens (Yatte mitara ko natta, in Japanese)". Strictly speaking, there is no room for objection to the following questions: How does a phenomenon which occurs in the virtual world created in a computer or on an experimental site relate to the real world? Is it nothing to do with that, actually? The answer is, in thinking about problems such as order errors, it is very important to use the process of building upon an experience of "try it and this is what happens", and then to consider a countermeasure based on the experience. Although if things seem as if they cannot occur in the real world, there is no shortage of things that we cannot even imagine until we try it out and it really occurs on the experimental site.

```
132           fShortReferenceTerm, 1);↓
133     //↓
134     if (previousShortTermMA < 0.0) {↓
135         order.buysell = Order.NONE;↓
136         return order;↓
137     }↓
```

3.   Market research and research using the market

I discovered a lot of things when I created a U-Mart system and studied it. First of all, and above everything else, I was faced with the issue of what a market really is. This issue, put like that, could be rather profound and have a philosophical tone. However, what we really experienced was simpler and more visceral. At first, prices are absolutely unstable. They wobble up and down with a slight fluctuation in orders, including order errors. In the world we now live in, octopus balls cost 200 yen with eight balls in a package, and a tofu costs 88 yen. Of course, there is other tofu which costs 128 yen for someone who dearly loves tofu; or sometimes we can buy tofu at 88 yen if we buy two. Whichever price it is, something goes up in price or comes down in price on the basis of 88 yen for one tofu. But when it comes to the price in a forward market, it is quite unstable, just like it costs 5 yen and then it costs 8000 yen. It is an unsettling feeling just like driving a car on ice with normal tires.

Additionally, I experienced what can only be described as "a muddy swamp" at best, following the research step-by-step. It was when I did a search on what influence price sequence has when an investing algorithm differs. There is a need to set a basing point somewhere in order to determine its influence, and set there as the basing point confirming that a particular circumstance is caused by particular condition. Then when the condition was changed, the influence would be determined by measuring how much it is out of alignment from the basing point. Ideally, the basing point could be "a dot" better, though it is hard for this to be the case. Trying for everything with the same condition, I found an area where probably the basing point is covered within "a specific range". In fact, when I started the experiment and tried to find the basing point, there was no way to determine the influence, even though I tried the experiment again and again, because "the range" is so wide. Literally speaking, I was left utterly helpless.

Another point that I noticed in research using the market was the difficulty of interdisciplinary study. We are a team concentrating on researchers from engineering, economics and management. Originally it would be ideal if we could carry our research forward together by sharing common awareness and approaching it in different ways. However, it is quite difficult to "share common awareness" at first. In the end, what often happens is that one helps the others' research based on common awareness. In the case of the U-Mart research, as the object is the market and the tool is the program, it became an entirely one-sided relationship, where engineering researchers helped the study of economics and theory of management.

Looking at the research subject of engineering and of economics and management, there is a tendency for the former to be interested in research using the market and the latter to be interested in research regarding the market. In the public experiment UMIE200x series which issued invitations to machine agents, there were some agents that applied to participate from a laboratory developing a decision-making assist system for the purpose of performance evaluation for its new system. Also when research was done to find out the most suitable investing method by learning with U-Mart, there was an example of an agent that "did not do anything" as a result of learning. Accidentally, this proved that the will of grandfather which says "forward trading would be the last thing you would do" was right. The "Thin board market", which is the research subject of the present U-Mart project, is research in the economics area. It is quite challenging to find answers for the following questions: What kind of qualities does the thin board market have? What can we do to call orders to the thin board market? The real market has a market maker, who is an expert at changing thin board into thick board. What kind of regulations can those experts follow in order to send an order? How can a machine agent, which can be more specific market maker, be developed? When it comes to these issues, these are the issues that researchers of engineering are good at. U-Mart is a pioneering project in this area, but it is considered that know-how of interdisciplinary study in this area will be stored as social simulation study progresses. Here I introduce examples of conducting engineering and economics research, two by two.

by. Yoshihiro Nakajima

```
205
206     }↓
207     if (order.price > 0) {↓
208         break;↓
209     }↓
210     } // Add normal random number around prevPr
```
8

An attempt to build an approximation model of an economic and social system

Isao Ono
(Tokyo Institute of Technology)

As a method of building an approximation model of a macro indicator for an ESS (Economic and Social System) which is like stock prices in the market, a variety of methods are proposed: such as a method based on a numerical statement, a method based on a neural-network, or a method based on genetic programming. However, only a macro level, like the temporal transition of stock price, can be analyzed with an approximation model built by those methods mentioned earlier, and it is quite difficult to do analysis on the level of each agent activity which belongs to the micro level, i.e., a system that can be a factor of a macro indicator. On the other hand, there is the ABS (Agent-Based Simulation) approach to analysis for ESS, which is becoming of interest because it can do system analysis at both macro and micro level. ABS is a promising method; it is believed that there will be a problem associated with huge amounts of trial and error for getting a model that shows the same action with the targeted system, because it is necessary to decide agent types and its assortment from the bottom up in order to build a model.

Present research proposes a method for building the approximation model based on ABS in an evolutionary way. The proposed method designs an agent having some typical strategies in advance, and searches for the agent assortment, which causes similar phenomenon with the macro indicator observed by ESS of the approximation object, with a GA (Genetic Algorithm). The GA is an optimizing framework imitating organic evolution. As figure1 shows, it is a method whereby a group evolves, setting randomly generated several candidates of solution (individual) as a first group, by repeating three different phases: the phase selects a pair of individual to cross (multiple selection), the phase generates a new solution candidate with crossing (generating a child) and the phase

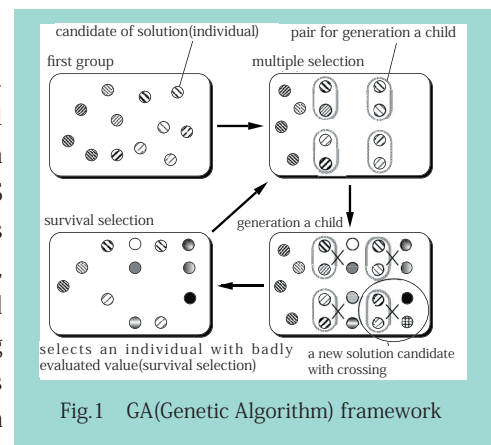phase selects an individual with badly evaluated value (survival selection).

The proposed method, as in figure 2, is taking on an assembly agent as an individual, has manipulation that exchanges an agent subclass as a cross and a model called MGG as a digenetic model which regulates multiple selection and its method.

An experiment using the U-Mart system was tried in order to test the effectiveness of the proposed method. In this experiment, the U-Mart system was used for object approximation for simplification. Four strategies, well known as typical trading strategies, were prepared (moving average refers to spot/forward price, RSI strategy) for the agents. Figure 3 shows trading volume rate and benefit of agents: agents who have each strategy in approximation object, and the other agents who have each strategy as a result of the simulation using the agent group obtained by five trials with the proposed method. From this, it can be seen that the proposed method succeeded in building a highly accurate approximation model at the micro level of the object approximation, such as the rate of trading volume of each strategy and its benefit. For the future, what will happen if numbers of strategies or complexity increase needs to be looked at, and experiments using actual price grouping need to be done.
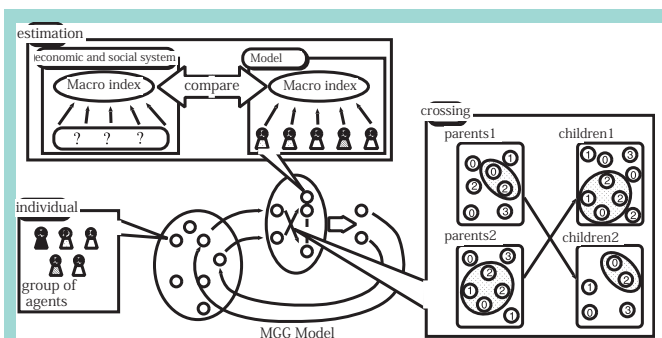

Fig.1 GA(Genetic Algorithm) framework

Fig.2 Framework of proposed method

comparison with the number of dealing (buy : sell)				
	move (U)	move (spot	RSI(U)	RSI(spot
approximate subject	0.18:0.18	0.12:0.12	0.17:0.12	0.04:0.07
approximate model	0.18:0.18	0.11:0.11	0.18:0.12	0.05:0.07
comparison with profits (1000)				
approximate subject	-297	-148	-110	122
approximate model	-286	-110	-131	120

Fig.3 Result of experiment of approximation model building using U-Mart, the man-made market
(In the chart, moving (U), moving (present), RSI (U), RSI (present) indicate the trading strategy. The approximation model indicates the average value of five trials.)

Construction of a trading agent for the man-made market research using multiple objective Genetic Algorithm

Rikiya Fukumoto
Hajime Kita
(Kyoto University)

Research into the man-made market requires agents with a variety of trading strategies which can form the market. For a variety of trading strategies to U-Mart, this research proposes methods of constructing an agent using a multiple objective Genetic Algorithm, paying attention to the quality of multipurpose in risk-return preference as a factor of versatility.

One issue of multiple objective optimization is the optimization of objective function; for all objective functions, "x dominates y" when solve x is superior to solve y. Generally there is a tradeoff between objective functions (e.g. risk and return), a group of "Pareto optimal solution: a solution that can never be dominated by any other solution" (Pareto optimal group) is considered to be understood as the solution of multiple objective optimization. This research requires various strategies of the pareto optimal group by means of an evolutionary method called a multiple objective genetic algorithm, estimating a strategy from both risk and return through a U-Mart simulation.

The right two models have been considered as agents for a target of evolution, from the standpoint of buying and selling:

Agents will be evaluated as follows using the U-Mart simulation:

Model 1: A technical analysis type agent that decides on buying and selling by estimating the forward price from past time-series prices
Model 2: A pseudo arbitrage transaction type agent that decides on buying and selling noting the price differential between spot prices and forward prices (spread)

- As in Figure1, an individual agent set as the object of evolution is evaluated by repeating the simulation, consisting of an individual agent and agent groups configured in advance with a fixed strategy, 30 times.
- In each simulation repeated 30 times for the evaluation test of agents, the using spot price group and the beginning position of the agent change.

Fig.1 How to evaluate an individual in multiple objective genetic algorithm

- The evaluation of "return" is profit and loss ratio (equals (final property minus beginning property) divided by beginning property) followed by each simulation operation, and "risk" is evaluated by variance of profit and loss ratio
- For other agents, a strategy developed by a graduate student will be used in the experiment implemented as part of a class at Tokyo Institute of Technology
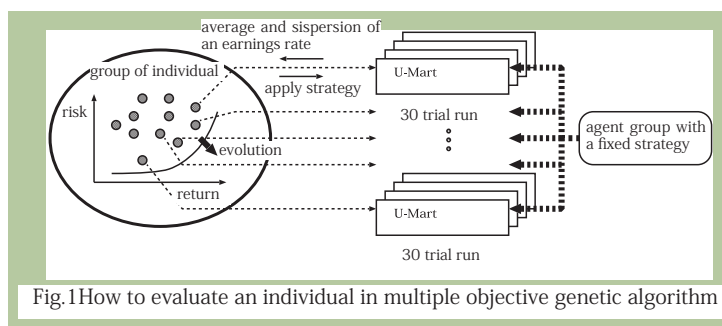
Figure 2 shows the revolutionary determination of the technical analysis type agent, and Figure 3 shows the other one, the pseudo arbitrage transaction type agent. In both cases, it can be seen that agents on a frontier of risk and return were obtained.
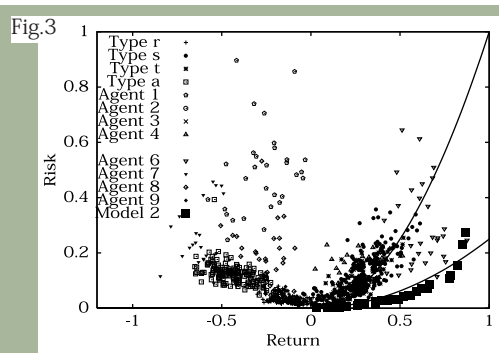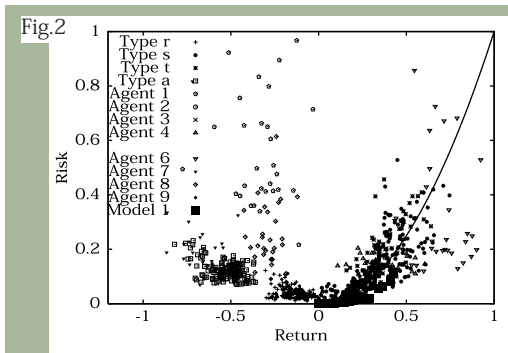

Fig2：An evaluated value of the technical type agent obtained by evolution
Fig.3：An evaluated value of the pseudo arbitrage transaction type agent obtained by evolution

Market maker research

Yoshihiro Nakajima,Yoshinori Shiozawa
(Osaka City University)

▶ 1、Research aim

The aim of this research is to develop a market maker program to activate a "thin board market" that has hardly any orders. There is a market that can hardly carry on an actual trading even if systematically maintained. Such markets are known and described as a thin (board) market, or a low fluid market. It is quite dangerous to send an order to the thin board market because the order might be left alone for a long time. An accidental case, which is unexpected at the time of sending an order, might occur during waiting for the trading. The thin board market gathers fewer orders simply because it is thin board, even if it looks like attractive market.
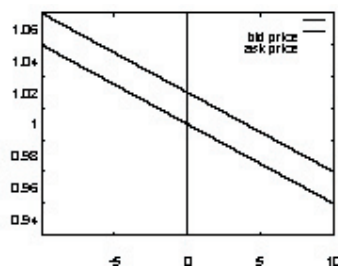
▶ 2、Market Maker

There are many market maker experts in the world. In a case of small market making, it can be assumed that it uses an investing program which sends an order semi-automatically, because it makes less profit. But actually, the reality is not clearly reported. Because of this, we made brand new model for the market maker in order to make a study of the market maker. (An astronomical number of market making studies have been done. But they do not teach us what effective action the market maker should take actually in the thin board market.)

When the market flows with one-sided orders, market makers make a loss. Suppose, for instance, that a market maker might have many buying positions because of a crash in the market. At this time, he might think "I don't want to increase the buying position any further" and "I really want to clear the inventory". In order to do that, it is good to cut the bid price and the selling price. We thought that a negative function relating to stock would be available for bid prices and selling prices of the simplest market maker. Three models were made based on the difference of this function.
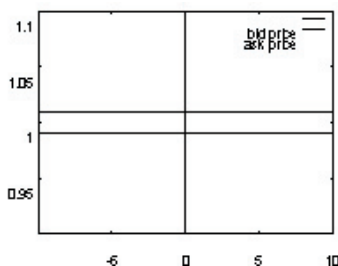
MM Model1(MM1)
Simple Spread type

MM Model2(MM2)
Linear type
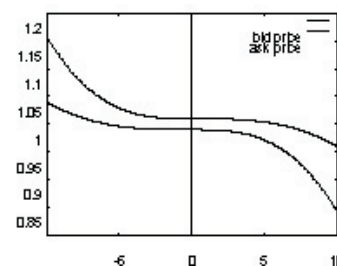
MM Model3(MM3)
Polynomial type

▶ 3、Usefulness of market maker and its feasibility

Let's determine a contracted rate as an indicator of fluidity which checks the effect of a market maker. Also, market makers need to make a fixed return. In a small market consisting of 10 agents that send orders in a random manner with low frequency, we checked the usefulness and the feasibility of three different models of market maker. As a result, the contracted rate rose with a threefold increase, by getting any type of market maker to participate. Also, all three types of market makers could make profits with some degree of stability.

	contractual rate		MM rate of contribution		profit	
	average	S.D.	average	S.D.	average	S.D.
MM1	28.6%	1.1%	80.2%	2.6%	¥3,922,600	¥1,411,405
MM2	28.9%	1.6%	80.6%	2.4%	¥3,231,100	¥645,763
MM3	27.6%	1.5%	79.1%	1.7%	¥4,196,900	¥1,085,071

Fig.1：Price fluctuation of market and market maker position
　　　　(X：time、Y：price/position)
Fig.2：Benefit of market maker
　　　　(X：time、Y：benefit)

Fig.1

Fig.2

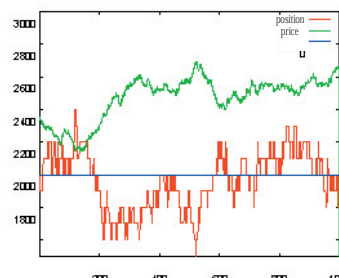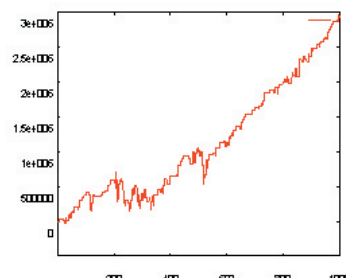# Behavior analysis of human agent

Kazuhisa Taniguchi
(Kinki University)

The U-Mart system was developed as an educational tool in understanding the financial futures market and to help in research, and this system can help participants to deepen their understanding of markets through experience of practical trading.The experiment carried at the Department of Economics, Kinki University in 2004, is provided here as a practical example.

Conditions and purpose of experiment

・Purpose

1. How does board information disclosure affect the trading behaviors of market participants?

2. How do trading behaviors of human agents change the course of the U-Mart experiment?

・Conditions for trading

1. The Itayose trading session is held three times a day, and twenty seconds is given to each.
2. Total thirty-days futures market, namely ninety times of Itaawase trading, is performed.

The disclosure of board information and contracted rate

The disclosure of board information and the contracted rate

A hypothesis test was conducted with 5% of significant level. A one-way analysis of variance, regarding contracted rate setting the availability of board information as the factor, was conducted.The test was conducted toward null hypothesis, with 5% of significant level. "Null hypothesis: The experimental data belong to the same parent population. Namely, the disclosure of board information does not affect the contracted rate." The result showed significant difference as seen in the chart below.

fluctuate factor	fluctuation	free degree	dispersion	surveyed dispersion	F border value(5% significant level)
board information	0.134	1	0.134	7.177	4.149
error	0.597	32	0.019		
amount	0.730	33			

Change in number of orders and number of ordering

The number of orders and the number of ordering increased as the experiments were repeated, and the number of orders in the fourth experiment increased approximately 3.1 times, compared with the first experiment. There is not such a big change in the number of ordering, the average number of ordering per capita, in one Itayose trading session, is in the degree of 1.2 through 1.6 times. Judging from these things, the order frequency does not that much depend on conditions for trading, when it comes to human agents.

Position transition

Almost all agents came to maintain positions by means of the pilot study for learning.

Realized profit and loss transition

Realized profit and loss do not come under the influence of disclosure or nondisclosure of board information.
Character of human agents appears.

Etc.

For more details on the experiment see: "Market mechanism learnt with man-made market (U-Mart economics volume)" scheduled for publication by Kyouritu-Shuppan.
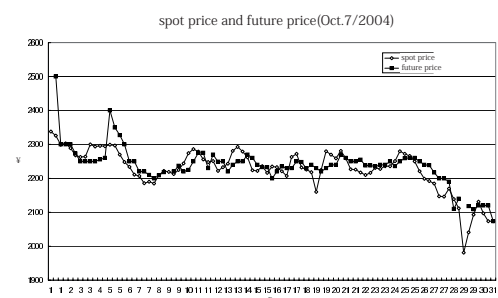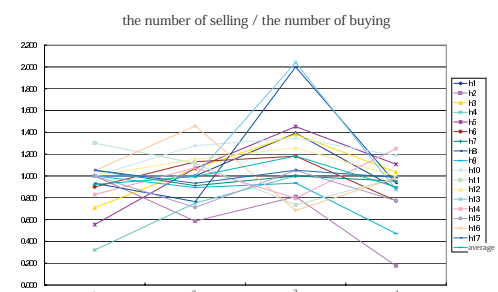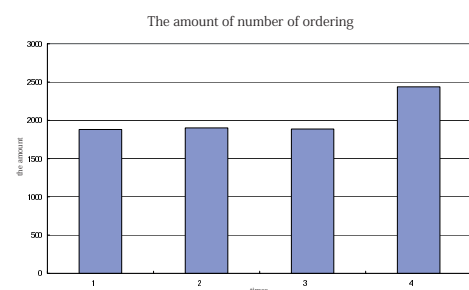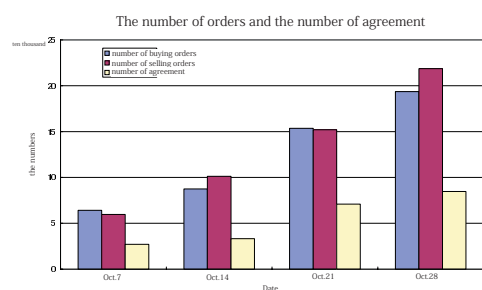

spot price and future price(Oct.7/2004)

Fig.1　Example of price movement
(The 1st experiment)

The number of orders and the number of agreement

The amount of number of ordering

the number of selling / the number of buying

U-Mart for Education

Use of U-Mart for engineering education

Actual implementation example
- Tokyo institute of technology
- Tokyo University
- Tokushima University
- Kyoto University
- Future University - Hakodate

Agent-based simulation exercise, Mainly used for parogramming of software agents

It can be widely used regardless of the skill levels of the students.
- Application of intelligent technique for NN or GA
- Exercise to express one's own strategy in calculatior code
- Application of intelligent technique for price forecasting
- Providing open-ended tasks
- The tutorial for social and economic fields

Use of U-Mart for economics education

Actual implementation example
- Kyoto University
- Osaka City University
- Osaka Sangyo Univesrity
- Tsukuba University
- Chuo University
- Kinki University
- Chiba institute of technology

- With a focus on market simulation by human agents
- Introduction of agent-simulation or gaming
- Individual trades and realization of market formed by trades

U-Mart Summer school

- July 26 to 30, 2002 (5 days)

  Lecturers: 7 Attendees: 20(from 10 uni. and 1 research institute)

  Place: Suzukakedai Campus, Tokyo Institute of Technology
- July 31 to August 4, 2003 (5 days)

  Lecturers: 6 TA: 4 Attendees: 13 (from 7uni. and 1 corporation)

  Place: Academic Center for Computing and Media Studies, Kyoto Uni.
- September 13 to 17, 2004 (5 days)

  Lecturers: 6 TA: 4 Attendees: 17(from 8universities)

  Place: Future University-Hakodate
- August 3 to 7, 2005 (5 days)

  Place: Campus Plaza Kyoto

- Design of a large-scale system
- Thread and network programming
- Description of a technique for highly reliable software development
- Description of modeling method, network programming or concurrent programming
- Learning of system programming for agent-based modeling based on drills using a specific exercise

Activities abroad

Actual implementation example
- Saint-Petersburg State University (Russia, ⇔ Osaka City University)
- Universita di Bologna (Italy)
- National Kaohsiung University of Applied Science(Taiwan)

- Holding a lecture at two locations using a video conference system
- To participate in an event, and trading by human agents, A lecture about machine agent development

Actual implementation examples at Tokyo Institute of Technologies and Tokyo University

Tokyo Institute of Technology's case

- ・Exercise class in the first year of the master's course
- ・Concentrated experiment for 2 days
- ・Half a day was reserved for orientation
- ・One week was given for agent creation
- ・Half a day tournament

Tokyo University's case

- ・Exercise class in the third year of University
- ・Twice a week, for 6 weeks

Curriculum (Tokyo University)

(1) Description of index futures, U-Mart and agent development kit
(2) Experiencing U-Mart through manual trade
(3) Creation of agent (self-study or homework)
(4) Strategy presentation/tournament

（First）

(5) Improved agents
(6) Strategy presentation/tournament

（Second）

(7) Preparation of report
(8) Agent development kit
 ・Originally Tokyo Institute of Technology had developed the kit for use in an exercise class, and Tokyo
・University used it for an exercise too.
  Formal expressions of strategies
Input: Spot, futures price series, position, and holding cash
Output: Selling/buying, order quantity, and index
・Expressed a strategy as one class/method of Java and coded it.
・Components of the kit
Development package: Trading with built-in agents

It works as a stand-alone at each student's hand

Findings for Experiment

- ・Students worked on it with interest.
- ・Students with various skills attended the class.
- - Event a simple theory would do in the market. (Invent a simple theory that would do in the market)
- - Some students who were interested in finance implemented the typical technical analysis or arbitrage theory.
- ・Some students tried to improve the accuracy of forecasting by implementing regression analysis or approximation of function.
- - Levels and achievements of students
- - As for third year undergraduates, their major issue was that if they would be able to express their own strategies in codes.
- - As for graduate students, they were able to try more sophisticated strategies.
- ・Tools must be improved.

Scene of class
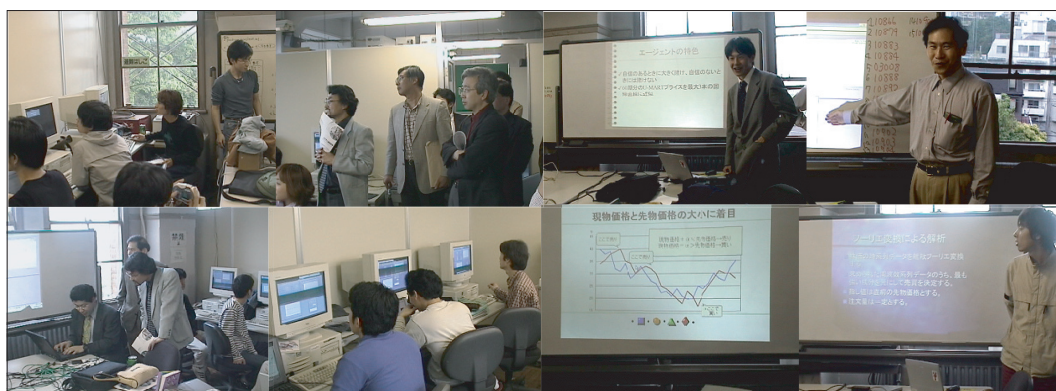
Actual implementation example at Kyoto University

The contents of an experiment

Experiments with human agents
(1) Use of U-Mart for educational purpose
(2) Experiments held at Graduate School of
    Economics/Faculty of Economics, Kyoto University
(3) Experiments held three times

Conditions of experiments

・Results of the third experiment
・Machine agent: 1
・Order randomly at around spot price
・Human agents: 7
Participants were divided into two types: those who made big profits or those who lost everything. Three went bankrupt

Behavior of agents with big profits

Transition of the price
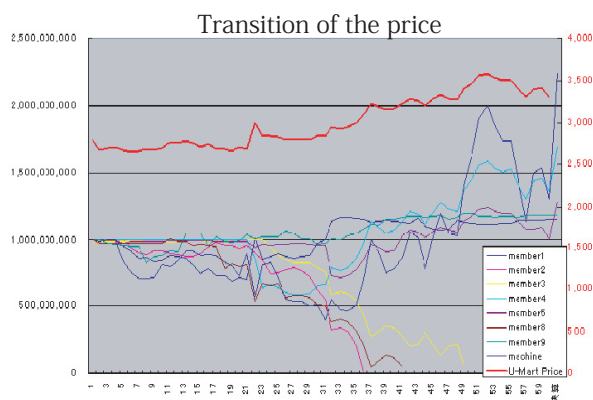
・They repeated small lot orders and gradually accumulated profits.
・Numbers/quantities of selling and buying orders were well balanced.

Behavior of bankrupted agents

Transition of profit
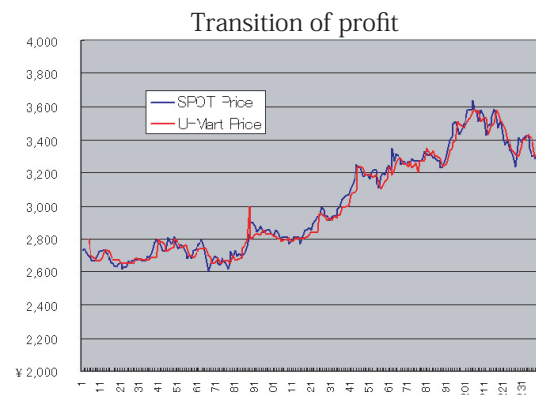
・When they judged on whether the market was going to move in a downward phase, market price raised rapidly, and if their hidden losses (unrealized loss) grew.
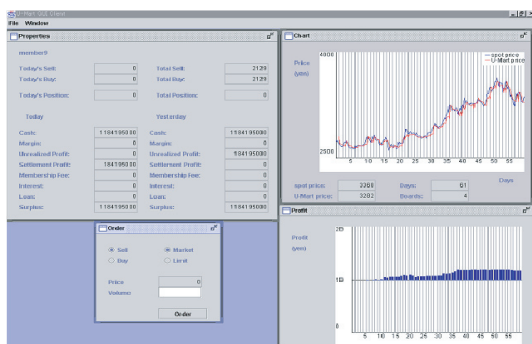
Scene of experiment

Actual implementation example at Chiba Institute of Technology

■ Purpose of lecture

・Practically learn a mechanism of forward trading through participation in the experiment
>> Establishment of the courseware for education
・Learn how to proceed with the project of research and system development through real experiences
・Validation of scalability of the U-Mart system

Contents of lecture

Chiba Insititute of Technology
Faculty of Social Systems Science, Project management
・All sophomores participate (160 sophomores)
・Lecture is given divided into two rooms, because of rooms and number of students
・Students understand the mechanism repeating experiments and participate in the lecture taking their own laptop computers

Data（Style of three days intensive course）

Ⅰ Feb.26 ～ 28, 2004
Ⅱ Feb.28 ～ Mar.2, 2005
・Lecture is conducted one or two times a day, human agents with 80 students in a class
・Set a goal before conducting an experiment, look back over logs after conducting the experiment
・Goal: to realize profit and to keep maintaining positions

Outcome of the lecture

・It could confirm that there is scalability in large-scale environment, and the market can be formed with only human agents, even without machine agents
・Since there are various, different things to know, it brought forth fruit as the courseware of education combined with lecture and experiment regarding the contents which are hard to understand with classroom lecture alone
・Evolution in the understanding of students

Improvement in student trading before and after the maintenance of positions
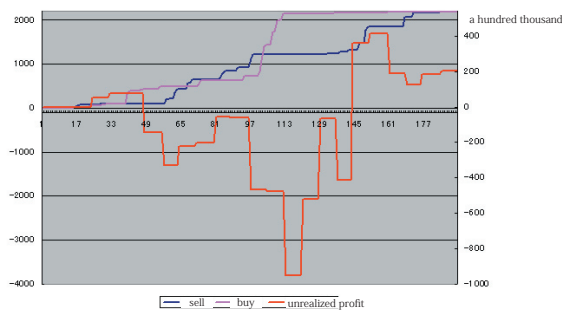
Student trading before learning the maintenance of positions
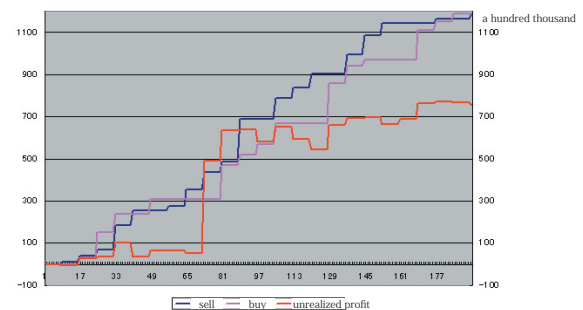
Student trading after learning the maintenance of positions

Scene of lecture

Actual implementation example at Osaka Sangyo University

■ **Summary**   Experiment with human (students of Osaka Sangyo University) agents
- As a feature of U-Mart: GUI especially developed for a research project in which humanities and science (machine human agents) are integrated, and easy to handle for human agents.
- Experiments including preliminary ones were held during May to July ten times
- 28 of the human agents and 3 random machine agents participated

Purposes of experiments

- To know the influence of board information disclosure on trading
- Verify efficiency of the market (analysis of institutional issues)
- To know relationships among information disclosure, trade volume, and price movement
- Specialists in the NY Market secure opportunities for profit gain by monopolizing board information or seller/buyer and the quantity information.

Scene of experiment

Preparation and conditions of experiment

- Learned about securities market and futures market
- Learned about U-Mart Market and how to use GUI
- Creation of formats used for the experiment
- Itayose interval: 10 seconds Duration: 50 minutes per experiment
- Participants were divided into two groups: those where their board information was disclosed, and those not disclosed.

Findings from the experiment

Causes of bankrupt
Total experiment: 28 participants x 4 cycles = 112. Among those, there were 7 bankruptcy cases.
- When the participants got excited, they tended to have input errors (for example, quantity and price were inputted in opposite fields). There were two bankruptcies in that way.
- Because the participants were not able to cut losses, they failed in position management. There were five bankruptcies that way.
- Human agents tended to hope that the price would reverse eventually.

Hasty selling order

100 yen for 1500
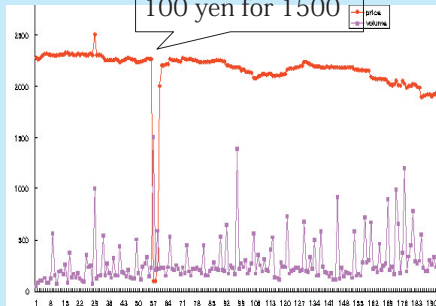
Operation example of a student

Bankrupted on the 14th day
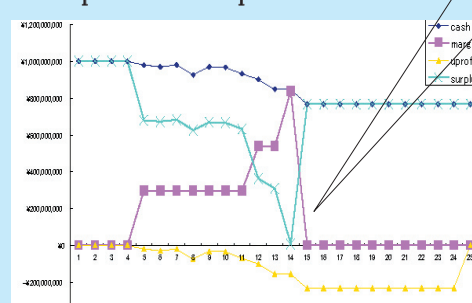
Actual implementation example at Kinki University

■ Purpose of lecture

・An experiment giving consideration to education >> Practically: learn a mechanism of forward trading through participation in the experiment
・Through the experiment: investigate how the disclosure of board information affects trading behaviors of market participants
・Search for conditions of the experiment

Contents of implementation

The experiment by human agents (the year of 2004)
① Educational use of U-Mart (using a new U-Mart server)
② Implementation terms
　　・Pilot tests for learning: 4 times
　　　　(2 times in first stage + 2 times in second stage)
　　・4 times for main experiment(Oct.7・14・21・28, 2004)
③ Participants：17(third grade)

Conditions of implementation

・Times of the Itayose trading session: 3 times a day
・A given time for one Itayose trading session: 20 seconds
・Total thirty-days forward market, ninety times of Itaawase trading
・(20 seconds * 3 + 20 seconds) * 30 days = 40 minutes
・Time given to the experiment: 40 minutes

Learning beforehand

・An experiment for learning using U-Mart in the first stage
・Three days and two nights summer school, to submit assignments, to confirm and to master trading rules.
　In the summer school, develop understanding of trading strategies, knowing what strategies others were using for trading.
・The pilot study was conducted in the second stage. Setting enough time for the Itayose trading session, and took time for everybody to send an order then think.

How to conduct

・17 examinees are divided into two groups, group A has 9 examinees and group B has 8 examinees
・Case1：Disclosure to group A, nondisclosure to group B
・Case2：Nondisclosure to group A, disclosure to group B
・Case3：Disclosure to all
・Case4：Nondisclosure to all

The result of experiments

・Contracted rate of each agent

(contract number divided by order number)
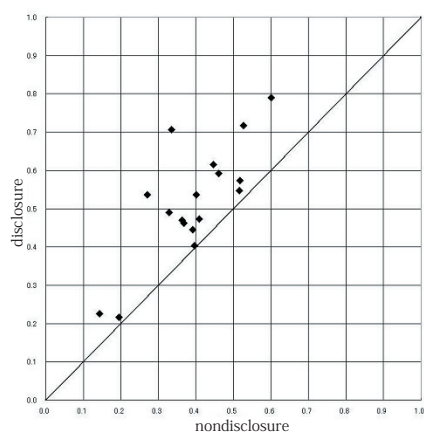
* Vertical axis: Board information is available

Horizontal axis: Board information is unavailable

・The degree of acquisition

Did participation in the U-Mart experiments help to deepen your understanding of forward markets?

No 0%
Somewhat 41%
Yes 59%
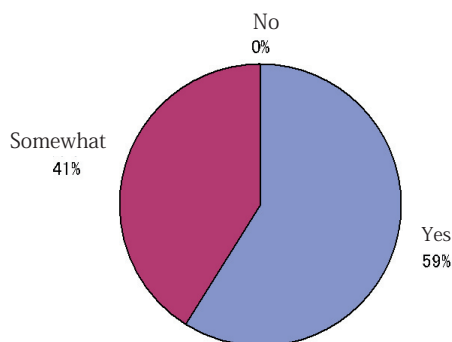
U-Mart Summer School

July 26 to 30, 2002 (5 days)

Lecturers: 7 Attendees: 20
(from 10 universities and 1 research institute)
Place: Suzukakedai Campus, Tokyo Institute of Technology

July 31 to August 4, 2003 (5 days)

Lecturers: 6 TA: 4 Attendees: 13
(from 7 universities and 1 corporation)
Place: Academic Center for Computing and Media Studies, Kyoto University

September 13 to 17, 2004 (5 days)

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(from 8universities)
Place: Future University-Hakodate

August 3 to 7, 2005 (5 days)

Place: Campus Plaza Kyoto

Purposes of U-Mart Summer School

- ・Explain techniques for developing highly reliable software
- ・Explain modeling techniques, network programming, and parallel programming
- ・Learn system programming for ABM by mainly doing practical exercises

Purposes of experiment

- ・Acquire the knowledge necessary for basic programming for agent-based simulation
- ・Analyze, design, and implement object-oriented software
- ・Server client model
- ・Programming of TCP/IP communications
- ・Parallel programming using thread
- ・Tips for developing a large-scale program
- ・Coding conventions including comment statements and variable naming
- ・Design pattern
- ・Modularization of program (method)
- ・Program unit test
- ・Communication between programmers via UML

Scenes of class
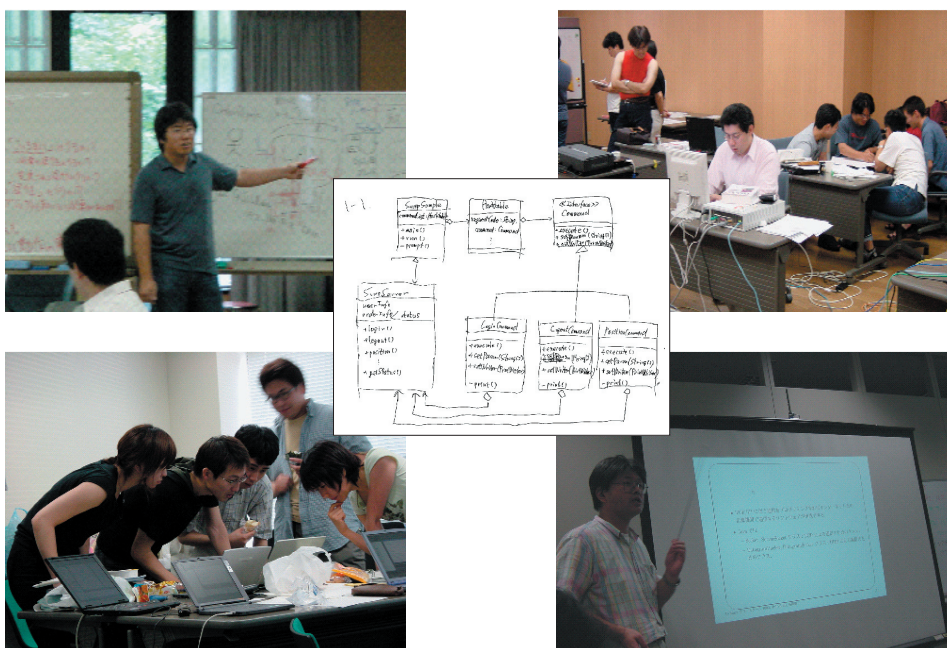
Activities in foreign countries

The joint lecture at St.Petersburg State University(Russia) and Osaka City University (May 6, 2005)

A joint lecture was held. Russian and Japanese students were able to take the same classes through a video conferencing system. They also dealt on the same market using the internet.
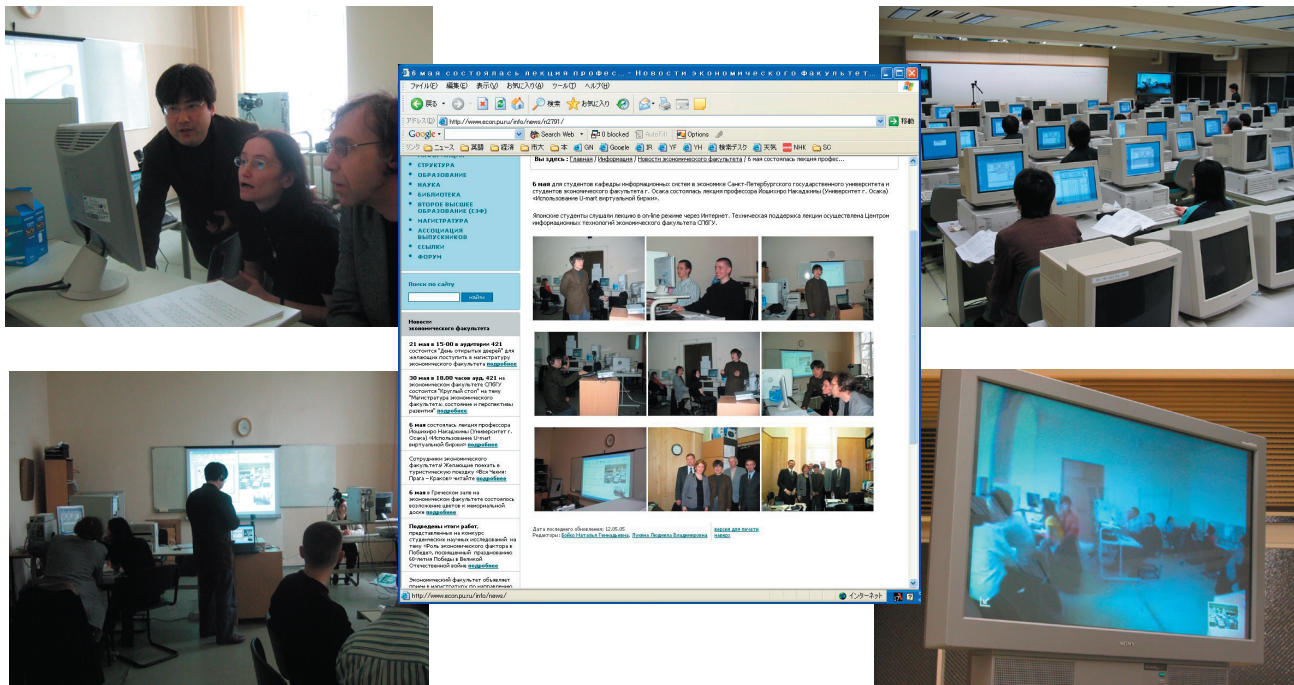
The activity at University of Bologna(Italy, Aspect of Complexity)　　（September 18 〜 25, 2005)

The U-Mart system was introduced at a summer session called "Aspect of Complexity" held in Itlay on July 20th.
A lecture on an experiment using human agents and the creation of machine agents was also given.

The activity at National Kaohsiung University of Applied Science(Taiwan, EFM@CI2005)　（August 12・13, 2005)

The U-Mart system was introduced at a summer session called "Financial and Managerial Applications of Computational Intelligence" held in Taiwan on August 13th. A lecture on an experiment using human agents and the creation of machine agents was also given.

Open Experiment

In the U-Mart Project, open experiments are periodically held.

Open experiments have served as prefaces to U-Mart's new researches, educational targets for programming or financial investment classes, or test cases of various researches. So far we have done ten open experiments as follows:

PreU-Mart2000	Machine Agent		
U-Mart2001	Machine and Human Agent		
U-Mart2002	Machine and Human Agent	/UMIE2002	Machine Agent
U-Mart2003	Machine and Human Agent	/UMIE2003	Machine Agent
U-Mart2004	Machine and Human Agent	/UMIE2004	Machine Agent
U-Mart2005	Machine and Human Agent	/UMIE2005	Machine Agent

Through these experiments, positions and rules of open experiments have changed gradually

We held the first open experiment, PreU-Mart 2000 to see if U-Mart's System would work as designed. So "Pre" meant that it was not a formal one. We had many things to confirm – Would a machine agent designed based on "U-Mart Protocol"(SVMP) operate correctly? Would the U-Mart Server appropriately process various commands received from several agents concurrently? Would U-Mart work as a futures market? ...etc. Participants brought their own machine agents and laptop PCs to the experiment site to connect to the U-Mart System for the first time. They managed to do all of the planned tasks and completed the experiment over night. As a result, many agents went bankrupt, because inflation and collapse occurred often, although most functions of the system including communication using the M-Mart Protocol, U-Mart Market and accounting functions worked correctly. Contrary to our expectations, we found problems with the system as a market through the results of experiments. One of the problems was, for example, random agents (agents randomly selling and buying at around the spot price) developed for debugging always led the market.

One year after the first experiment, our first formal experiment in U-Mart2001 was held to research the artificial futures market. Human and machine agents participated in this experiment according to the first purpose of the U-Mart Project. Machine agents were collected prior to the experiment and participated in several competitions using five types of the time series (i.e. random, up, down, reverse, oscillate), and excellent machine agents were awarded. And on the day of the experiment, the "actual" competition was held and both machine and human agents participated. At the experiment, the absence of random agents led to inflation and collapse, but less frequently than Pre-Mart2000. The market became stable after random agents joined. As the result, we found that agents with abundant assets were strong when inflation or collapse occurred and random agents were very strong in any situation. Because the random agents placed stop orders at around a spot price, naturally their transactions worked like arbitrage trading, so that they were able to secure stable profits and at the same time contributed to the market's stabilization. Although machine agent development kits (to be described later) had been distributed prior to the experiment, the time required to do the pre-experiment was same that of an ordinal experiment (60 minutes), because machine agents which directly corresponded to the U-Mark Protocol also participated

In 2002, the first international open experiment was held. Taking this occasion, the purposes of the open experiment were clarified and its contents were largely improved. The most major change was that positions of two types of open experiments were clarified: only machine agents can participate in an international open experiment (UMIE 200X), and both human agents and real-time processing machine agents can participate in domestic open experiments (U-Mart 200X). As for international open experiments, participating strategic-class machine agents can be transferred via e-mail, so that the participants can join the market from everywhere in the world at any time. If we know that participants are all machine agents in advance, we can invite only machine agents which are free from concern about itayose (a trading method used when orders are flooded in a market: selling/buying orders are collected until the number of both orders becomes the same while adjusting the price according to the volume of orders, then at last, all are sold/bought at the same price) interval, to have an acceleration experiment.

In fact, only strategic-class machine agents using machine agent development kits (developed by Professor Kita, etc., Tokyo Institute of Technology, for use in class) were invited to the first international open experiment. If you use a machine agent development kit, five types of data (time series of futures market price, time series of spot price, number of future goods currently retained, current cash balance, and remaining possible number of itayose) are automatically given and you can develop a machine agent only by creating a class implementing the strategic part for order output. The agent simulator that is developed in the same way is also included in the kit. The agent simulator enables a user to compete with a maximum of ten machine agents simultaneously using his/her own PC, analyze competitors'logs and track their selling/buying activities. With these features, actions of machine agents are traceable step-by-step so that more practical algorithm development and more detailed tuning are possible. As an acceleration experiment can be conducted smoothly, evaluation criteria for agents have changed. Conventionally, agents who made the biggest were regarded excellent and awarded, but that meant high-risk, high-return investing was more advantageous in the competition. We thought that was not a preferable and improved evaluation method. We set four criteria (winning percentage, maximum gain, average gain, and bankruptcy percentage) and evaluate the scores comprehensively based on Pareto-ranking concept. In 2002, the first international open experiment UMIE2002 was held. And among the participants, an agent developed by students of Tokyo University as a task in class and an agent implementing the decision-support system that was using an on-line learning ability developed by Osaka Prefecture University had remarkable scores.

On the other hand, domestic open experiment U-Mart 200x provides university or graduated school students who have used the U-Mart System in classes with good opportunities to gather and compete. Thus, students are more motivated by working toward this open experiment. And because more human agents who are seriously working on investments participate in the experiment, much more practical data is collected. This experiment is also good for testing machine agents with real-time processing functions. Since data/actions the agents developed by the agent development kit (Strategic-class agents) can use or take are limited, they are not allowed to try many ideas like using data changing time to time(e.g. other agents'order information) or investing in collaboration with other agents. Participants are allowed to bring their own PCs and the experiment is a good opportunity for them to compete with other challenging machine agents. In 2002, another domestic open experiment, U-Mart 2002 was held and students of Osaka Sangyo University who had used U-Mart for an investment practice in the class, students of Chuo University, and graduate students who had developed machine agents participated. Especially students who had achieved excellent performance in the class of Osaka Sangyo University (so called "speculators") also scored high marks on the experiment. Among real-time processing machine agents, an agent that exchanged data with other agents and chose the most appropriate strategy on the spot, the development by Team Sawa from Tokyo Institute of Technology, was outstanding.

In 2003, teams who had learned from the results of the previous open experiment received high scores. Especially, among machine agents, "agents who used short-run trends" and "agents with on-line learning ability" mostly achieved high scores. At both UMIE 2003 and U-Mart 2003, Tokyo Institute of Technology's agent that was developed based on the experience at the previous experiment won first prizes. Prototype of U-Mart System Version 2.0 was first used at the domestic open experiment in 2003, U-Mart 2003.

New teams from Ritsumeikan-University and Kinki-University participated in UMIE2004. The winning five agents were FuzzyB, Classififire agents who won UMIE2003, TriDiceP using reinforcement learning, NN2 using neural-network, and KInvestor-25 conducting arbitrage transaction. In the convention, major learning algorithms developed in AI field were almost on the table, and they topped the list. On the other hand, classical technical agents faced a difficult situation in getting an improved performance. Five years have passed since the convention started, and the pool of agent applicants is now over a hundred. It can be considered that the development of investment agents based on the condition of U-Mart has now reached the terminus, ad quem. In U-Mart2004, a two locations match was organized for the first time ever. The main venue of the event was Suzukakedai campus (Yokohama city) of Tokyo Institute of Technology where the autumn conference for JAFEE(Japan Association for Evolutionary Economics) was held. Three traders joined it over the internet from the economics faculty of Osaka City University. Machine agents which play market makers also participated. These agents were entered in order to verify their possibility of performance in a market where human agents also take part, and were not aiming to win.

There have been international developments in 2005. In May 6th, a joint lecture with Saint-Petersburg University in Russia and Osaka City University was held. Russian and Japanese students were able to take the same classes through a video conferencing system. They also dealt on the same market using the internet. The U-Mart system was introduced at a summer session called "Aspect of Complexity" held in Itlay on July 20th, and at a summer session called "Financial and Managerial Applications of Computational Intelligence" held in Taiwan on August 13th. A lecture on an experiment using human agents and the creation of machine agents was also given.

Steps in public experiments

Pre U-Mart 2000
Agent type : Machine
Conditions
:15(Session interval: seconds)
* 4 (# Sessions) * 60 (# of days)

Description　: Held to see if the whole U-Mart System would work correctly.

U-Mart 2001
Agent types : Machine and Human
Conditions
: 15(Session interval: seconds)
* 4 (# Sessions) * 60 (# of days)

Description　: First full-scale open experiment. Participating machine agents gathered and conducted several experiments prior to U-Mart 2001 to collect data for the final evaluation.

Only human agents participate.　Each participant conducts the experiment only one time during the session.

Only machine agents participate. Comprehensive evaluation method based on Pareto-ranking concept is used.

Domestic open experiment

U-Mart2002
Description: Many students from Osaka Sangyo University and Chuo University participated and a large-scale human agents' experiment was held.

Conditions :
10 (Session interval: seconds) * 8 (# Sessions) * 24 (# of days)

U-Mart2003
Description: It was held as a demosession of International ISAGA Conference,there were many all comers. Newsystem, U-Mart Ver. 20 was used for the first time.

Conditions :
10 (Session interval: seconds) * 8 (# Sessions) * 30 (# of days)

U-Mart2004
Description: It was held as a demosession of International ISAGA Conference,there were many all comers. Newsystem, U-Mart Ver. 20 was used for the first time.

Conditions :
10 (Session interval: seconds) * 8 (# Sessions) * 30 (# of days)

U-Mart2005
Description: In human agents, "a professional speculator" also applied to participate. Also, co-organized by UMIE2005, all machine agents who applied to this were able to participate.

Conditions :
20 (Session interval: seconds) * 3 (# Sessions) * 30 (# of days)
& 10 (Session interval: seconds) * 8(# Sessions) * 24 (# of days)

International open experiment

UMIE2002
Description: Acceleration experiment had been premised and machine agents suitable for such experiments were invited. Comprehensive evaluation method based on Pareto-ranking concept was used.

Conditions : 4 (# Session) per day * 60(#of days)

UMIE2003
Description: Fewer, but "strong" agents participated, reflecting the results of UMIE 2002.

Conditions : 4 (# Session) per day * 60(#of days)

UMIE2004
Description: Fewer, but "strong" agents participated, reflecting the results of UMIE 2002.

Conditions : 4 (# Session) per day * 60(#of days)

UMIE2005
Description: Co-organized by U-Mart2005, usually held in autumn. Fewer artificial-intelligence agents, that were active until last year, participated.

Conditions : 4 (# Session) per day * 60(#of days)

Shedule in 2006

Total five conventions are scheduled to be held (hold at the same time)

< New approach to public experiments in 2006 >

1)　New suggestion as to open problem
"Market maker type agents that stimulate thin board market"
Market maker type agents
　　Market maker killer type agents 　} public offering
2) Project management by students
3) The development of continuous session version of U-Mart
　Quote driven market
　Judgment of buying and selling by board information (order)

Ⅰ, UMIE2006、U-Mart2006、U-Mart Japan：
U-Mart Japan, being held by students aimed at a domestic, will be held in addition to previous public experiments, UMIE and U-Mart

Ⅱ, UMIE MM 2006：
Demonstration and preparation for a public experiment with thin board market

Ⅲ, UMIE MM Demo：
To demonstrate a continuous session version of U-Mart system in preparation for the convention in 2007

Basic rules of competitions

Basic rules

(with human and machine agents)

Rules of real-time experiment

Trading rules of U-Mart futures market

・Initial Amount of Cash: 1,000,000,000 yen
・Trading unit: Multiplying contract index
　by 1000 = contract amount
・Margin rate: 300,000 yen per trade
・Fee: None (0 yen)
・Lone limit:・30,000,000 yen
・Interest rate of loan: 10%

U-Mart 2002, U-Mart 2003

・Trading period: 30 or 24 (virtual)
・# Sessions per day: 8・times
・Session interval: 10 seconds
・Time series data: Distribution kit J30 (experimental data
　is not released until the experiment starts)
－Human agents and machine agents trade in the same market.
・Use of graphical user interface (GUI)
・Strategic machine agents participate. Participants bring their
　own PCs.
－Evaluation method
・Coalition and discussion with team members are allowed.
Both personal and team performances are evaluated.

Rules of acceleration experiment

(with only machine agents)

UMIE2002, UMIE2003,UMIE2004

Market rules
・Trading period: 60
・# Sessions per day: 4・times
・Session interval: 0
Summary: － Each agent is scored and ranked total 125 times, with 5 types of
experiments (Ex1, Ex2-1, Ex2-2, Ex2-3, Ex3).
－ Experiments with different agents compositions
－ 4 types of time series for spot prices(up, down, reverse, oscillate) are used.
－ Conduct experiment under various market conditions
・Comprehensive ranking by ranking agents based on 4 (maximum gain, average
　gain, bankruptcy count, profit gain percentage) + 1 evaluation criteria and using
　Pareto-ranking concept.
・Comprehensive evaluation based on several indexes
EX1) One agent entry per applicant + 20 standard agent sets
EX2) All agent entries + 20 standard agent sets
EX2-2) Qualifiers' agents + 20 standard agent sets
EX2-3) Qualified teams' agents + 20 standard agent sets
EX3) Choose a half of (qualifiers' agents + number of standard agent set) randomly

【Evaluation method】
0) Comprehensive ranking: Rank based on the following four criteria and using
　Pareto-ranking concept.
1) Maximum gain: Evaluate based on the maximum gain amount throughout the session
2) Average gain: Evaluate based on the average gain amount throughout the session
3) Profit count: Number of experiments finished in the black throughout the session
4) Bankruptcy count: Number of experiments terminated by bankruptcy throughout
　the session

【Experiment procedure】
Pattern 1 (for EX1, EX2, EX2-2, EX2-3)
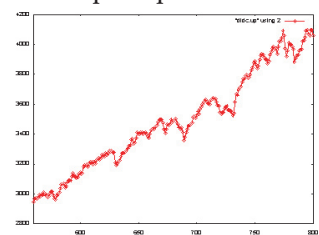Initialization --> Repeat same sequence 50 times
Repeat 4 patterns (up, down, reverse, oscillate) total 200 times
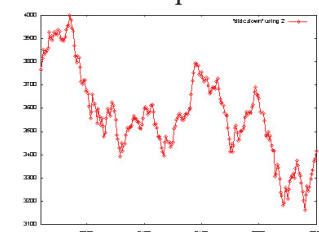Evaluate each sequence and total of all the sequences (for 5 types)
Rules of real-time experiment (when human and machine agents coexist in the market)
Rules of acceleration experiment (when only machine agents exist)

Up sequence

Down sequence

Down-up sequence
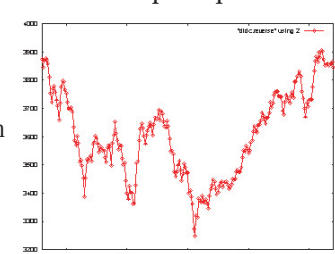
Oscillate sequence
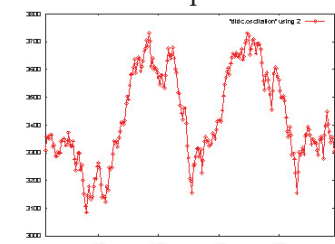
PreU-Mart2000

Summary

● Date: August 19, 2000
● Place: SICE Natsuno Gakko, INTEC Oyama Training Center
● Participants: 11 teams (54 agents)
● Agent type: Machine

Rules

(1) # Sessions per day: 4 times
(2) Session interval: 15 seconds
(3) Trading period: 60
(4) Total # sessions: 240 times
(5) Two experiments were conducted per two different time series.

Description

This was the first experiment after the U-Mart System developed. The purpose of this experiment was to confirm if the system would work as designed. There had been many concerns about the system: if the server program would work correctly, if the system would be able to communicate with agents working on PCs and connecting to the network, etc. Since we did not grant this experiment as a formal one, added "Pre" to its name. Participants brought their own laptop PCs and connected to the network at the experiment site. It took one night for final debugging. Experiments were conducted twice during the session, and as the results, we found that random agents were very excellent and violent fluctuations were more apparent than we had expected.

List of participants

Team	University	Member ID
Ono	University of Tokushima（Engineering）	m1 ～ m5
Deguchi	Kyoto University(Economics)	m6 ～ m10
Fukumoto	Tokyo Institute of Technology(Engineering)	m11 ～ m15
Yamamura	Tokyo Institute of Technology(Engineering)	m16 ～ m20
Murakami	University of Tsukuba – Yamatake Sangyo System Co., Ltd.(Engineering)	m21 ～ m25
Mori	Osaka Prefecture University (Engineerin)	m26 ～ m30
Taniguchi	Osaka Sangyo University (Economics)	m31 ～ m35
Sato	National Defense Academy in Japan(Engineering)	m36 ～ m40
Nakajima	Kyoto Sangyo University (Economics)	m41 ～ m45
Ishinishi	National Defense Academy in Japan (Engineering)	m46 ～ m50
Hashimoto	Osaka City University (Economics)	m51 ～ m55

Result: Up-Down-Up

Rank	Agent name	MemberID	Team	University	CASH
No.1	Kaubaka	m41	Kyoto Sangyo University	Kyoto Sangyo University	3,960,884,296
No.2	Osaka‐Huritu 02	m27	Osaka Prefecture University	Osaka Prefecture University	582,474,000
No.3	Osaka‐Huritu 01	m26	Osaka Prefecture University	Osaka Prefecture University	380,437,000
No.4	Kyoto 02	m 7	Kyoto University	Kyoto University	317,955,000
No.5	Tokushima 05	m 5	Tokusima University	Tokusima University	310,538,000

Transition of the price in the 1st games
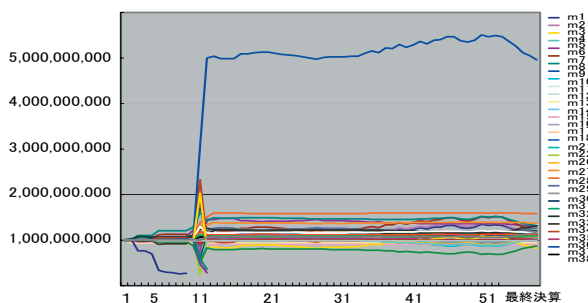
Transition of profit in the 1st games
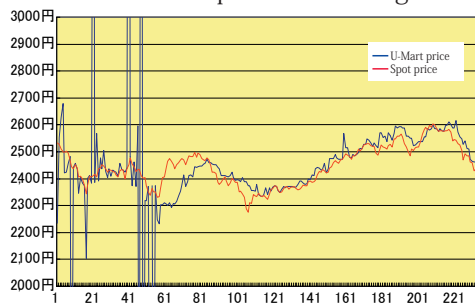
Rank	Agent name	MemberID	Team	University	CASH
No.1	Fukumoto‐02	m12	Fukumoto	Tokyo Institute of Technology	3,005,755,296
No.2	Hukumoto‐03	m13	Fukumoto	Tokyo Institute of Technology	1,792,902,000
No.3	Yamamura‐04	m18	Yamamura	Tokyo Institute of Technology	1,686,144,000
No.4	Yamamura‐05	m19	Yamamura	Tokyo Institute of Technology	820,188,000
No.5	Nerinerikun	m43	Kyoto Sangyo University	Kyoto Sangyo University	710,379,000

Transition of the price in the 2nd games

Transition of profit in the 2nd games
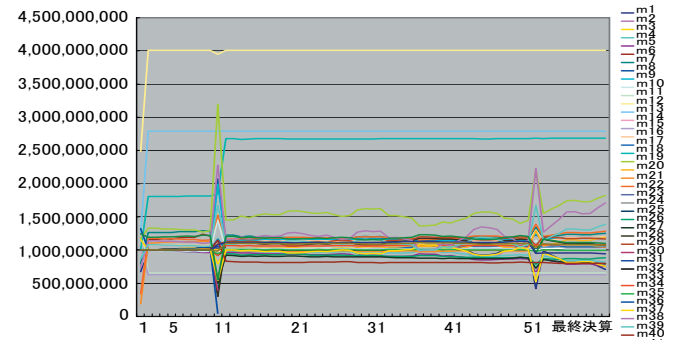
Scene of experiment
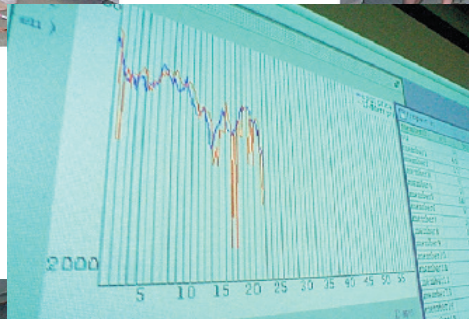
U-Mart2001

Summary

● Date: August 25, 2001
● Place: SICE Natsuno Gakko, INTEC Oyama Training Center
● Participants: 14 teams (39 agents)
● Agent type: Machine and Human

Rules

(1) # Sessions per day: 4 times

(2) Session interval: 15 seconds

(3) Trading period: 60

(4) Total # sessions: 240 times

(5) Two experiments were conducted per time series in advance (with/without random agents). Total ten experiments were conducted during the session.

Description

In order to evaluate the U-Mart System formally, machine agent programs had been invited prior to the experiment to do pre-experiments. Four types of time series (up, down, reverse, oscillate) were used in the experiment and participating machine agents were ranked based on the results. All such machine agents were set to connect to the server via a network and to collect information or order real-time. It took about two hours per trial, even with the machine agents.

List of participants

Team	University	Member ID	Team	University	Member ID
Koyama	Kyoto Sangyo University	m1	Vincent	National Defense Academy in Japan	m21
Kobayashi	Tokyo University	m2 ～ m6	Kawauchi	National Defense Academy in Japan	m22 ～ m25
Ariyama	Osaka Prefecture University	m7 ～ m8	Ishii	Tokyo Institute of Technology	m26 ～ m30
Arai	Chiba Institute of Technology	m9	Kumei	Osaka City University	m31 ～ m33
Ihara	Chiba Institute of Technology	m10	Goto	Osaka City University	m34
Arima	Kyoto University	m11	Ueda	Osaka City University	m35
Inoue	Kyoto University	m12 ～ m20	Hashimoto	Osaka City University	m36 ～ m39

Case 1: Default sequence Profit Upper ranks Agent

◆ Without random agents

Rank	Agent name	MemberID	Team	University
No.1	DaytTrade	m34	Goto	Osaka City University
No.2	Inoue7	m18	Inoue	Kyoto University
No.3	Inoue6	m17	Inoue	Kyoto University

◆ With random agents

Rank	Agent name	MemberID	Team	University
No.1	Inoue6	m17	Inoue	Kyoto University
No.2	DayTrade	m34	Goto	Osaka City University
No.3	Test2 Strategy	m3	Kobayashi	Tokyo University

Case 2: Upper sequence Profit Upper ranks Agents

◆ Without random agents

Rank	Agent name	MemberID	Team	University
No.1	Inoue5	m16	Inoue	Kyoto University
No.2	Test2 Strategy	m3	Kobayashi	Tokyo University
No.3	DayTrade	m34	Goto	Osaka City University
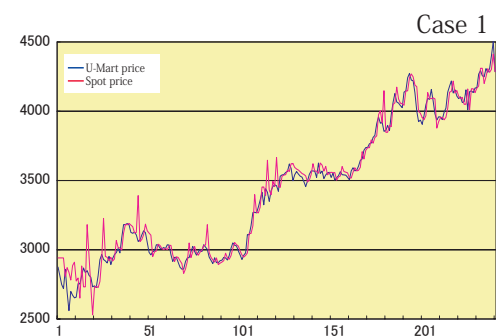
Case 1
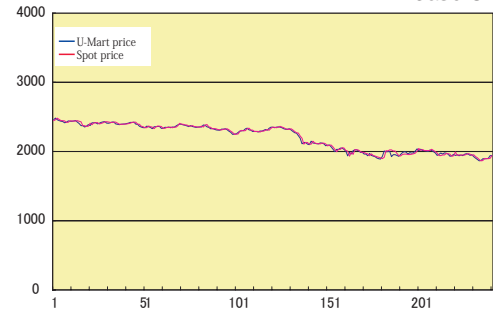
◆ With random agents

Rank	Agent name	MemberID	Team	University
No.1	Inoue6	m17	Inoue	Kyoto University
No.2	DayTrade	m34	Goto	Osaka City University
No.3	Test2 Strategy	m3	Kobayashi	Tokyo University

Case 3: Down sequence Profit Upper ranks Agents

◆ Without random agents

Rank	Agent name	MemberID	Team	University
No.1	Inoue6	m17	Inoue	Kyoto University
No.2	Inoue7	m18	Inoue	Kyoto University
No.3	Test3 Strategy	m4	Kobayashi	Tokyo University

◆ With random agents

Rank	Agent name	MemberID	Team	University
No.1	ZaimaStrategy	m11	Arima	Kyoto University
No.2	Random Trade	m42	U-Mart-Kit	
No.3	Inoue4	m15	Inoue	Kyoto University

Case 4: Reverse sequence Profit Upper ranks Agents

◆ Without random agents

Rank	Agent name	MemberID	Team	University
No.1	Fumi1	m36	Hasimoto	Osaka City University
No.2	Fumi3	m38	Hasimoto	Osaka City University
No.3	Sonkiri	m24	Kawauchi	National Defense Academy in Japan

◆ With random agents

Rank	Agent name	MemberID	Team	University
No.1	Random Trade	m41	U-Mart-Kit	
No.2	Random Trade	m40	U-Mart-Kit	
No.3	Random Trade	m42	U-Mart-Kit	

Case 5: Oscillate sequence Profit Upper ranks Agents

◆ Without random agents

Rank	Agent name	MemberID	Team	University
No.1	DayTrade	m34	Goto	Osaka City University
No.2	Inoue7	m18	Inoue	Kyoto University
No.3	Inoue6	m17	Inoue	Kyoto University

◆ With random agents

Rank	Agent name	MemberID	Team	University
No.1	Inoue6	m17	Inoue	Kyoto University
No.2	DayTrade	m34	Goto	Osaka City University
No.3	Test2 Strategy	m3	Kobayash	Tokyo University

Case 2

Case 3

Case 4

Case 5

Findings from U-Mart 2001

・Prices were more stable than in Pre U-Mart 2000.
・There were less incompetent participants.
・There were more economic savvy participants
・Strategic types, the majority participating agents, must be mounted with the limit.
・Even with the preferable conditions mentioned above, the market had a turbulent sometimes.
・Turbulent occurred often from the midpoint to the ending of the session.
(At Pre U-Mart 2001, turbulent occurred from the beginning.)

U-Mart2002

Summary

● Date:　　November 5, 2002
● Place:　　Department of Economics, Osaka City
　　　　　　University – Co-hosted by SICE and
　　　　　　Japan Society of System Engineering
● Participants:　　7 teams with machine agents and
　　　　　　　　　12 teams with human agents
● Agent type:　　Machine and Human

Rules

(1) # Sessions per day: 8 times
(2) Session interval: 10 seconds
(3) Trading period: 24
(4) Total # Sessions: 192 times

Description

Many students including those from Osaka Sangyo University and Chuo University participated. Students of Osaka Sangyo University and Chuo University had experienced trading using U-Mart many times in classes. So those universities regarded that this open experiment was an opportunity to understand the results of their educations. After the experiment, a joint seminar was organized by participant universities for academic exchange among students.

【Breakdown of human agents】

■ Osaka Sangyo University:　　8 teams, total 24 members
【Among those】: Undergraduates who had used the U-Mart System in class for half a year, and Several "speculators"(maybe).
■ Kyoto University:　　1 team, total 3 members
【Among those】:　Graduates and undergraduates who were not familiar with the U-Mart system and futures market trading.
■ Chuo University: 1 team, total 3 members
【Among those】:　Undergraduates who had experienced the U-Mart System and developed machine agents.

List of participants（Machine)

Team	University	Member ID	Description
Ishiyama	Chuo University	m1 ～ m3	・Strategic trading posing as an amateur・in the market: Kawasaki ・Decisions based on George Soros's Theory of Reflectivity and Williams %R: Kim ・Decisions based on the Oscillation – Trend: Ishiyama
Kobayashi	Chuo University	m4 ～ m6	・Stochastics Theory (revised): Harada ・Day-to-Day Price Movements Psychological Line: Kobayashi ・Stochastics Theory: Nakata
Nakajima	Osaka City University	m7 ～ m9	・Kaubakka ・Price Maker ・Selling/buying according to price range
Sawa	Osaka City University	m10 ～ m12	・Sophisticated clients with three agents working in coordination ・Each agent had 7 strategies: ・Countermeasure against losing at the last count, semi-simple regular siege, RSI Analysis, series method, short-to-medium-term average method, regular siege, Williams %R ・Duration of search: 14 days ・Each participant implemented every strategy --> Results were reported to the server. ・Duration of using optimum strategy: 8 days ・After trials of the 7 strategies, decided the best one and used it. ・Duration of taking countermeasure against losing at the last count: 2 days ・Tried to secure position near zero
Kobayashi	Tokyo University	m13 ～ m15	・Day trade type ・Trend type ・Pseudo-arbitrage Type
Kanai	Osaka City University	m16 ～ m18	・Arbitrage trading between spot and futures ・Simple averaging sell ・Averaging buy employing dollar cost averaging method ・Teamworking ・When the market was on its upward course, (3) would make profit and (2) would hedge loss, and in opposite condition, those would take opposite roles respectively. (1) would make a profit under any condition only if an arbitrage opportunity given.
Ariyama	Osaka Prefecture University	m19 ～ m21	・On-line fuzzy learning A ・On-line fuzzy learning B ・Neural network

Team	University	Member ID	Member name
Taniguchi A	Osaka Sangyo University	m31 ～ m33	Ogasawara, Tabuchi, Inoue
Fudaikeihokonsei	Osaka Prefecture University & Osaka University of Economics and Law	m36 ～ m38	Ariyama, Fukase, Kitano
Taniguchi G	Osaka Sangyo University	m39 ～ m40	Ihara，Takachi
Chuo 2002	Chuo University	m34・m41・m42	Nakata, Kobayashi, Harada
Chuo 1	Chuo University	m44 ～ m46	Kim, Kawasaki, Ishiyama
Taniguchi F	Osaka Sangyo University	m47 ～ m49	Goto, Yokoyama, Kato
The Sai	Osaka Sangyo University	m50・m60・m61	Sai, Ichikawa, Fujii
Kyotodai	Kyoto University	m51 ～ m53	Shinagawa, Endo, Lee
Taniguchi B	Osaka Sangyo University	m55 ～ m57	Irifune, Sugihashi, Matsuo
Taniguchi 2	Osaka Sangyo University	m63 ～ m65	Kubosaki, Tanaka, Sen
SUPER M	Osaka Sangyo University	m67 ～ m69	Emura, Sakamoto, Okoshi
Taniguchi E	Osaka Sangyo University	m71 ～ m73	Ota, Maekawa, Hayashi

Result: Agent

Rank	Agent name	Member ID	Team	University	Result
No.1	Ariyama02	m20	Ariyama	Osaka Prefecture University	7,412,344,000
No.2	Ariyama01	m19	Ariyama	Osaka Prefecture University	5,226,312,000
No.3	Kato	m49	Taniguchi F	Osaka Sangyo University	2,271,369,000
No.4	Tabuchi	m 32	Taniguchi A	Osaka Sangyo University	2,090,150,000

Result：Team

| Rank	Agent name	Member ID	Team	University
No.1	Ogasawara, Tabuchi, Inoue	m3 ～ m33	Taniguchi A	Osaka Sangyo University
No.2	Ihara・Takachi	m39 ～ m40	Taniguchi G	Osaka Sangyo University
No.3	Team_TK01 ～ 03	m13 ～ m15	Team_TK	Tokyo University
No.4	Isiyama01	m1 ～ m3	Ishiyama	Chuo University
No.5	Ita・yose・com01 ～ 03	m10 ～ m12	Ita・yose・com	Tokyo Institute of Technology

Findings from U-Mart 2002

◆ m 19, 20, 21 (Team Ariyama, Osaka Prefecture University) were prominent (including a bankrupted agent in the count).
【Agents in the black】 Machine 14/23 (60%) Human 16/35 (46%)
【Bankrupted Agents】 Machine 2/23 (9%) Human 3/35 (9%)
Total 5/58 (7%)

Result of U-Mart 2002
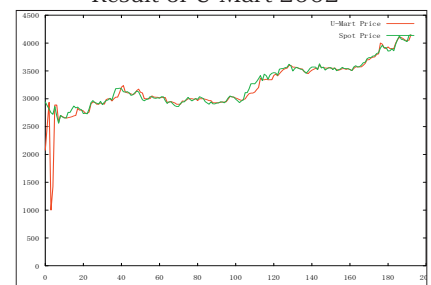
U-Mart2003

Summary

● Date:　　August 27, 2003
● Place:　Joso Academia Park – Held as a demo
　　　　　session for ISAGA 2003.　University
　　　　　Co-hosted by SICE and JapanSociety of
　　　　　System　Engineering
● Participants:　　10 teams with machine agents and
　　　　　　　　　18 teams with human agents
● Agent type:　　 Machine and Human

Rules

(1) # Sessions per day: 8 times
(2) Session interval: 10 seconds
(3) Trading period: 30
(4) Total # Sessions: 240 times

Description

U-Mart 2003 was held as a demo session for ISAGA, an international academic conference where gaming business people gathered.　Including all comers, many people from various universities and organizations applied for participation.　Prototype of the new system (U-Mart System Version 2.0) was used.　Log data was saved per item in CSV format files, and that enabled participants to analyze orders or etc. on the spot.　After completion of the experiment, we had a debriefing to analyze the results together with the participants: secrets of the first prize agent's strength, cause of rapid rise/down, etc.

List of participants（Machine）

Team	University	Member ID
Ritsumeikan	Ritsumeikan University	m21 ～ m22
Abe	Chuo University	m23
Irie	Tokyo Institute of Technology	m24
Kitakubo	Tokyo Institute of Technology	m25 ～ m27
Aiba	Chuo University	m28
Nakajima	Osaka City University	m29・m30

List of participants（Human agents）

Team	University	Member ID	Member name
Obara	Businessperson	m32	Obara
TCLD	TCLD	m33	Nakano
Ritsumeikan	Ritsumeikan University	m34 ～ m36	Fukumori, Yamanaka, Sengi
Osaka Keizaigaku	Osaka University of Economics	m37	Morimoto
Fukuokadai	Fukuoka University	m38 ～ m39	Igarashi, Okayasu
Tokyo Kogyo	Tokyo Institute of Technology	m40	Higuchi
Chuo Dai	Chuo University	m41 ～ m48	Aiba, Yagyu, Abe, Sinjyo, Miyazaki, Kudo, Nakata, Harada
Science Council of Japan	Science Council of Japan	m49	Motoki
Kitakubo	Tokyo Institute of Technology	m50	Kitakubo

Result：Machine: Human

Rank	Agent name	Member ID	Team	University	CASH(¥)
No.1	Kitakubo1	m26	Degice・Kitakubo	Tokyo Institute of Technology	1,627,966,000
No.2	RandomStrategy	m5	U-Mart-kit	Standard agent	1,111,777,000
No.3	DayTradeStrategy	m30	U-Mart-kit	Standard agent	1,109,821,000
No.4	Irie	m24	Degice・Irie	Tokyo Institute of Technology	1,087,145,000
No.5	fuzzy b	m20	U-Mart-kit	Standard agent	1,081,898,000
No.6	Abe	m43	Chuo University	Chuo University	1,076,467,000

Result：Machine

Rank	Agent name	Member ID	Team	University	CASH(¥)
No.1	Kitakubo1	m26	Degice・Kitakubo	Tokyo Institute of Technology	1,627,966,000
No.2	Irie	m24	Degice・Irie	Tokyo Institute of Technology	1,087,145,000
No.3	Ayaki	m21	Ritsumeikan	Ritsumeikan University	1,051,744,000
No.4	Kitakubo2	m27	Degice・Kitakubo	Tokyo Institute of Technology	1,041,098,000
No.5	Kitakubo0	m25	Degice・Kitakubo	Tokyo Institute of Technology	1,041,007,000

Result：Human

Rank	Agent name	Member ID	Team	University	CASH(¥)
No.1	Aiba	m43	Chuo Dai	Chuo University	1,076,467,000
No.2	Yamanaka	m35	Ritsumeikan	Ritsumeikan University	1,065,835,000
No.3	Nakata	m47	Chuo Dai	Chuo University	1,030,137,000
No.4	Harada	m48	Chuo Dai	Chuo University	1,026,038,000
No.5	Motoki	m49	Science Council of Japan	Science Council of Japan	1,021,310,000

Findings from U-Mart 2003

◆ Special Prize Winner

Mr. Fukumori, Ritsumeikan University who finished second to last among survivors.
Failure in selling escalation?
Creation of short positions --> Ones who repeatedly realized profits did this.
They made big profits halfway into the session...
Gradually they increased the quantity of the round lot --> Got involved in a sudden plunge.

◆ Secrets of winners

・They reviewed the order history very carefully.
・They checked their own contract in detail.
・They ordered few, but secured profit per order without fault.

Result of U-Mart 2003

【Bankrupted Agents】
Human 3/18 (17%)
Machine 1/10 (10%)
Total   4 / 28(14%)

Scene of experiment

U-Mart2004

Summary

● Date:　　 2, October, 2004
● Place:　 Tokyo Institute of Technology
　　　　　 & Osaka City University
　　　　　 Demo Session in Autum Conference of
　　　　　 Japan Association of Evolutionary Economics
● Participants:　 Machine Agent　5 Agents
　　　　　　　　 Human Agentt　　30Agents
● Agent type:　 Machine and Human

For 1st Trial

(1) # Sessions per day: 2 times

(2) Session interval: 30Seconds

(3) Trading period: 20days

(4) Total # sessions: 40 times

For 2nd Trial

(1) # Sessions per day: 90 times

(2) Session interval: 1Seconds

(3) Trading period: 20 days

(4) Total # sessions: 1800 times

Description

To estimating parameters for experiments with human agents, 2 kinds of rule were tried. These were different in sessions interval, and number of itayose per day. This was the first time to held multi-location experiment by point to point connection.

List of participants(Machine)

Team	MemberID	Menber Name
Kinki University	h31	MarketMaker
Kinki University	h32	TaniguchiSeminar
Kinki University	h33	TaniguchiSeminar2
Kinki University	h34	TaniguchiSeminar3
Kinki University	h35	TaniguchiSeminar4

List of participants(Human agents)

| Team	MemberID	Member name
Chuou University	h1 〜 h15	Takada・Kousin・Hutakushi・Kobayashi・Otuka・Chiba・Shinjyo・Abe・Yagyu（Itai・Kanami・Akazaki・Maeyama・Segawa・Kamio）（Shinohara・Koyama・Kanada・Tahira・Osako・Nakamura）
Kinki University	h16 〜 h20	Ikeda・Matuura・Yamamoto・Asahina・Noguchi
Osaka City University	h26 〜 h28	Nakajima・Ueki・Morimoto

Scene of experiment

Result of the 1st trial：Total（Machine & Human）

Rank	Agent name	Member ID	Team	CASH
No.1	Matsuura	h17	Kinki University	1,683,575,000
No.2	Kamio	h15	Chuo University	1,146,053,000
No.3	Nakajima	h26	Osaka City University	1,117,262,000
No.4	Chiba	h7	Chuo University	1,047,100,000
No.5	Kamami	h11	Chuo University	1,035,990,000

Result of the 2nd trial：Total（Machine & Human）

Rank	Agent name	Member ID	Team	CASH
No.1	Yamamoto	h18	Kinki University	3,968,359,000
No.2	TaniguchiSeminar2	h33	Kinki University	3,426,796,000
No.3	TaniguchiSeminar	h32	Kinki University	3,088,683,000
No.4	TaniguchiSeminar3	h34	Kinki University	2,918,254,000
No.5	Noguchi	h20	Kinki University	2,559,112,000

U-Mart2004　Result of the 1st trial

spot price ■ future price
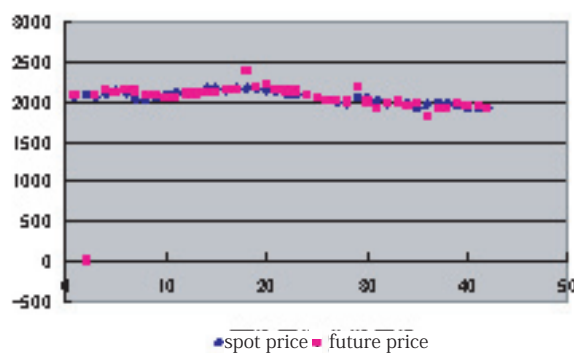
U-Mart2004　Result of the 2nd trial

◆ spot price ■ future price
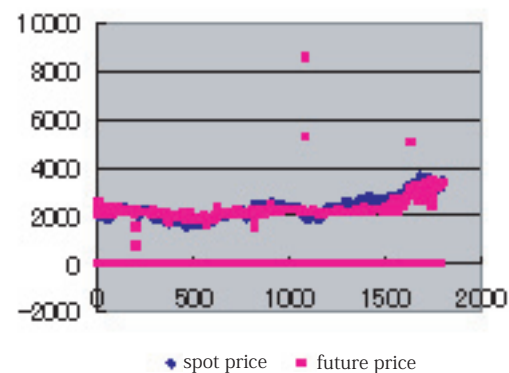
Findings from U-Mart 2004

In the fisrt trial, human agents could show good performance because they can carefully consider to trade in 30 seconds for 1 session. However, in the next trial, itayose was held in each 1 second. This settings were proposed to realize continuous session. Human agents were confused and machine agents could show good performance. Indeed, only 2 human agents were bankrupted in the first trial, but it was increased to 11 agents in the second trial. In this experiment adding to the agents in pursuit of good performance, a market maker participated. The agent was participated to check the availability and feasibility. The agent could gain a surefire profit constantly in both trials.

U-Mart2005

Summary

● Date 12, Septimber, 2005

● Place Kyoto University

    (Event of Social Infomatic Fair)

● Participants Machine Agent : 30 Agents

     Human Agent

      1st trial : 29 Agents

      2nd trial : 26 Agents

● Agent type Machine & Human

Description

Two-thirds of the human agent participants in U-Mart2005 were students from Chuo and Kinki Universities who take part every year, the remaining third were from research laboratories. "A professional speculator" who saw information about U-Mart2005 published in Kyoto-Shinbun also applied to participate. The convention was co-organized by UMIE2005 which issues invitations to machine agents. All machine agents who applied to the international convention were able to participate. More than 80 percents of participants were experienced, therefore, the price fluctuations was moderate. Even so, one participant placed orders up to 168 times, competition was fierce.

For 1st Trial

① # Sessions per day; 3 times

② Session interval; 20 seconds

③ Trading period; 30 days

④ Total # sessions; 90 times

For 2nd Trial

① # Sessions per day; 8 times

② Session interval; 10 seconds

③ Trading period; 24 days

④ Total # sessions; 192 times

List of Participants(Machine)

MemberID	Team	University	Agent No.
1 ～ 5	OCU-Nakajima	Osaka City University	T01 Series
6・7	Team titeCHuo	Tokyo Institute of Technology & Chuo University	T02 Series
8 ～ 10	Kyoto University,Pocket Seminar Kita 2005	Kyoto University	T03 Series
11 ～ 13	Kinki University	Kinki University	T04 Series
14 ～ 25	hobomegane	Shizuoka University	T05 Series
26 ～ 30	Chuo University	Chuo University	T06 Series

List of Paricipants(Human)

MemberID	Team	University	Name
1 ～ 11	Chuo University	Chuo University	Akazaki・Itai・Osako・Kanami・Seto・Shinohara・Segawa・Tabira・Nakamura・Murakami・Tamasaki・Yamasaki
12 ～ 14	Kinki University	Kinki University	Ueda・Uenishi・Kajiwara
16 ～ 19	Hobomegane	Shizuoka University	Sato・Umeda・Sakane・Kanazawa
20	Kyoumo uousaouda yamashikun	officer	Tatsuta
h1		Kyoto University	Torii
h2			Takagi
h3・h4・h6		Kyoto University	Matsuda・Murakami・Matsumoto
h5			Ono
h8		Tokyo Institute of Technology	Sasaki
h12 ～ 15・h18			

Result of the 1st trial : Machine & Human

Rank	Agent Name	ID	Team	University	CASH（¥）
No.1	Sasaki	h8		Tokyo Institute of Technology	1,986,474,000
No.2	Ueda		Taniguchi seminar of Kinki University	Kinki University	1,603,156,000
No.3	T06_Nakamura_spreadStrategy	27	Chuo University	Chuo University	1,292,246,000
No.4	Kajiwara		Taniguchi seminar of Kinki University	Kinki University	1,237,180,000
No. 5	Segawa		Chuo University	Chuo University	1,147,133,000

Result of the 2nd trial : Machine & Human

Rank	Agent name	ID	Team	University	CASH（¥）
No.1	T06_Nakamura_spreadStrategy	27	Chuo University	Chuo university	2,840,995,000
no.2	T04_TestStrategy	11	Kinki University	Kinki University	1,433,484,000
No.3	T04_TestStrategy3	13	Kinki University	Kinki University	1,423,468,000
No.4	T04_TestStrategy2	12	Kinki University	Kinki University	1,422,139,000
N0.5	Sasaki	h8		Tokyo Insitute of Technology	1,406,772,000

Result of 1st trial
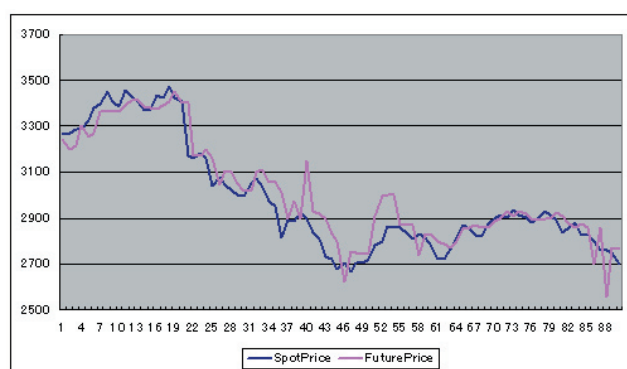
Result of 2nd trial
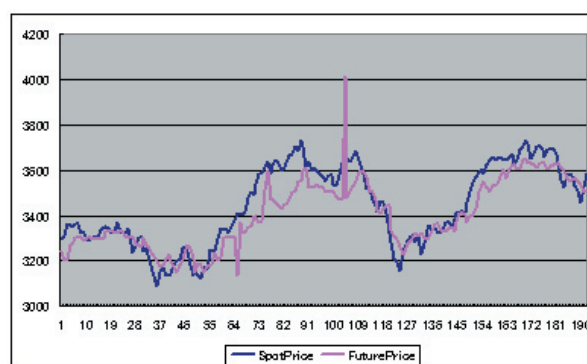
UMIE2002

Summary

- Date: June 22, 2002
- Place: Carnegie Mellon University, U.S.A. – Held
             as a demo session for CASOS 2003 Conference.
- Participants: 11 teams with 48 agents
- Agent type: Machine

Description

It was the first international convention for us. Intending to do an acceleration experiment, we designed a full-scale experiment by reviewing the conventional combination of agents, time series, and evaluation criteria very carefully. This experiment attracted social interest, because many agents created through programming courses at universities and graduate schools entered, and a research group that had developed a decision making support system joined to evaluate the system. Participating agents were high quality and properly tuned, so that prevented random agents from acting aggressively in the market. A full-scale log analysis was conducted so that we were able to measure the influences of the time series difference on agents' ranks.

List of participants

Team	University	Agent name	Description
polynch	Hong Kong Institute of Technology	TestStrategy	• Technical agent that used the moving-average theory of futures price • The agent calculated moving-averages for both long-term and short-term, and bought when a price became above both (and sold when it became below both).
Dead Weight Loss	Future University-Hakodate	MUCCHAN01 ～ 05	• Agents that used the short-term trend in the latest four spot prices have to decide on selling/buying. • Ten of such agents with different parameters (i.e., trend vector, etc.) participated.
Osaka Sangyo University Taniguchi	Osaka Sangyo University	Hiro510・MK2Strategy MKStrategy・OsuTani01 ～ 05・monkey・monkey2	• Several agents created by three authors entered. Among those, the agent that sold/bought based on the relationship between several latest spot prices and futures prices, and the agent with technical analysis (stochastic) ability that used time series of spot prices and futures prices were included.
GSSM Tsukuba	Tsukuba University	GA1 ～ 2・Psychological MoveAverage・Trickstar	• Actually, the following participated in the experiment: an agent that used futures prices such as moving-average line and psychological line, an agent that used price difference between spot and futures, and an agent that invested based on price estimated by using GA assumed from the relationship between both short-term and medium-term trends.
Yuasa-lab. U-Tokyo	Tokyo Institute of Technology	Psi20837_3・Psi20859_3 Psi20878_3	• A picked team of agents created through a university class. The team was composed of agents that used spot spread, agents that decided selling/buying based on spot price trend measured by the method of least square, and agents that used moving-average method.
IE-OPU	Osaka Prefecture University	FuzzyAgentA・FuzzyAgentB	• Fuzzy rule based and neural network based on-line learning agent. A research group that had developed a decision-making support system entered for benchmarking. Tokyo Institute of Technology Tatakeyama Agent-Arashiyama
Deguchi-Lab.TIT	Tokyo Institute of Technology	hatayama Agent kinoshitaAgent	• Agent that used the moving-average theory and an agent that sold/bought based on comparison with the first price participated.
Aruka-Lab.CU	Chuo University	Agent A ～ D	• Agent that employed an arbitrage trading method and William's %R.
OCU	Osaka City University	Baba・Kanai・Kaubakka	• Each of the three authors created one agent respectively: an agent doing arbitrage trade, an agent that repeated selling/buying per 10 rotations, and an agent that a employed dollar cost averaging method. Kenkyu Tokyo Institute of Technology
Society_for_study _of_Stocks_&_Fin ance	Tokyo Institute of Technology	F_S_saeki・Hensachy	• Agent that used the rate of deviation from the moving-average, and an arbitraging-type agent that used spot spread participated.
U-T	Tokushima University	Abe6・Hamaguchi Mizuguchi・Nakahashi	• Each of the five authors created one agent respectively including: an agent that used down/up patterns of past spot prices and futures prices, and an agent that employed the moving-average theory.

Rank	Agent name	Member ID	Team	University
No. 1 (No. 1 in Ex1, Ex2 and Ex3)	Psi20878_2	m29	Yuasa-lab. U-Tokyo	Tokyo University
No. 1 (No. 1 in Ex1, Ex2 and Ex3)	FuzzyAgentB	m31	IE-OPU	Osaka Prefecture University
No. 2 (No. 1 in Ex2 and No. 2 in Ex3)	FuzzyAgentA	m30	IE-OPU	Osaka Prefecture University
No. 2 (No. 2 in Ex1 and No. 1 in Ex2 and Ex3)	F_S_saeki	m42	Stocks_&_Finance・Kenkyukai	Kenkyu Osaka University of Economics

Rank of agents

Experiment: 3 types, Ex1, Ex2 and Ex3
Time series: 4 types, Up (ASC), Down (DES), Oscillation(OSC) and Reverse (R) + all time series(ALL) = 5 types

Parate Rank											
Participating agent						Ex1					Ex2
Time series	ALL	ASC	DES	OSC	REV	ALL	ASC	DES	OSC	REV	ALL
T01_TestStrategy	1	1	4	1	10	2	3	23	4	19	3
T02_KK_B00	1	1	1	1	1	2	13	4	9	3	2
T02_KK_B05	1	1	1	1	1	3	10	5	8	4	2
T02_KK_B10	1	1	1	1	1	2	9	6	7	4	3

Correlation between experiments   Correlation among experiments

(Influence of internal conditions) How would each agent's rank alter when its competitor changed?

How would each agent's rank alter when its competitor changed?

Findings from results

correlate 1% levels of significiance
correlate 5% levels of significiance

	Ex2	Ex3
Ex1	0.66	0.69
Ex2		0.84

	Descent	Oscilation	Reversal
Ascent	-0.24	-0.10	0.37
Descent		0.56	0.24
Oscilation			0.11

Strong agents were strong whoever their competitors were.

Strong/weak time series were different per agent.

Findings from UMIE 2002

◆ Levels (technical) of participating agents improved.
・Agents participated in this experiment were stronger than ordinary agents.
◆ Levels were higher than Pre U-Mart 2000 and U-Mart 2001.
・More sophisticated algorithms were employed.
◆ Emergence of on-line learning agent developed by index features of an agent development kit.
・Fuzzy on-line learning type
・Under various conditions, this agent always scored high (No. 1 in Pareto-ranking)susisikaku

◆ Some agents took the divesting option or countermeasures against bankruptcy.
・By improving such abilities of the conventional standard agent, agents that were able to manage positions at a more sophisticated level emerged.
◆ There was no overwhelmingly (comprehensively) strong agent.
・The combination of agents and time series ruled victory or defeat.
◆ Occurrence of overlearning
・Neural network learning type agents marked very high scores with distributed J30 data, but went bankrupt with the other time series.

UMIE2003

Summary

- Date: June 24, 2003
- Place: Held during NAACSOS 2003 Conference session as one of related events.
- Participants: 7 teams with 18 agents
  - Ratio of engineering vs. economics = 4:7
- Agent type: Machine

Description

Because the contents of the experiment were defined more clearly, and agent creation conditions and agents that had participated in UMIE 2002 were analyzed in details, fewer but well-built agents participated in the UMIE 2003. An agent with "on-line leaning ability" focused on the "short-term trend" won first prize, and that reflected the past experiment's results. At UMIE 2002, scores of agents largely depended on the medium-term trend such as up/down. However, the achievements of the agents participated in UMIE 2003 depended on if they were able to cope with the changes in trend or not.

List of participants

Team	University	Agent name	Description
Osaka University of Economics and Law Zaiteku Kenkyukai	Osaka University of Economics and Law	CrossStrategy NaminoriStrategy DsStrategy	• The following agents participated: an agent that used the rate of deviation from the moving-average of futures price to adjust selling/buying or order quantity, arbitraging-type agent that used spot-futures spread participated, and an agent that ordered when the futures price and spot price crossed.
Deglab Team	Tokyo Institute of Technology	ClassifierAgent	• Agent that invested by choosing and employing an optimum strategy among four (strategies using arbitrage trade, moving-average, futures trend or spot trend) participated. This agent was created based on the agent using the short-term price changes and with on-line learning ability that had participated and marked high scores in UMIE 2002.
Osaka-city-uni-hk	Osaka City University	• Averaging arbitrage trade • Buy escalation arbitrage trade • Averaging buyescalation • Averaging buy escalation 2	• Agent that employed the arbitrage trade and dollar cost averaging method Total five agents with different parameters and initial positions participated
Chuo University	Chuo University	CK_R10・CK_R20 CK_R30・CK_R40 CK_R50	• Arbitrage type agent. This agent decided that the index at around the moving-average of spot price, and decided order quantity using spot-futures spread. Five agents with different moving-average periods entered.
OCU_Nakajima	Osaka City University	PriceMaker Transaction	• Two agents, one that did speculative dealing, and the other that ordered a bunch of buying/selling at the same time price entered.
TN	Kyoto University	SimpleProgram	• Arbitrage type agent participated
syn-1only	Ritsumeikan University	syn	• Agent that compared spot prices of the last three times with futures prices and ordered when the spread between those were widening

Scores: Comprehensive Pareto-ranking

Pareto-ranking   agent No.1 → 14(17%)
Comprehensive-ranking   agent No.1 → :8(44%)

Rank	Agent name	Member ID	Team	University
No. 1 (No. 1 in Ex1, Ex2 and Ex3)	ClassifierAgent	m4	Degulab	Tokyo Institute of Technology
No. 1 (No. 1 in Ex1, Ex2 and Ex3)	Strategy4	m7	Osaka-city-uni-hk	Osaka City University
No. 3 (No. 2 in Ex2 and No. 1 in Ex3, Ex1)	Strategy1	m5	Osaka-city-uni-hk	Osaka City University
No. 3 (No. 2 in Ex2 and No. 1 in Ex3, Ex1)	Strategy6	m9	OCU_Nakajima	Osaka City University
No. 3 (No. 1 inEx1, Ex2and No. 2 in Ex3)	Transaction	m16	OCU_Nakajima	Osaka City University

Correlation between experiments

(Influence of internal conditions)
How would each agent's rank alter when its competitor changed?

	Ex2	Ex3
Ex1	0.31	0.57
Ex2		0.33

Correlation among experiments

How would each agent's rank alter when its competitor changed?

	Descent	Oscilation	Reversal
Ascent	-0.80	-0.74	0.24
Descent		0.68	-0.20
Oscilation			- 0.32

Differences from UMIE 2002

1) There was no correlation between experiments.
   Results altered largely depending on the competitors.

UMIE2002		
	Ex2	Ex3
Ex1	0.66	0.69
Ex2		0.84

→

UMIE2003		
	Ex2	Ex3
Ex1	0.31	0.75
Ex2		

2) Strong/weak time series per agent changed.
   Last year's main focus point was down/up, but this year, it was the occurrence of trend changes that influenced an agents' achievements dramatically.

	Descent	Oscilation	Reversal
Ascent	-0.24	-0.10	0.37
Descent		0.56	0.25
Oscilation			0.11

→

	Descent	Oscilation	Reversal
Ascent	-0.81	-0.74	0.24
Descent		0.68	-0.20
Oscilation			-0.32

Findings from UMIE 2003

10 agents out of 18 participants were agents conducting arbitrage transactions. The agents other than the winner ClassifierAgent were all technical agents. In addition, it was the first time there was a "stock exchange speculators" agent (Price Maker) which changes the price itself. The ranking correlation was as low as 0.33 between the two experiments Ex2 and Ex3. It might have been caused by a large deviation of the market environment that changed according to the existence or non-existence of a stock exchange speculator or of ClassifierAgents, and by the joining percentage of an agent conducting arbitrage transactions. As a matter of fact, in Ex1 and Ex2, only PriceMaker was bankrupted, but in Ex3 there was an increase up to 4 in bankrupted agents. Generally speaking, an arbitrage transaction type agent achieved good results. From first to third ranking were occupied by arbitrage type agents. Besides, by investigating average ranking in Ex1, Ex2 and Ex3, the strength of an arbitrage type agent resided in the average profit and in the profit gain numbers.

UMIE2004

Summary

- ● Date: May 29,2004
- ● Place: Session in AESCS04' at Kyoto Univ.
- ● Participants: 12 teams with 36 agents
- ● Agent type: Machine

Description

New faces were appeared from Osaka Prefecture University, Kinki University, Ritumeikan University. In this experiments, 4 agents won the first prize. Two of them were past winners, that is, FuzzyB (The winner of UMIE2002) and ClassifierAgent (the winner of UMIE2003), and two of them were new face, TriDiceP and NN2. TriDiceP uses reinforcement learning, and NN2 uses neural-network. During these 3 years, almost all famous method from artificial intelligence were appeared. Winnes tend to fixed and some kinds of break through should be needed.

List of participants (Machine)

Team	University	Agent name	Description
OCUNakajima	Osaka City University	Transaction	An agent simulating off-market trading
Kinki University A Team	Kinki University	KinkiAsahina, KinkiIkeda, Kinkiakaji	This is an agent judging buying and selling based on short-term trends estimated from last several spot and future prices, or on the divergence range of spot price and future price. Three Kinki University students entered.
Kinki University B Team	Kinki University	KinkiMasa01, KinkiMasa02, KinkiMasa03 KinkiMasa04	The agent that judges buying and selling by short-term trends estimated from latest spot and future prices, by the divergence range of spot price and future price, and by the average of quarter moving. The agent was developed by Mr.Yamamoto, a student of Kinki University.
Kinki University C Team	Kinki University	KinkiNg001, KinkiNg002, KinkiNg003, KinkiNg004	The agent that judges buying and selling based on the positional relationship of latest future prices and spot prices. The agent was developed by Mr.Noguchi of Kinki University.
OsakaCityUnivercityRoom419	Osaka City University	BreakOut, LastSpreadHunter, MovingAgerageIntersect	There were three agents entry, i.e., an agent does buying and selling when new price updated, an agent that invests only in the final trade day, and an agent that invests based on the moving averages of long period and of short period. The agents were implemented by Mr.Morimoto of Osaka City University.
M.Kojima	Ritsumeikan University	TriDice2,TriDiceP, TriDiceR,Zcrossover	In total four agents composed of an agent that invests by calculating the price moving approximation equation based on reinforcement learning, two alternative agents, and an agent that does trend estimation by long and short term load moving averages.
TCIT	Tokyo Institute of Technology	RandomLossCutStrategy, MovinAverageStrategy	An agent that does buying and selling in random order, and an agent that uses the moving average of short and long period. They were developed by Mr.Ishiyama and Mr.Kaneko from Tokyo Institute of Technology.
kamlab	Ritsumeikan University	AR,AR_NN,NN,NN2	Four agents got in the competition, i.e., an agent that invests by means of AR parameter estimation, an agent that forecasts the oncoming price by neural network and its improved version, and an agent that applies both strategies of AR and neural network.
OPUshu	Osaka Prefecture University	OPUFuzzyStrategyA, OPUFuzzyStrategyB, OPUPositionControlStrategy OPUSteadyStrategy, OPUallProbabilityStrategy	The team has been keeping outstanding records since 2002. The main active payers every year were FuzzyA and FuzzyB. Additionally there were other agents, i.e., the improved versions and an agent that does buying and selling randomly based on particular probability distribution.
negative trader	Osaka City University	activeRSI	An agent that trades by applying RSI.
Osaka University of Economics and law	Osaka University of Economics and Law	KInvestor-20, KInvestor-25, Kinvestor-8	An agent that conducts arbitrage transactions.Order quantity depends on each agent.
team tar	Tokyo Institute of Technology	UMIE2003Winner, ClassifireAgent2	An agent that won the prize successfully last year, and its improved version. It selects the most appropriate one from four kinds of investment strategies.

Rank	Agent name	Member ID	Team	University
No.1 （No. 1 in Ex1, Ex2 and Ex3）	TriDiceP	m17	M .kojima	Ritsumeikan University
No.1 （ 〃 ）	NN2	m25	kamlab	Ritsumeikan University
No.1 （ 〃 ）	OPUFuzzyStrategyB	m27	OPUshu	Osaka Prefecture University
No.1 （ 〃 ）	KInvestor-25	m33	Osaka University of Economics and law	Osaka University of Economics and Law
No.1 （ 〃 ）	ClassifireAgent2	m36	team tar	Tokyo Institute of Technology
No.6 （No. 1 in Ex1and Ex2,No.2 in Ex3)	KinkiNg001	m9	Kinki University C Team	Kinki University

Correlations in ranking between experiences and time series
(comparison method was the same as we had done with UMIE 2003)

Correlation between experiments

(Influence of internal conditions)
How would each agent's rank alter when its competitor changed?

UMIE2004		
	Ex2	Ex3
Ex1	0.77	0.83
Ex2		0.92

Correlation among experiments

How would each agent's rank alter when its competitor changed?

	Descent	Oscilation	Reversal
Ascent	-0.29	-0.35	0.27
Descent		0.67	0.22
Oscilation			0.35

Result of Analysis 1

Compare with UMIE2002, UMIE2003, correlation among Exes appeared again.

UMIE2003		
	Ex2	Ex3
Ex1	0.31	0.57
Ex2		0.33

UMIE2004		
	Ex2	Ex3
Ex1	0.77	0.83
Ex2		0.92

Result of Analysis 2

Almost all correlation is distinct.

	Descent	Oscilation	Reversal
Ascent	-0.81	-0.74	0.24
Descent		0.68	-0.20
Oscilation			-0.32

	Descent	Oscilation	Reversal
Ascent	-0.29	-0.35	0.27
Descent		0.67	0.22
Oscilation			0.35

Findings from UMIE2004

◆ The result of rank correlation is same as UMIE2002.

Rank correlation amoung Ex1, Ex2 and Ex3 all relation is strongly correlated. So we can say,

"Strong agent is strong whenever the oposits are". Rank correlation among variation of spot prices

is week without the relation between "Discent" and "vibration".

UMIE2005

Summary

- Date: 12, September, 2005
- Place: Kyoto University (Event of Social Infomatic Fair)
- Participants: 6 teams with 30 agents
- Agent type: Machine

Description

This year's convention was a joint bid with U-Mart2005, usually organized in autumn. From this convention, all tools were unified to U-Mart system version 2, with redevelopments of the batch processing system for acceleration experiment, and the tool for Pareto ranking. In total six teams, three teams each from the science and engineering faculties and from the economics science faculties, and 30 agents participated in this convention. The winner was the agent which used the classical technical assay, and the agent who achieved good results in UMIE2005 also got better grades in U-Mart2005. No agent was bankrupted from Ex1 through Ex3. But it seems as if the advance tuning was not sufficient, since agents who were top in all items of Ex1 were at 3, and agents who were in first place according to the Pareto rank were at 11. Additionally, one of the convention characteristics is to have few participants of AI-related agents; those were active until last year. After the convention, there was a report on a new plan for the next fiscal year. A continuous session version of U-Mart now under development, and a new league plan, with the theme of "Market maker roles in thin board market", were announced

| ID	Team	University	Agent name	Description
T01	OCUNakajima	Osaka City University	MarketMakerStrategy_MM1 MarketMakerStrategy_MM2 MarketMakerStrategy_MM3 MarketMakerStrategy_MR MarketMakerStrategy_RR	• There are five agents in total, i.e., three market maker agents, and two random agents, as for comparative experiments. • Liquidity is provided to the market by sending an order for one selling and one buying in each session. The spread is adjusted by judging the phase direction upward or downward through observation of its own position.
T02	Team titeCHuo	Tokyo Institute of Technology & Chuo University	Trend_fuzzyStrategy Trend_swiftStrategy	• Two other agents, developed by three researchers, were entered. One agent enhanced the management ability position from the Fuzzy agent and is active for a couple of years. The other agent has a bigger position through catching the bigger trend, it erases the position when the trend is over.
T03	Kyoto University, Pocket Seminar Kita 2005	Kyoto University	A0027279aStrategy A0027544kStrategy A0027757aStrategy	• Other agents were developed within the Kyoto University training course and were implemented by three independent students. The three agents were: firstly, an agent that does contrary trade having its own indicator by means of the past price divergence or repurchase divergence; secondly, an agent which conducts pseudo arbitrage transactions, and finally an agent which, applying its own calculation method, combines both contrary trade methods by divergence and market following factors with short-term trends.
T04	Kinki University	Kinki University	TestStrategy TestStrategy2 TestStrategy3	• An agent implemented by Kinki University. • It does buying and selling taking advantage of moving average conversion premiums for future prices of short duration when its band exhibits more volatility. Usually it judges buying and selling by using bigger price conversion premiums, comparing both the moving average conversion premium for short duration spot prices, and the moving average conversion premium for future prices. Three agents were entered which had different thresholds for judging moving average conversion premiums.

| T05 | Hobomegane | Shizuoka University | FireModoki3Strategy
FireModoki4Strategy
FireModoki5Strategy
FirstLogisticStrategy
FMACDStrategy
FMACDStrategy0
FMACDStrategy2
IMACDStrategy
MACDStrategy
MACDStrategy02
Psycho4Strategy
SecondLogisticStrategy | ・New entry team from Shizuoka University.
・Three agents entered: an agent that encodes the agent' s action, future price and spot price, then does matching of the action and input by means of the bucket-brigade algorithm, and an improved version agent; and two agents that judge buying and selling approximating the future price movement by logistic curve, and an improved version agent. There were six agents using MACD, i.e., the classical technical assay. And, this is an agent that employed the psychological line. These twelve agents, having various measures, all entered. |
| T06 | Chuo University | Chuo University | Murakami_spreadStrategy
Nakamura_spreadStrategy
Osako_pivotStrategy
Shinohara_WmaRsiStrategy
Tabira_bolingerStrategy | ・Five students from Chuo University implemented five independent agents.
・These five agents implemented and entered were as follows: an agent that sends an order of quantity that follows a stepwise increase according to the conversion premium of cash goods and future goods; a similar type of agent that sends an arbitrage order considering repurchase spread, together with an order preparing for bulge and collapse; an agent that does buying and selling using the pivot; an agent that sends an order by combining both WMA and RSI; and lastly an agent that trades using a classical technical agent "Bollinger band" but also implements an independent strategy. |

Scores: Comprehensive Pareto-ranking

Rank	Agent name	ID	Team	University
No.1（No. 1 in Ex1, Ex2 and Ex3）	Nakamura_spreadStrategy	T06	Chuo University	Chuo University
No.1（　　　〃　　　）	Trend_swiftStrategy	T02	Team titeCHuo	Tokyo Institute of Technology & Chuo University
No.1（　　　〃　　　）	Osako_pivotStrategy	T06	Chuo University	Chuo University
No.4（No.1 in Ex1 and EX2, No.4 in Ex3）	Shinohara_WmaRsiStrategy	T06	Chuo University	Chuo University
No.5（No.1 in Ex1, No.5 in Ex2, No.4 in EX3）	Trend_fuzzyStrategy	T02	Team titeCHuo	Tokyo Institute of Technology & Chuo University
No.5（No.1 in Ex1, No.5 in Ex2, No.4 in EX3）	A0027544kStrategy	T03	Kyoto University, Pocket Seminar Kita 2005	Kyoto University,
No.5（No.1 in Ex1, No.5 in Ex2, No.4 in EX3）	Murakami_spreadStrategy	T06	Chuo University	Chuo University
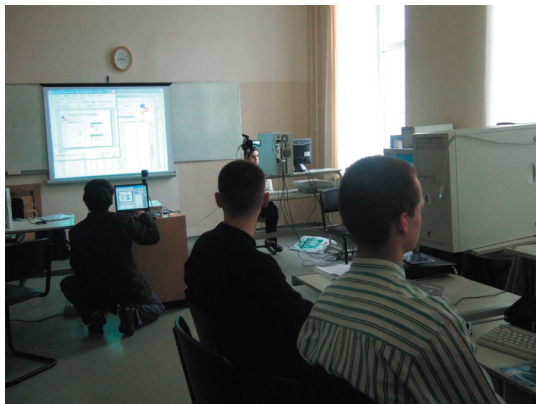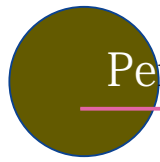
Perspective for the future

U-Mart research has developed in three areas: (1) Study tools development, (2) engineering, and (3) economics. Skipping details, each of them contains various matters.

First, in (1) Study tools development, this includes the development of main unit, U-Mart system. It develops and provides common test bed.
Following points and research aspects were observed.

1.1 Following points and research aspects were observed.

1.2 Man-made market research

1.3 Engineering and economics research
(research that integrate the humanities and science)

1.4 Event-driven type research

Next, in (2) engineering (computer engineering), the following opportunities and objects of research have been provided:

2.1 Application and development of AI (Artificial Intelligence) toward man-made market

2.2 Opposite simulation

2.3 Learning and research by gaming

2.4 Education of system development

2.5 Agile programming to deal with research needs

Finally, in (3) economics. This is the ultimate purpose of U-Mart research. Comparing with the result of the engineering side, the main part of economics research is an issue for the future. But the following results have already been obtained:

3.1 Development in market understanding by means of man-made market

3.2 Generation of new learning opportunity for the education of financial market

3.3 Providing new environment for the research field of experimental economics

3.4 Starting of thin board market research

On the basis of these results and research processes, the U-Mart project has a view on the following issues. These issues tell a tale, of course. Specifically, individual researchers should investigate each issue and go forward, depending on what stage the research is at. However, we believe that we have following general directions in totality.

UnReal Market as an
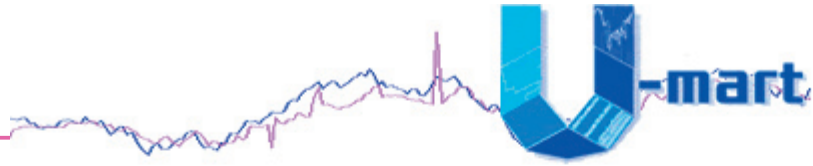
1．Research method / the development of a third science study technique
　・To build up "simulation", which is the third study technique following upon theory and experiment, as a scientific method.
2．Engineering / establishment of engineered approach social study and the solution of social problems
　・To make it possible to conduct an experiment of institution design beforehand
　・In order to do this: to make large-scale social simulation possible technologically.
3．Economics / economics of third generation
　・To establish a research method by ABS (Agent-Based Simulation) as economics for third generation, which supplements prosaic and mathematical grammar.
　・To study the micro structure of markets like thin market as main theme, and to provide the foundation for institution design.
4．New educational method / train future researchers
　・To establish training for development engineers for large-scale system, and produce future ABS researchers.

by. Yoshinori Shiozawa

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Artificial Reseach Testbed

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