

# Overview of UMIE2005

July 28<sup>th</sup>, 2005 Version

UMIE2005 System Operational Committee

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## 1. Introduction

This document describes the details of and how to participate in the U-Mart International Experiment 2005 (UMIE2005). The latest version of this document is available at <http://www.u-mart.econ.kyoto-u.ac.jp/umie2005/>.

## 2. What is UMIE2005?

The U-Mart project has successfully held four domestic open experiments in Japan (Pre U-Mart 2000, UMart2001, U-Mart 2002, U-Mart 2003 and U-Mart 2004) and three international open experiments in CASOS 2002 Conference (UMIE2002), NAACSOS Conference (UMIE2003) and WEHIA 04 & AESCS2004 joint Conference (UMIE2004) as contests of trading agents, and possibility of this approach is confirmed. The U-Mart system is also used as an effective education tool both in schools of economics and computer science in several universities in Japan.

Based on the above experience, we have decided to have the second international open experiment of the U-Mart, i.e., contest of trading agents, in Social Informatics Fair 2005 in Kyoto University in September 2005. Our web site is:

<http://www.lab7.kuis.kyoto-u.ac.jp/sifair2005/index.html>

and

<http://u-mart.econ.kyoto-u.ac.jp/u-mart-2005/>

It is named 'U-Mart International Experiment 2005 (UMIE 2005)', and UMIE2005 is cohosted as a part of U-Mart2005 session(September 12, 9:20~12:00 and 15:00~17:30 at Room 213, Integrated Research Bldg. ).

The aims of this experiment are:

- (1) to share an artificial market system as a common test bed for agent-based simulation,
- (2) to share variation of trading strategies, and methodologies for developing them for artificial market study, and
- (3) to know complex behavior of the market consisting of agents having various trading strategies.

The UMIE2005 calls for participation of trading software agents. With submitted agents, a demonstrative contest is held at the site of the conference. Also, the committee carries out intensive experiments with the submitted agents for various market situations in advance, and the results are reported at U-mart 2005 session in Social Informatics fair 2005.

Furthermore, all the codes and documents of the submitted agents also will be shared by all the participants for further study on the artificial market.

### **3. Time Schedule**

July 28th 2005

Publish Overview of UMIE2005

August 1st 2005

Start distributing the agent development kit(Ver.2)  
(umie2005sdk)

August 1st– 31st 2005

Entry

September 12th – 14th 2005

Social Informatics fair 2005 at Kyoto University

Distribution of the report & Demonstration in U-Mart 2005 session

September 12, 9:20~12:00 and 15:00~17:30

at Room 213, Integrated Research Bldg.

### **4. How to participate in UMIE2005**

#### **4.1 How to obtain Overview of UMIE2005**

Download Overview of UMIE2005 from U-Mart Web page  
(<http://www.u-mart.econ.kyoto-u.ac.jp/umie2005/>), or request it via mail to  
umie2005@u-mart.econ.kyoto-u.ac.jp

## 4.2 How to obtain the agent development kit

Apply for New version's agent development kits from <http://www.u-mart.econ.kyoto-u.ac.jp/UMIE2005/kit/>. This requires your name, company (or institution), job title, address, telephone, facsimile, e-mail address, and desired obtaining method.

You receive an e-mail that notifies how to obtain the kit. It is available as e-mail attachment or HTTP download. This kit including The U-Mart server over TCP/IP, Java API for client programs that communicates the U-Mart server over TCP/IP, Wrapper program to make the strategy developed with the standalone kit U-Mart clients, SUN JRE (for Windows only) and others. The file size is about 51MB.

umie2005sdk.tgz	for UNIX user
umie2005sdk.zip	for Windows user

\*You need SUN JDK environment, in order to develop an agent.

\*If you need old version's developer kit(umie2004sdk), we can offer it. The agent who developed by umie2004sdk secures use by the U-Mart system(Ver.2).

Your application for the agent development kit is automatically assumed as preliminary entry for UMIE2005, and your e-mail address is registered with our mailing list (umie2005-tech@u-mart.econ.kyoto-u.ac.jp) to exchange technical and general information.

## 4.3 Entry

To make an entry, follow the instruction on the entry form at <http://www.u-mart.econ.kyoto-u.ac.jp/umie2005/entry/>, and provide entry information, source codes of your agents (TestStrategy.java and the related codes), and explanatory documents of the agents, supposing it is possible. The format of the document is XML style text and PDF or PostScript format (US Letter or A4, one page or more for each agent).

\* Entry must be made between June 1st and June 30th 2005.

\* The provided source codes and explanatory documents are opened to the public with the results of experiments. Note that the license for the source codes and the documents are complied with Open Source Document. See Appendix B for the details of the license.

## 5. Formation of Team and Agents

Entry should be made by a team of at least one person. A person cannot belong to more than one team. The entries from one team are limited to ten agents. Each agent is allowed to adopt different strategies, or all of them can adopt the same strategy with different parameter settings. While whole agents can adopt the same strategy and the same parameter setting, only one agent is allowed to participate in Experiment 1. In Experiment 2, 2', 2'', 3, and 3', the alliances between attended agents are not prohibited. Evaluation is made by each agent and by each team.

\* We do not guarantee the proper operation of alliances.

Note that Experiment 2', 3, and 3' are conducted only with selected agents.

## 6. Attended agents

The agent must be developed as `TestStrategy.java` (and its sub-classes) with "u-mart-standalon-1\_3" contained in the agent development kit (umie2005sdk). The class name is assigned to each team at the entry.

To develop a network-capable client agent, use your `TestStrategy.java` and "for-real-u-mart-1\_3" contained in the network-capable development kit(umie2005sdkn).

A client agent that independently implements SVM is not accepted for UMIE2005. However, from technical and academic point of view, it is welcomed in network demonstration held the network demonstration session at AESCS'05 Conference.

## 7. Initial values of the experiments

The initial setting of U-Mart in UMIE2005 is as follows (basically compliant with Pre U-Mart 2000, U-Mart 2001, U-Mart 2002, U-Mart 2003, UMIE2002, Umie2003 and UMIE2004):

Trading period: 60 days,  
Itayose: four times a day,  
Membership fee: none,  
Commission charges: none,  
Underlying securities: J30,  
Initial cash in hand: 1,000,000,000 yen,  
Contract amount: one unit of contract amount is 1,000 times of J30,  
Margin money: 300,000 yen for one unit of position,  
Limit of loan from the exchange: 30,000,000 yen, and  
Interest rate of the loan: 10% per annum, daily payment.

Spot data:

We use four series of spot data: ascending, descending, reversal, and oscillation series.

The data is not disclosed until the experiment is completed.

Patterns of experiments:

1) Pattern 1 (for Experiment 1, 2, 2' and 2'')

Beginning of experiment

Initialization of agents

Ascending series: repeated 50 times

Initialization of agents

Descending series: repeated 50 times

Initialization of agents

Reversal series: repeated 50 times

Initialization of agents

Oscillation series: repeated 50 times

Calculate of experiment

End of experiment

2) Pattern 2 (for Experiment 3 and 3')

Beginning of experiment

Initialization of agents

Ascending, descending, reversal, and oscillation series are randomly executed 1,000 times

Calculate of experiment

End of experiment

## 8. Evaluation of agents

Agents should be evaluated based on multiple indicators after repeating sufficient number of times with multiple patterns of spot data. We evaluate agents by finding Pareto-based ranking with multiple indicators. See Appendix A for the algorithm of Pareto-based ranking.

Number of times:  $N_g=200$ (for Experiment 1, 2, 2' and 2'') or  $N_g=1000$ (for Experiment 3 and 3')

Evaluation indicators:  $N_f=4$

f1: maximum bottom line profit

f2: average of bottom line asset

f3: bankruptcy ratio (the number of times the agent go into bankruptcy)

f4: ratio of making profit (the number of times the agent make bottom line profit)

Gentlemen's rules:

It is desirable to follow the rules stated below, although they are not the criteria of evaluation:

- 1) Agents should make transactions positively. It is desirable to place orders around 10 % of entire transactions.
- 2) Agents should make transactions commensurate with its asset situation. It is desirable to manage its position. Avoiding bankruptcy leads to better evaluation.

We also evaluate and analyze the volume of transaction or the traded volume of the market, although they are not used for evaluation of agents.

## 9. Experiments

The standard set of agents that are used in an experiment and documents are included additional kit of a distribution schedule on August 1st, 2005.

### 9.1 Experiment 1

1) Composition of agents:

Each attended agent + standard set of agents

1 attended agent

Standard set of agents:

2) Pattern of experiment: Pattern 1

3) Outputs:

Logs of whole simulations: standard output of each simulation for every data series

Spot data used in the experiment

Composition of agents

Records of every transaction

Analysis results of the logs (data for ranking)

List of bottom line assets: for each data series + for whole data series

f1: maximum bottom line profit

f2: average of bottom line asset

f3: bankruptcy ratio (the number of times the agent goes into bankruptcy)

f4: ratio of making profit (the number of times the agent makes bottom line profit)

Ranking of each item → Pareto ranking → rank for preliminary round

Price fluctuation, traded volume, statistic and quantitative analyses for asset situations (optional)

Analysis notes, comments (optional)

\* Definition of the qualified agent in preliminary round:

the agent whose bankruptcy ratio (f3) is less than 10% in Experiment 1.

## 9.2 Experiment 2

1) Composition of agents:

All attended agents + standard set of agents

Attended agents:

Team 1

Agent 1

:

Agent 5

Team 2

:

Standard set of agents:

2) Pattern of experiment: Pattern 1

3) Outputs: same as Experiment 1

\* Alliances between attended agents are not prohibited.

## 9.3 Experiment 2'

1) Composition of agents:

Qualified agents + standard set of agents

Attended agents:

Team 1

Agent 1

Team 2

Agent 3

:

Standard set of agents:

:

2) Pattern of experiment: Pattern 1

3) Outputs: same as Experiment 1

\* Alliances between attended agents are not prohibited.

#### **9.4 Experiment 2”**

1) Composition of agents:

Agents of the team on which all the qualified agents cleared Experiment 1 +  
standard set of agents

Attended agents:

Team 1

Agent 1

:

Agent 5

Team 2

:

Standard set of agents:

:

2) Pattern of experiment: Pattern 1

3) Outputs: same as Experiment 1

\* Alliances between attended agents are not prohibited.

#### **9.5 Experiment 3**

1) Composition of agents:

Randomly selected agents from attended agents and standard set of agents.  
50 % of whole agents are selected.

2) Pattern of experiment: Pattern 2

3) Outputs: same as Experiment 1



\* Alliances between attended agents are not prohibited.

### **9.6 Experiment 3'**

1) Composition of agents:

Randomly selected agents from qualified agents and standard set of agents.  
50 % of whole agents are selected.

2) Pattern of experiment: Pattern 2

3) Outputs: same as Experiment 1

\* Alliances between attended agents are not prohibited.

## **10. Demonstration session in AESCS'05 Conference**

1) Demonstration

We demonstrate U-Mart in AESCS'05 joint Conference. This demonstration is conducted via network using our network server, so we welcome the participations of human agents (GUI clients) and network-capable machine agents.

2) Report of experimental result and awarding

We report the experimental result in AESCS'05 Conference. The attended agents and their strategies are evaluated technically and academically based on the explanatory documents and UMIE2005 System Technology Committee offers the special prizes to remarkable agents. This prize may be offered to the agent that does not achieve good results. The report of the experimental result is distributed to all of the participants.

## **11. Others**

The development kit for network-capable agent (including GUI client for human agent and related documentations) enables simulation on LAN and human gaming simulation. We will also provide a wrapper program to represent outputs from stand-alone server graphically.

## **12. About license**

The license of this document is complied with Open Publication License. The programs developed by U-Mart project are complied with MIT license.

The attended agents in UMIE2005 and their explanatory documents are opened to the public for the limited use for academic purpose and they are complied with Open Source

License.

### 13. Contacts

#### Secretariat of UMIE2005

E-mail: [umie2005@u-mart.econ.kyoto-u.ac.jp](mailto:umie2005@u-mart.econ.kyoto-u.ac.jp)

<http://www.u-mart.econ.kyoto-u.ac.jp/umie2005/>

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## Appendix A. Algorithms of Pareto-based Ranking

### 1. Multi-purpose evaluation of agents

This method evaluates agents based on the result multiple indicators under multiple experimental conditions such as price data, agents attended in the group, institution of the market. The simulations are conducted  $N_g$  times under each experimental condition. The evaluation indicators are:

f1: the maximum bottom line profit among  $N_g$  times of simulations,

f2: the average of bottom line asset in  $N_g$  times of simulations,

f3: the ratio of times that the agent does not go into bankruptcy within  $N_g$  times of simulations, and

f4: the ratio of times that the agent make bottom line profit within  $N_g$  times of simulations.

Each agent is given a numeric number called "rank" under each experimental condition. The rank is calculated with Pareto-based ranking. Since the smaller number of rank is better, the evaluation score of each agent is given as a sum total of reciprocals of the ranks.

## **2.Pareto-based ranking**

Pareto-based ranking is a method proposed by Goldberg to apply genetic algorithms to multi-purpose optimization problems.

It assumes that the agent A dominates the agent B if A is superior to B on every evaluation indicator. When no agent dominates an agent within a group of agents, the agent is defined as the Pareto optimum agent.

Based on this concept, the Pareto-based ranking algorithm is composed as below:

<<Pareto-based Ranking>>

1. Set rank  $r = 1$ .
2. Select all of the Pareto optimum agents from the group of agents, give them the rank  $r$ , and remove them from the group.
3. Set rank  $r = r + 1$ .
4. Repeat step 2 and 3 until every agent is ranked.

### **3. Algorithm of multi-purpose evaluation**

The algorithm of multi-purpose evaluation is as below:

<<Multi-purpose evaluation of agents>>

1. Define  $N_c$  pieces of experimental conditions,  $N_f$  pieces of evaluation indicators, and the times of simulations  $N_g$  conducted per an experimental condition.
2. Conduct  $N_g$  times of simulations under each experimental condition and rank the agents for each environment using Pareto-based ranking. Each agent gets  $N_c$  pieces of ranks.
3. Calculate the evaluation score of each agent by adding up the reciprocals of the  $N_c$  pieces of ranks, and then place them in the order based on their evaluation scores.

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