

# Overview of UMIE2004

December 1<sup>th</sup>, 2003 Version

UMIE2004 System Operational Committee

Copyright (c) 2004 by UMIE2004 System Technology Committee & U-Mart Project. This material may be distributed only subject to the terms and conditions set forth in the Open Publication License, v1.08 or later (the latest version is presently available at <http://www.opencontent.org/openpub/>).

## 1. Introduction

This document describes the details of and how to participate in the U-Mart International Experiment 2004 (UMIE2004). The latest version of this document is available at <http://www.u-mart.econ.kyoto-u.ac.jp/umie2004/>.

## 2. What is UMIE2004?

The U-Mart project has successfully held four domestic open experiments in Japan (Pre U-Mart 2000, U-Mart2001, U-Mart 2002 and U-Mart 2003) and two international open experiment in CASOS 2002 Conference (UMIE2002) and NAACSOS Conference (UMIE2003) 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 WEHIA 04 ( 9th WORKSHOP ON ECONOMICS AND HETEROGENEOUS INTERACTING AGENTS) and AESCS'04( The Third International Workshop on Agent-based Approaches in Economic and Social Complex Systems ) joint Conference held in Kyoto University in May 2004. Our web site is:

<http://www.nda.ac.jp/cs/AI/wehia04/>

and

<http://www.ipe.media.kyoto-u.ac.jp/aescs04/>

It is named 'U-Mart International Experiment 2004 (UMIE 2004)'.

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 UMIE2004 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 WEHIA 04 & AESCS'04 Conference.

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**

December 1st 2003

Publish Overview of UMIE2004

January 15th 2004

Start distributing the agent development kit  
(umie2004sdk and umie2004sdkn)

April 1st – May 1st 2004

Entry

May 27th – 29th 2004

WEHIA 04 and AESCS'04 joint Conference at Kyoto University

Distribution of the report & Demonstration

### **4. How to participate in UMIE2004**

#### **4.1 How to obtain Overview of UMIE2004**

Download Overview of UMIE2004 from U-Mart Web page (<http://www.u-mart.econ.kyoto-u.ac.jp/umie2004/>), or request it via mail to [umie2004@u-mart.econ.kyoto-u.ac.jp](mailto:umie2004@u-mart.econ.kyoto-u.ac.jp)

#### **4.2 How to obtain the agent development kit**

Apply for agent development kits from

<http://www.u-mart.econ.kyoto-u.ac.jp/UMIE2004/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. The file size is about 2MB.

umie2004sdk.tgz	for UNIX user
umie2004sdk.zip	for Windows user

And, we distribute the network server's 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 and others). The file size is about 2MB.

umie2004sdkn.tgz	for UNIX user
umie2004sdkn.zip	for Windows user

Your application for the agent development kit is automatically assumed as preliminary entry for UMIE2004, and your e-mail address is registered with our mailing list ([umie2004-tech@u-mart.econ.kyoto-u.ac.jp](mailto:umie2004-tech@u-mart.econ.kyoto-u.ac.jp)) to exchange technical and general information.

\* The development kit is available from January 15th 2004 to April 15th 2004.

### **4.3 Entry**

To make an entry, follow the instruction on the entry form at <http://www.u-mart.econ.kyoto-u.ac.jp/umie2004/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 April 1st and May 1st 2004.

\* 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 (umie2004sdk). 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(umie2004sdkn).

A client agent that independently implements SVMP is not accepted for UMIE2004. However, from technical and academic point of view, it is welcomed in network demonstration held the network demonstration session at WEHIA 04 and AESCS'04 joint Conference.

## 7. Initial values of the experiments

The initial setting of U-Mart in UMIE2004 is as follows (basically compliant with Pre U-Mart 2000, U-Mart 2001, UMIE2002 and UMIE2003):

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 January 15th, 2004.

### 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 WEHIA 04 and AESCS'04 joint Conference**

1) Demonstration

We demonstrate U-Mart in WEHIA 04 and AESCS'04 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 WEHIA 04 and AESCS'04 joint Conference. The attended agents and their strategies are evaluated technically and academically based on the explanatory documents and UMIE2004 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 UMIE2004 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 UMIE2004

E-mail: [umie2004@u-mart.econ.kyoto-u.ac.jp](mailto:umie2004@u-mart.econ.kyoto-u.ac.jp)

<http://www.u-mart.econ.kyoto-u.ac.jp/umie2004/>

### UMIE2004 Organizing Committee

Chair: Hajime Kita (National Institution of Academic Degrees, JAPAN)

Hiroshi Deguchi (Tokyo Inst. Technology, JAPAN)

Rober Axtell (The Brookings Institution, USA)

Kathleen M. Carley (Carnegie Melon University, USA)

Takao Terano (Univ. of Tshukuba, JAPAN)

Petter Dittrich (F.-S.-U. Jena, GERMAN)

Yoshinori Shiozawa (Osaka City University, JAPAN)

Maksim Tsvetovat (Carnegie Melon University, USA)

### UMIE2004 System Operational Committee

Chair: Hiroyuki Matsui (Kyoto University, JAPAN)

Hiroshi Sato (National Defense Academy, JAPAN)

Naoki Mori (Osaka Prefecture University, JAPAN))

Isao Ono (University of Tokushima, JAPAN)

Yoshihiro Nakajima (Osaka City University, JAPAN)

## 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.

## **Appendix B: License**

**1. License of documentations about U-Mart project and UMIE2003. This applies to the OPEN PUBLICATION LICENSE.**

## I. REQUIREMENTS ON BOTH UNMODIFIED AND MODIFIED VERSIONS

The Open Publication works may be reproduced and distributed in whole or in part, in any medium physical or electronic, provided that the terms of this license are adhered to, and that this license or an incorporation of it by reference (with any options elected by the author(s) and/or publisher) is displayed in the reproduction.

Proper form for an incorporation by reference is as follows:

Copyright (c) <year> by <author's name or designee>. This material may be distributed only subject to the terms and conditions set forth in the Open Publication License, vX.Y or later (the latest version is presently available at <http://www.opencontent.org/openpub/>).

The reference must be immediately followed with any options elected by the author(s) and/or publisher of the document (see section VI).

Commercial redistribution of Open Publication-licensed material is permitted.

Any publication in standard (paper) book form shall require the citation of the original publisher and author. The publisher and author's names shall appear on all outer surfaces of the book. On all outer surfaces of the book the original publisher's name shall be as large as the title of the work and cited as possessive with respect to the title.

## II. COPYRIGHT

The copyright to each Open Publication is owned by its author(s) or designee.

## III. SCOPE OF LICENSE

The following license terms apply to all Open Publication works, unless otherwise explicitly stated in the document.

Mere aggregation of Open Publication works or a portion of an Open Publication work with other works or programs on the same media shall not cause this license to apply to those

other works. The aggregate work shall contain a notice specifying the inclusion of the Open Publication material and appropriate copyright notice.

SEVERABILITY. If any part of this license is found to be unenforceable in any jurisdiction, the remaining portions of the license remain in force.

NO WARRANTY. Open Publication works are licensed and provided "as is" without warranty of any kind, express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose or a warranty of non-infringement.

#### IV. REQUIREMENTS ON MODIFIED WORKS

All modified versions of documents covered by this license, including translations, anthologies, compilations and partial documents, must meet the following requirements:

- 1) The modified version must be labeled as such.
- 2) The person making the modifications must be identified and the modifications dated.
- 3) Acknowledgement of the original author and publisher if applicable must be retained according to normal academic citation practices.
- 4) The location of the original unmodified document must be identified.
- 5) The original author's (or authors') name(s) may not be used to assert or imply endorsement of the resulting document without the original author's (or authors') permission.

#### V. GOOD-PRACTICE RECOMMENDATIONS

In addition to the requirements of this license, it is requested from and strongly recommended of redistributors that:

- 1) If you are distributing Open Publication works on hardcopy or CD-ROM, you provide email notification to the authors of your intent to redistribute at least thirty days before your manuscript or media freeze, to give the authors time to provide updated documents. This notification should describe modifications, if any, made to the document.
- 2) All substantive modifications (including deletions) be either clearly marked up in the document or else described in an attachment to the document.

Finally, while it is not mandatory under this license, it is considered good form to offer a free copy of any hardcopy and CD-ROM expression of an Open Publication-licensed work to its author(s).

## VI. LICENSE OPTIONS

The author(s) and/or publisher of an Open Publication-licensed document may elect certain options by appending language to the reference to or copy of the license. These options are considered part of the license instance and must be included with the license (or its incorporation by reference) in derived works.

A. To prohibit distribution of substantively modified versions without the explicit permission of the author(s). "Substantive modification" is defined as a change to the semantic content of the document, and excludes mere changes in format or typographical corrections.

To accomplish this, add the phrase 'Distribution of substantively modified versions of this document is prohibited without the explicit permission of the copyright holder.' to the license reference or copy.

B. To prohibit any publication of this work or derivative works in whole or in part in standard (paper) book form for commercial purposes is prohibited unless prior permission is obtained from the copyright holder.

To accomplish this, add the phrase 'Distribution of the work or derivative of the work in any standard (paper) book form is prohibited unless prior permission is obtained from the copyright holder.' to the license reference or copy.

### OPEN PUBLICATION POLICY APPENDIX:

(This is not considered part of the license.)

Open Publication works are available in source format via the Open Publication home page at <http://works.opencontent.org/>.

Open Publication authors who want to include their own license on Open Publication works may do so, as long as their terms are not more restrictive than the Open Publication license.

If you have questions about the Open Publication License, please contact TBD, and/or the Open Publication Authors' List at opal@opencontent.org, via email.

**2. License of source codes of U-Mart project and UMIE2003. This applies to the MIT license.**

Copyright (c) 1999 Hiroshi Sato  
Copyright (c) 1999 Makio Yamashige  
Copyright (c) 1999 Rikiya Fukumoto  
Copyright (c) 2002 U-Mart Project

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

-----