

- A typical CAT game consists of a CAT server and several CAT clients, which may be markets or traders.
- JCAT [Niu et al., 2008]: the server platform in Java for CAT games, extending the single-market simulator JASA [Thepiss, 2007]

CAT games
an overview

- **Motivations**
 - Experimental approaches in the literature with different assumptions and criteria make the results incompatible.
 - Markets are not isolated in the real world and usually compete against each other as the traders in a market do.
- A CAT game has multiple players, each as a market and includes trading agents that move between these markets and exchange some sort of virtual goods.
- Under the umbrella of Trading Agent Competition (TAC).
- CAT is an abbreviation of catalactics, the science of economic exchanges, and a reverse of prior TAC competitions.

Background

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Background



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CAT Game and JCAT Platform

- A CAT game lasts a certain number of days, each day consists of rounds, and each round lasts a certain number of ticks, or milliseconds
- (game starting) the game server broadcasts the list of markets and traders.
- (day opening) markets post their price lists, specifying fees on 1. registration 2. information 3. short 4. transaction 5. profit
- (day opening) the game server assigns each trader a private value, all of which determines the supply and demand schedules of the global market.
- (day opening) traders select a market to do business to maximize their profits based on their experience with the markets and fees the markets charge.

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CAT game rules (I)

- Game rules
- How trading agents behave
- How markets behave

CAT games Outline

- (day opening) both trader and market may optionally subscribe with a set of markets to receive additional information about shouts and transactions in those markets.
- (trading) a trader has a change each round to make a new shout or modify its existing shout; at most one active shout is allowed at any moment for a trader; and a shout persists until it is matched or modified, or the trading day closes.
- (trading) a market may allow or reject the placement of a new shout or a modifying one, and match an active ask and an active bid at any time as long as the bid price is no lower than the ask price and the transaction price falls in between.

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CAT game rules (II)

- **random:** the trader randomly picks a market;
- **ε-greedy:** the trader treats the choice of market as an *n*-armed bandit problem which it solves using an ε-greedy exploration policy [Sutton and Barto, 1998]
- **softmax:** similar to ε-greedy, but using a softmax exploration policy [Sutton and Barto, 1998]

Trading agents
Market selection strategy

- (day closed) a daily score is calculated for each market according to the following rule

$$\text{Daily Score} = \text{Market Share} + \text{Profit Share} + \text{Transaction Success Rate}$$

$$\text{Total Score} = \sum_{\text{agents}} (\text{Daily Score})$$
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CAT game rules (III)

10/17	CFAI/ICFV	Joshi/Boyd+SCCC/DMV
<ul style="list-style-type: none"> ● how to determine the fees ■ changing policy ● how to determine the market quotes ■ quoting policy ● when to clear the market, i.e., finding matchable shouts and executing transactions ■ clearing policy ● how to determine transaction prices for matched shouts ■ pricing policy ● how to match placed shouts ■ matching policy ● whether a shout from a trader should be allowed to place ■ shout accepting policy 		
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<ul style="list-style-type: none"> ■ ZI-C (Zero intelligence with constraint) [Gode and Sunder, 1993] picks offers randomly but ensures at no loss. ■ ZIP (zero intelligence plus) [Cliff and Bruten, 1997] adapts its profit margin by using a simple heuristic rule to remain competitive in the market based upon information about shouts and transactions. ■ RE [Roß and Frey, 1995] uses the profit earned through the previous shout as a reward signal and learns the best profit margin level to set. ■ CD [Gjostad and Dickhaut, 1998] estimates the probability of an offer being accepted from the distribution of past offers, and chooses the offer that maximizes its expected utility. 		
<hr/> Trading agents Trading strategy		

Parameter	Value
shout accepting policy	Always (A), Quote-bearing (Q), Transacted-based (AT), ...
matching policy	Equilibrium-based (ME), MaxVolume (MV)
pricing policy	Discriminatory (PD), Unanimous (PU), Based (PB), ...
clearing policy	Continuous (CC), Roundwise (CR), Probabilistic (CP)
quoting policy	One-sided (SO), Two-sided (ST)
changing policy	Fixed (GF), Bail-and-switch (GB), Cutting-price (GC), ...

Parameterized market mechanism framework
Policies implemented in CMT

Parameter	Value
shout accepting policy	Whether a shout from a trader should be allowed to place
matching policy	How to match placed shouts
pricing policy	How to determine transaction prices for matched shouts
clearing policy	When to clear the market, i.e., finding matchable shouts and executing transactions
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References (1)


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How to compile and run?


- **Prerequisites**
 - Sun Java 1.6+
 - Apache ant 1.6.2
- **Download and decompress**
 - `java -jar cat.jar`
- **Compile and execute**
 - `ant jar`
 - `ant run`
 - `ant test`
- **Configuration file**
 - `ant -Dcat.jar=cat.jar`
 - `ant -Dcat.jar=cat.jar`


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Where to start?

- **To extend the existing policies in CAT**
 - [Papers on the official CAT competition website](#)
 - [AMMS 2008 paper \[Niu et al., 2008b\]](#)
 - [IAT 2008 paper \[Niu et al., 2008a\]](#)
 - [AMC 2008 paper \[Cai et al., 2008\]](#)
 - [TADA 2007 paper \[Niu et al., 2007a\]](#)
 - [papers that entrants wrote on their designs.](#)
- **JCAT API Doc**
 - <http://jcat.sourceforge.net/api/>
- **JCAT Tutorial [Niu, 2008]**
- **CAT Protocol (CAT) Specification [Niu et al., 2007b]**
- **Overview of CAT: A Market Design Competition [Genting et al., 2007]**
- **JCAT version 0.12**
 - <http://jcat.sourceforge.net/>

Where to download?

