

CS378

Autonomous Multiagent Systems

Spring 2005

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Final RoboCup Tournament
Friday, May 13th, 2005

Agents

1. Sense
2. Decide (“think”)
3. Act

Agents

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2. Decide (“think”)
3. Act

Situated in an Environment

Environments

Environment $\Rightarrow$ sensations, actions

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Environment $\Rightarrow$ sensations, actions

- fully observable vs. partially observable
- deterministic vs. non-deterministic
- episodic vs. non-episodic
- static vs. dynamic
- discrete vs. continuous
- single-agent vs. multiagent

An international AI and Robotics research initiative

RoboCup

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- Use **soccer** as a rich and realistic test-bed

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 - 2 teams of agents on a field with 2 goals
 - **Purpose:** direct ball into opponent's goal

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 - 2 teams of agents on a field with 2 goals
 - **Purpose:** direct ball into opponent's goal
- Robot and simulation **competitions**

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- Use **soccer** as a rich and realistic test-bed
 - 2 teams of agents on a field with 2 goals
 - **Purpose:** direct ball into opponent's goal
- Robot and simulation **competitions**
- Workshops; RoboCup-Jr; RoboCup-Rescue

Research Challenges

- Multiple **teammates** with a common goal
- Multiple **adversaries** — not known in advance

Research Challenges

- Multiple **teammates** with a common goal
- Multiple **adversaries** — not known in advance
- **Real-time** decision making necessary
- **Noisy** sensors and actuators
- Enormous state-space

RoboCup Simulator

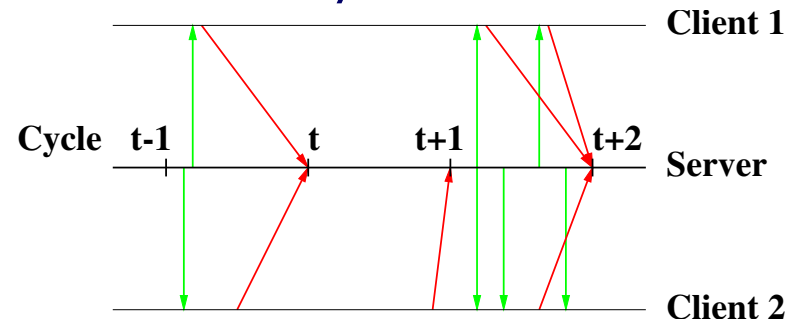


RoboCup Simulator

- Distributed: each player a separate client
- Server models dynamics and kinematics

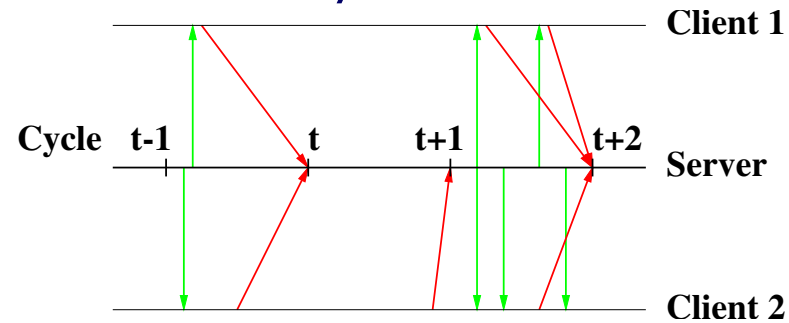
RoboCup Simulator

- Distributed: each player a separate client
- Server models dynamics and kinematics
- Clients receive **sensations**, send **actions**



RoboCup Simulator

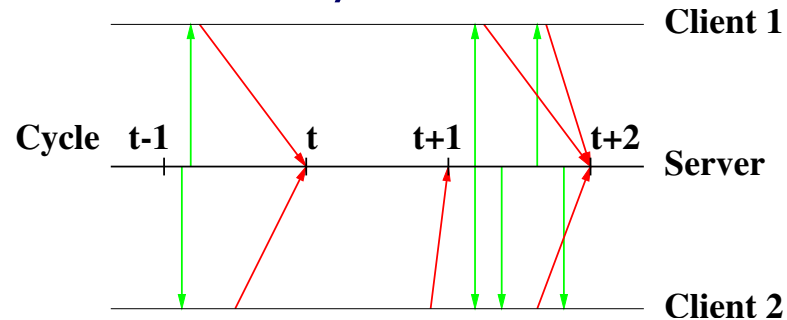
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- Parametric actions: **dash, turn, kick, say**

RoboCup Simulator

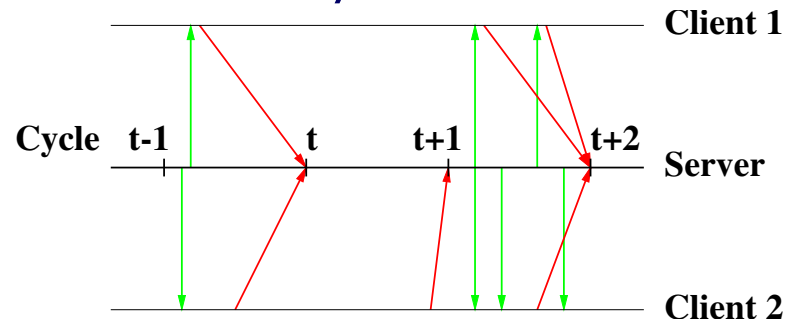
- Distributed: each player a separate client
- Server models dynamics and kinematics
- Clients receive **sensations**, send **actions**



- Parametric actions: **dash, turn, kick, say**
- Abstract, noisy sensors, hidden state
 - **Hear** sounds from limited distance
 - **See** relative distance, angle to objects ahead

RoboCup Simulator

- Distributed: each player a separate client
- Server models dynamics and kinematics
- Clients receive **sensations**, send **actions**



- Parametric actions: **dash, turn, kick, say**
- Abstract, noisy sensors, hidden state
 - **Hear** sounds from limited distance
 - **See** relative distance, angle to objects ahead
- $> 10^{9^{23}}$ states
- Limited resources : stamina
- Play occurs in **real time** ($\approx$ human parameters)

Schedule

- Overview
- **Tournament part 1**
- Other class projects: rescue and ants
- Video: real soccer robots
- Tournament part 2
- Challenge matches: winner vs.:
last year's champ, US Open, UvA-trilearn 2003

The Teams

- | | |
|-------------------------------|-----------------------------|
| 1. RoboTrapper | Kulaga and Narula |
| 2. ntUnited | Knaack and Popova |
| 3. Give and Go Goonies | Chrien and Kloepping |
| 4. Bollywood Ballers | Lonkar and Sachandani |
| 5. CICA FC | Mittal and Tschetter |
| 6. Trilearn United | Little and Rogers |
| 7. Unreal Madrid | Lovitt, Mundra, and Reveley |

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| 7. Unreal Madrid | Lovitt, Mundra, and Reveley |
| 8. RescueSpread | Kang and Srivastava |
| 9. Ant sim | Boothe and Broyles |

The Tournament

- Full round robins in a group of 7 (21 games)

The Tournament

- Full round robins in a group of 7 (21 games)
- Run **off-line**, but results kept secret

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						*	
B ntUnited		—						
C G & G Goonies			—					
D Ballers				—				
E CICA FC					—			
F Trilearn Utd						—		
G Unreal Madrid							—	

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						1-0	3
B ntUnited		—						
C G & G Goonies		*	—					
D Ballers				—				
E CICA FC					—			
F Trilearn Utd						—		
G Unreal Madrid	0-1						—	0

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						1–0	3
B ntUnited		—	2–2					1
C G & G Goonies		2–2	—					1
D Ballers				—				
E CICA FC					—	*		
F Trilearn Utd						—		
G Unreal Madrid	0–1						—	0

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						1–0	3
B ntUnited		—	2–2				*	1
C G & G Goonies		2–2	—					1
D Ballers				—				
E CICA FC					—	1–0		3
F Trilearn Utd					0–1	—		0
G Unreal Madrid	0–1						—	0

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						1–0	3
B ntUnited		—	2–2				0–0	2
C G & G Goonies		2–2	—					1
D Ballers		*		—				
E CICA FC					—	1–0		3
F Trilearn Utd					0–1	—		0
G Unreal Madrid	0–1	0–0					—	1

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						1–0	3
B ntUnited		—	2–2	0–3			0–0	2
C G & G Goonies		2–2	—					1
D Ballers		3–0		—				3
E CICA FC					—	1–0		3
F Trilearn Utd					0–1	—		0
G Unreal Madrid	0–1	0–0	*				—	1

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						1–0	3
B ntUnited		—	2–2	0–3		*	0–0	2
C G & G Goonies		2–2	—				0–3	1
D Ballers		3–0		—				3
E CICA FC					—	1–0		3
F Trilearn Utd					0–1	—		0
G Unreal Madrid	0–1	0–0	3–0				—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						1–0	3
B ntUnited		—	2–2	0–3		0–2	0–0	2
C G & G Goonies		2–2	—	*			0–3	1
D Ballers		3–0		—				3
E CICA FC					—	1–0		3
F Trilearn Utd		2–0			0–1	—		3
G Unreal Madrid	0–1	0–0	3–0				—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						1–0	3
B ntUnited		—	2–2	0–3		0–2	0–0	2
C G & G Goonies		2–2	—	0–7		*	0–3	1
D Ballers		3–0	7–0	—				6
E CICA FC					—	1–0		3
F Trilearn Utd		2–0			0–1	—		3
G Unreal Madrid	0–1	0–0	3–0				—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—						1–0	3
B ntUnited		—	2–2	0–3		0–2	0–0	2
C G & G Goonies		2–2	—	0–7		0–5	0–3	1
D Ballers		3–0	7–0	—				6
E CICA FC					—	1–0		3
F Trilearn Utd		2–0	5–0		0–1	—		6
G Unreal Madrid	0–1	0–0	3–0				—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—	1–0	4–0				1–0	9
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	2
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	1
D Ballers		3–0	7–0	—				6
E CICA FC		2–0	5–0		—	1–0		9
F Trilearn Utd		2–0	5–0		0–1	—	*	6
G Unreal Madrid	0–1	0–0	3–0				—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—	1–0	4–0				1–0	9
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	2
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	1
D Ballers		3–0	7–0	—				6
E CICA FC		2–0	5–0		—	1–0		9
F Trilearn Utd		2–0	5–0		0–1	—	3–0	9
G Unreal Madrid	0–1	0–0	3–0			0–3	—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—	1–0	4–0	*			1–0	9
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	2
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	1
D Ballers		3–0	7–0	—			1–0	9
E CICA FC		2–0	5–0		—	1–0	2–0	12
F Trilearn Utd		2–0	5–0		0–1	—	3–0	9
G Unreal Madrid	0–1	0–0	3–0	0–1	0–2	0–3	—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—	1–0	4–0	1–1			1–0	10
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	2
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	1
D Ballers	1–1	3–0	7–0	—			1–0	10
E CICA FC		2–0	5–0		—	1–0	2–0	12
F Trilearn Utd		2–0	5–0		0–1	—	3–0	9
G Unreal Madrid	0–1	0–0	3–0	0–1	0–2	0–3	—	4

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- Video: real soccer robots
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Other Class Projects

- **RescueSpread**

Kang and Srivastava

- **Ant sim**

Boothe and Broyles

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Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—	1–0	4–0	1–1		*	1–0	10
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	2
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	1
D Ballers	1–1	3–0	7–0	—			1–0	10
E CICA FC		2–0	5–0		—	1–0	2–0	12
F Trilearn Utd		2–0	5–0		0–1	—	3–0	9
G Unreal Madrid	0–1	0–0	3–0	0–1	0–2	0–3	—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—	1–0	4–0	1–1		2–0	1–0	13
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	2
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	1
D Ballers	1–1	3–0	7–0	—		*	1–0	10
E CICA FC		2–0	5–0		—	1–0	2–0	12
F Trilearn Utd	0–2	2–0	5–0		0–1	—	3–0	9
G Unreal Madrid	0–1	0–0	3–0	0–1	0–2	0–3	—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—	1–0	4–0	1–1		2–0	1–0	13
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	2
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	1
D Ballers	1–1	3–0	7–0	—	*	3–1	1–0	13
E CICA FC		2–0	5–0		—	1–0	2–0	12
F Trilearn Utd	0–2	2–0	5–0	1–3	0–1	—	3–0	9
G Unreal Madrid	0–1	0–0	3–0	0–1	0–2	0–3	—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—	1–0	4–0	1–1	*	2–0	1–0	13
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	2
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	1
D Ballers	1–1	3–0	7–0	—	0–3	3–1	1–0	13
E CICA FC		2–0	5–0	3–0	—	1–0	2–0	15
F Trilearn Utd	0–2	2–0	5–0	1–3	0–1	—	3–0	9
G Unreal Madrid	0–1	0–0	3–0	0–1	0–2	0–3	—	4

Round Robin

	A	B	C	D	E	F	G	Pts
A RoboTrapper	—	1–0	4–0	1–1	1–0	2–0	1–0	16
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	2
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	1
D Ballers	1–1	3–0	7–0	—	0–3	3–1	1–0	13
E CICA FC	0–1	2–0	5–0	3–0	—	1–0	2–0	15
F Trilearn Utd	0–2	2–0	5–0	1–3	0–1	—	3–0	9
G Unreal Madrid	0–1	0–0	3–0	0–1	0–2	0–3	—	4

Round Robin

	A	B	C	D	E	F	G	Rank
A RoboTrapper	—	1–0	4–0	1–1	1–0	2–0	1–0	1
B ntUnited	0–1	—	2–2	0–3	0–2	0–2	0–0	6
C G & G Goonies	0–4	2–2	—	0–7	0–5	0–5	0–3	7
D Ballers	1–1	3–0	7–0	—	0–3	3–1	1–0	3
E CICA FC	0–1	2–0	5–0	3–0	—	1–0	2–0	2
F Trilearn Utd	0–2	2–0	5–0	1–3	0–1	—	3–0	4
G Unreal Madrid	0–1	0–0	3–0	0–1	0–2	0–3	—	5

Playoffs

Semifinal: ClCA vs. Bollywood Ballers

Semifinal: RoboTrapper vs. Trilearn United

3rd Place: ? vs. ?

1st Place: ? vs. ?

Playoffs

Semifinal: CICA vs. Bollywood Ballers

5–2

Semifinal: RoboTrapper vs. Trilearn United

3rd Place: Bollywood Ballers vs. ?

1st Place: CICA vs. ?

Playoffs

Semifinal: ClCA vs. Bollywood Ballers 5–2

Semifinal: RoboTrapper vs. Trilearn United 1–0

3rd Place: Bollywood Ballers vs. Trilearn United

1st Place: ClCA vs. RoboTrapper

Playoffs

Semifinal: ClCA vs. Bollywood Ballers 5–2

Semifinal: RoboTrapper vs. Trilearn United 1–0

3rd Place: Bollywood Ballers vs. Trilearn United 5–2

1st Place: ClCA vs. RoboTrapper

Playoffs

Semifinal: ClCA vs. Bollywood Ballers 5–2

Semifinal: RoboTrapper vs. Trilearn United 1–0

3rd Place: Bollywood Ballers vs. Trilearn United 5–2

1st Place: ClCA vs. RoboTrapper 0–1

Final Standings

1. RoboTrapper	Kulaga and Narula
2. CICA FC	Mittal and Tschetter
3. Bollywood Ballers	Lonkar and Sachandani
4. Trilearn United	Little and Rogers
5. Unreal Madrid	Lovitt, Mundra, and Reveley
6. ntUnited	Knaack and Popova
7. Give and Go Goonies	Chrien and Kloepping

Challenge Matches

- RoboTrapper vs. Team Stamina
- RoboTrapper at US Open 2005
- RoboTrapper vs. UVA Trilearn 2003

Challenge Matches

- RoboTrapper vs. Team Stamina 1–0
- RoboTrapper at US Open 2005
- RoboTrapper vs. UVA Trilearn 2003

Challenge Matches

- RoboTrapper vs. Team Stamina 1–0
- RoboTrapper at US Open 2005 5th place (out of 6)
- RoboTrapper vs. UVA Trilearn 2003

Challenge Matches

- RoboTrapper vs. Team Stamina 1–0
- RoboTrapper at US Open 2005 5th place (out of 6)
- RoboTrapper vs. UVA Trilearn 2003 0–25

For More Information

- www.robocup.org
- www.cs.utexas.edu/~AustinVilla
- www.cs.utexas.edu/~pstone

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**Layered Learning in Multiagent Systems:
A Winning Approach to Robotic Soccer**
Peter Stone. MIT Press, 2000.