

FUZZ-IEEE 2007

Car Racing Competition

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Background

- First competition to be associated with FUZZ-IEEE
- Designed to have simple software interface
- And simple rules
 - Easy to enter (sample controller provided)
 - Hard to win!
- Task involves:
 - Fuzzy Control
 - Fuzzy Decision Making and Planning
- Similar to CIG 2007 and CEC 2007 Competitions
- Controllers had to be part-fuzzy

The Challenge

- Race against an opponent car
- Collecting prizes (points) at waypoints
- Only first car to reach a waypoint gets the point
 - Except they each get a point if they reach it at the same time step
- Points must be collected in strict order
- A car may choose to miss a waypoint

Screenshot

- Only next three waypoints are shown to cars at each point in time
- Waypoints generated randomly
- As soon as one is reached, another is generated
- Screenshot also shows trace of cars and previous points



The Physics

- Simple: based on Newtonian mechanics of point masses (except they have heading)
- At each point choose acceleration and steering angle (each within limited range)
 - No skidding or collisions
- Very simple to simulate
 - Can test designs very quickly + thoroughly
- Noise is added to observations and actions
- Challenging to complete a track in the fastest time

Software Interface

```
public interface Controller {  
    public Action action(  
        WayPoint[] track,  
        ICar you,  
        ICar oppo);  
}
```

- **Controllers have access to state of opponent car**
 - Position and velocity (methods of ICar)

The Challenge

- Choosing the optimum steering and acceleration at each time step is hard
 - Even for a single car
- When competing against an opponent car
 - A smart controller would also consider state of opponent
 - And even learn from their behaviour over time...
 - And choose when to skip a waypoint
- Demonstration (no noise)
- Demonstration (with noise)

The Competition Entries

- Nottingham (Ho Duc Thang, Phil Burkin and Jon Garibaldi)
- Madrid (Ruben Vazquez and Sergio Guadarrama)
- Osaka (Tomoharu Nakashima , Yasuyuki Yokota, Seiya Fujii and Hisao Ishibuchi)
- Lancaster (Xiowei Zhou and Plamen Angelov)
- Default heuristic controller

- All played each other in a round-robin league
- Entry with most wins would win
 - Points difference used in the case of a tie-break

Round Robin Results Table

(Each row: number of wins against col)

	Nott.	Madrid	Lanc.	Osaka	Heuristic
Nott.	-	72	90	97	100
Madrid	24	-	78	99	100
Lanc.	7	19	-	87	100
Osaka	2	0	11	-	85
Heuristic	0	0	0	8	-

League Places

Entry	Wins	Rank
Nott	359	1
Madrid	301	2
Lanc.	213	3
Osaka	98	4
Heuristic	8	5

Conclusions

- First FUZZ-IEEE has met with some participation
- All entries defeated the supplied heuristic controller
- Interesting to consider use of standard languages such as FCL ([Fuzzy Control Language](#))
- Interesting to compare other approaches (such as evolved neural networks) to the same problem.