Development of Artificial Intelligence for Legged Robots on RoboCup Soccer Environment

(Prof. T. Arai and Mr. R. Ueda)

RoboCup (robot soccer world cup) is nowadays an international joint project to promote artificial intelligences that act in this actual environment. Team ARAIBO, the united team of Univ. of Tokyo and Chuo Univ., has participated in RoboCup four legged robot league since 1999. In this league, SONY's quadruped robots, ERS-7, are used as shown in Fig. 1. Our team has achieved 2nd and 3rd prizes on the technical challenge, which has been held with soccer games, since 2003 to 2005.

We have proposed various novel methods that enable robots to work in the real world. Lately, the resetting method for kidnapped robot problems on self-localization1) (Fig. 1) and the real-time Q-MDP value method for decision-making under uncertainty of recognition2) are developed from our team. Moreover, software for adjustment of color recognition from color images, auto-generation algorithms of gates, and a simulator that can simulate the characteristics (noise, blur, and so on) of color cameras 3).

Our team will take a step in development of autonomous robots that work in home and office environment in this year. Our products in RoboCup will accelerate the challenge.

Keywords: RoboCup, Pet Robots, Particle Filters, Simulator, Real-Time Q-MDP

References

1) Ryuichi UEDA, Tamio ARAI and Kohei SAKAMOTO, Toshifumi KIKUCHI and Shogo KAMIYA: "Expansion Resetting for Recovery from Fatal Error in Monte Carlo Localization - Comparison with Sensor Resetting Methods," Proc. of IEEE/RSJ IROS 2004, pp. 2481-2486, 2004.
2) Ryuichi Ueda,Tamio Arai,Kohei Sakamoto,Yoshiaki Jitsukawa,Kazunori Umeda,Hisashi Osumi,Toshifumi Kikuchi and Masaki Komura : "Real-Time Decision Making with State-Value Function under Uncertainty of State Estimation —Evaluation with Local Maxima and Discontinuity," Proc. of IEEE ICRA,pp. 3475-3480,2005.
3) Kazunori ASANUMA, Kazunori UMEDA, Ryuichi UEDA and Tamio ARAI: "Development of a Simulator of Environment and Measurement for Autonomous Mobile Robots Considering Camera Characteristics," RoboCup 2003: Robot Soccer World Cup VII, pp. 446-457, 2004.

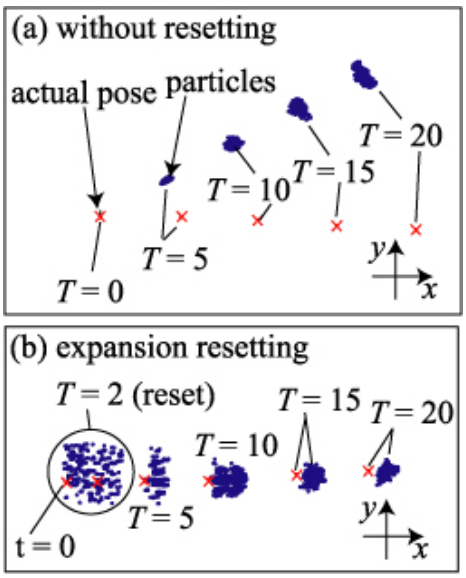

Fig. 2 resetting method

Fig. 1 RoboCup 2005 in Osaka

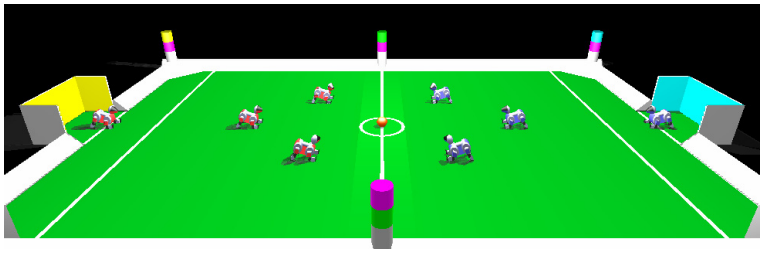

Fig. 3 ARAIBO simulatior