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ROBOT LOCALIZATION FROM SURROUNDING VIEWS USING MONTE CARLO ROBUST AGAINST SUCCESSIVE OUTLIERS

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Abstract. *We propose clustering Monte Carlo as a new method of localization for an autonomous robot from surrounding views and dead reckoning data. Localization is one of very important techniques for autonomous robots in many scenes, e.g., RoboCup (autonomous robot soccer league). Recently, a resetting Monte Carlo localization method was proposed. However, the method cannot deal with successive outliers well. The proposed methods are improvements of the resetting Monte Carlo localization method and good at dealing with successive outliers.*
Keywords: Autonomous robot, Localization, Monte Carlo, Clustering, Dead reckoning

1. **Introduction.** Recently, there were many advances in the techniques of autonomous robots. Localization is one of important techniques to control machines, robot or others. For example, ships, airplanes, robot arms searching spot welding positions, submarines avoiding obstacles and car navigation need localization. "Autonomous robots" move automatically. There are many tasks for autonomous robots, such as, moving to several positions and picking up an object. Those tasks need localization. Precise localization will be expected to contribute in many areas.

Localization uses surrounding environment views and dead reckoning. It uses some object recognition techniques. Some studies proposed methods to detect special marks such as road signboards [1,2]. Another study proposed a method to detect 3D structure [3]. Such 2D or 3D image processing gives a robot data for localization. Other surrounding environment views are land mark views by sonar sensor and laser range finder [4-10].

Monte Carlo method was applied to localization [5]. And there are land mark views by camera image [11-21]. A robot uses surrounding environment views and also dead reckoning data[10,22]. Dead reckoning data teach a robot its position from its movement records.

Extended Kalman filter (EKF) is also a popular method in robot localization [23,24]. EKF is superior with trusted evidences. However, EKF is hard to process fake evidences and kidnap situations. Monte Carlo Localization (ML) is better than EKF at such problems.

Our team played soccer games in RoboCup [25]. In 4-legged league of RoboCup, SONY AIBO robots were used. We used AIBO ERS-7 [26] (Figure 1).

There are several problems in localization [8].

1) position tracking problem;