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BISMARC: a biologically inspired system for map-based autonomous rover control

Terry Huntsberger ... John Rose

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Abstract

As the complexity of the missions to planetary surfaces increases, so too does the need for autonomous rover systems. This need is complicated by the power, mass and computer storage restrictions on such systems (Miller, D. P. (1992). Reducing software mass through behaviour control. In *Proceedings SPIE conference on cooperative intelligent robotics in space III* (Vol. 1829, pp. 472-475, 1992). Boston, MA. To address these problems, we have recently developed a system called BISMARC (**B**iologically **I**nspired **S**ystem for **M**ap-based **A**utonomous **R**over **C**ontrol) for planetary missions involving multiple small, lightweight surface rovers (Huntsberger, T. L. (1997). Autonomous multirover system for complex planetary retrieval operations. In P. S. Schenker, and G. T. McKee (Eds.), *Proceedings SPIE symposium on sensor fusion and decentralized control in autonomous robotic systems* (pp. 221-227).

Pittsburgh, PA). BISMARC is capable of cooperative planetary surface retrieval operations such as a multiple cache recovery mission to Mars. The system employs autonomous navigation techniques, behavior-based control for surface retrieval operations, and an action selection mechanism based on a modified form of free flow hierarchy (Rosenblatt, J. K. and Payton, D. W. (1989). A fine-grained alternative to the subsumption architecture for mobile robot control. In *Proceedings IEEE/INNS joint conference on neural networks* (pp. 317-324). Washington, DC). This paper primarily describes the navigation and map-mapping subsystems of BISMARC. They are inspired by some recent studies of London taxi drivers indicating that the right hippocampal region of the brain is activated for path planning but not for landmark identification (Maguire, E. A. et al. (1997). Recalling routes around London: activation of the right hippocampus in taxi drivers. *Journal of Neuroscience, 17*(18), 7103-7110). We also report the results of some experimental studies of simulated navigation in planetary environments.

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Keywords

Robot navigation; Hippocampal maps; Wavelets; Neural networks

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