A Mutual Information Accelerator for Autonomous Robot Exploration

1. Introduction & Summary of Contribution

Robotic Exploration

Where should the robot move next to learn the most about its environment?





Occupancy Map Mutual Information (MI) H(M|Z) = H(M) - I(M;Z)

Theoretically Proven Approach Move to the location that **maximizes the** mutual information between prospective range measurements and the map for **faster** mapping of the unknown environment.

the entire map of size 10.05mx10.05m with 0.05m resolution for the first time at 11Hz on an ASIC (88x faster than a typical ARM CPU used on robotic racecar while consuming only **164mW**.

✓ Enables more optimal selection of exploration path, which reduces total

4. Proposed Architecture & Detailed Implementation



Memory access locations (in same column or row every cycle) is scan









Arbiter Operation





During each cycle, the priority arbiter is guaranteed to **fairly** service the greatest number of requests from cores that idle for the longest number of cycles with the highest priority counters.

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Real-world Autonomous Exploration

Two remaining frontiers that will be explored next.