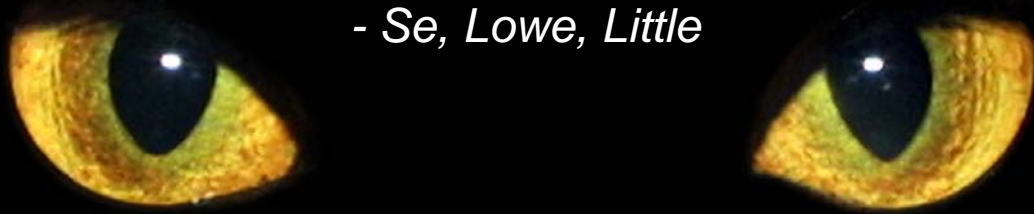


Vision-based SLAM

Mobile Robot Localization And Mapping With
Uncertainty using Scale-Invariant Visual Landmarks

- *Se, Lowe, Little*



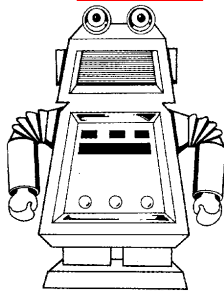
Vikash Mansinghka & Søren Riisgaard

Outline

- Søren: SLAM
 - SLAM introduction
 - SIFT SLAM
 - Experimental Results
- Vikash: SIFT matching

- Simultaneous Localization And Mapping
- The SLAM problem
- Preconditions

- Enough landmarks
- Static landmarks



SLAM!



State Est. vs SLAM

- State Estimation
 - EKF
 - HMM – Viterbi
 - HMM – Particle filters
- SLAM
 - Map and robot pose is coupled
 - Errors are correlated

3 SLAM Algorithms

- EKF based SLAM
- FastSLAM
- SIFT SLAM
- Comparison

	EKF	FastSLAM	SIFT SLAM
Robot Pose	EKF	Particle Filter	Least Squares EKF
Landmarks	Combined with pose	1 Kalman Filter per Landmark/sample	1 Kalman Filter per Landmark
Performance	$O(K^2)$	$O(M K) / O(M \log K)$	$O(K) ?$
Applications	Small scenarios	Large Scenarios	Vision
Observation	Landmarks	Landmarks	Robot pose

K = Landmarks, M = Particles

SIFT SLAM

- Odometry based state estimate
 - Where did I try to go?
- Least Squares localization estimate
 - Where did I go?
- Localization – EKF
 - Where did I really go?
- Mapping
 - Update landmark cov, add new landmarks