COMBINATION of Stochastic Sampling Methods and Deterministic Methods for **Optimization**

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ICVSS 2010
International Computer Vision Summer School
ComputerVisionLab
Seoul National University

ABSTRACT

Many computer vision applications have been formulated as optimization problems. Since most of them are NP-hard, all the existing methods end up with approximated solutions. To achieve better solutions, we propose a new hybrid algorithm which elegantly combines the stochastic sampling and deterministic algorithms. By combining those two different approaches in a unified framework, we can utilize the advantages from both approaches.

MOTIVATION

Energy Minimization

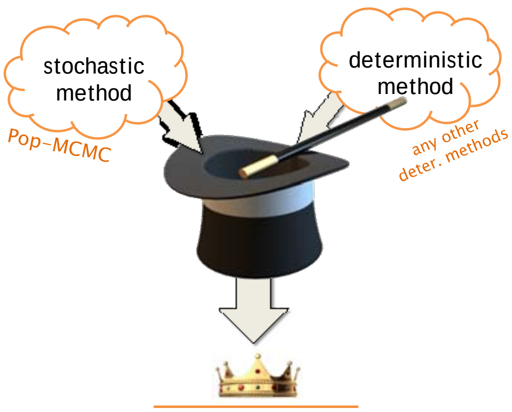
Many vision problems have been formulated as energy minimization problems

NP-Hardness

In general, we cannot obtain the exact solution

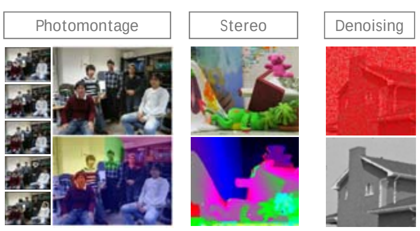
Goal: to develop a more efficient **optimization method**

MAIN IDEA



EXPERIMENTS

Real Problems

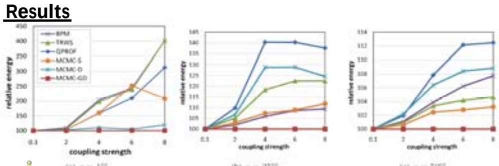


Synthetic Problems

Problem Spec

- Grid size: 30 x 30
- # of labels(L): 5
- % of NA terms: {1, 25, 50}
- Coupling strength: {0.1, 2, 4, 6, 8}

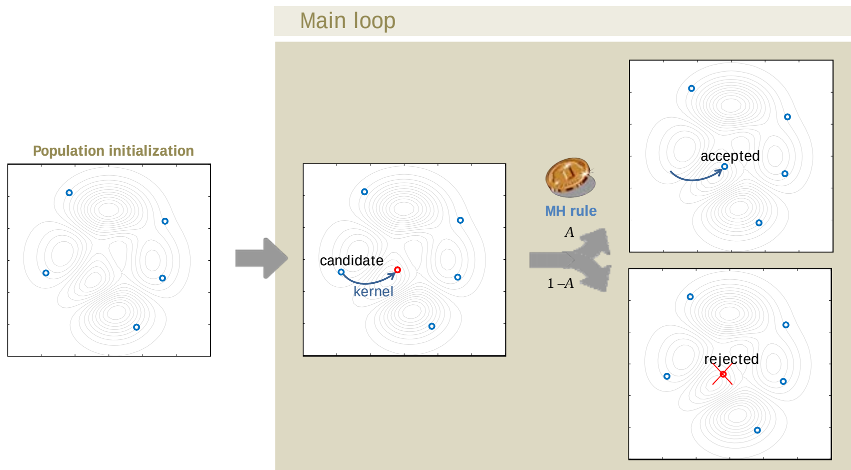
Results



Our Algorithm always find lowest energy state

ALGORITHM

Population-based MCMC previous work



Metropolis-Hastings rule

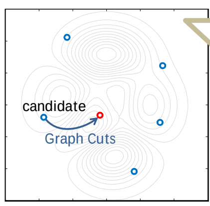
$$A = \min\left(1, \frac{\exp\{-E(\mathrm{x}_{next})\}K(\mathrm{x}_{next}, \mathrm{x}_{current})}{\exp\{-E(\mathrm{x}_{current})\}K(\mathrm{x}_{current}, \mathrm{x}_{next})}\right)$$

It guarantees sample to converge to the optimal point

We propose MCMC kernels using DMs

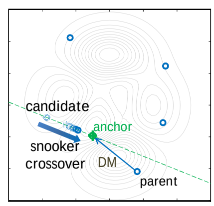
Naïve(BAD) Example

of using deterministic methods for kernels



Direct use of DM breaks REVERSABILITY
MH rule cannot be applied

Proposed(GOOD) Kernel



Dynamic anchor-based proposal

1. Choose cand. and parent
2. Apply DM to parent
3. Snooker crossover

← move making
↓ message passing

Proposed Method