

A Constraint on the Number of Distinct Vectors with Application to SLAM

Gilles Chabert and Luc Jaulin

SWIM'09 June 11th 2009

Outline

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

- 1 The SLAM problem
- 2 The NVector constraint
- 3 Algorithm
- 4 Complexity issue

The SLAM problem

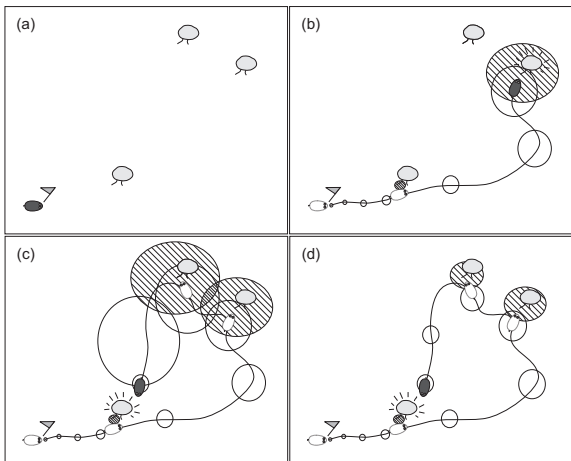
A Constraint on the Number of Distinct Vectors with Application to SLAM

The SLAM problem

The NVector constraint

Algorithm

Complexity issue



Potential mistakes : omission, illusion, **mismatching**.

Outline

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

- 1 The SLAM problem
- 2 The NVector constraint
- 3 Algorithm
- 4 Complexity issue

The NVector constraint

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

Let $\mathbf{x}^{(i)}$ be the position of the object corresponding to the i^{th} detection.

$$\text{atmost_nvector}(n, \{\mathbf{x}^{(1)}, \dots, \mathbf{x}^{(k)}\}) \\ \iff |\{\mathbf{x}^{(1)}, \dots, \mathbf{x}^{(k)}\}| \leq n.$$

The NVector constraint

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

Let $\mathbf{x}^{(i)}$ be the position of the object corresponding to the i^{th} detection.

$$\begin{aligned} \text{atmost_nvector}(n, \{\mathbf{x}^{(1)}, \dots, \mathbf{x}^{(k)}\}) \\ \iff \\ |\{\mathbf{x}^{(1)}, \dots, \mathbf{x}^{(k)}\}| \leq n. \end{aligned}$$

The NVector constraint

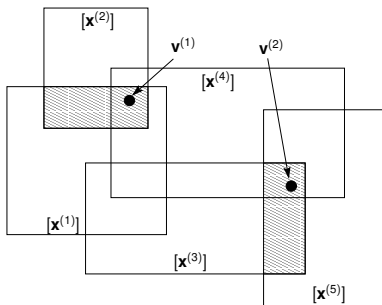
A Constraint on the Number of Distinct Vectors with Application to SLAM

The SLAM problem

The NVector constraint

Algorithm

Complexity issue



The NVector constraint

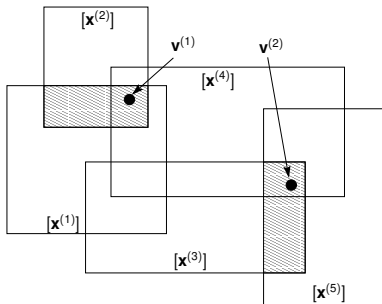
A Constraint on the Number of Distinct Vectors with Application to SLAM

The SLAM problem

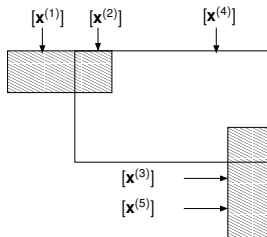
The NVector constraint

Algorithm

Complexity issue



Initial state



Final state

Outline

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

- 1 The SLAM problem
- 2 The NVector constraint
- 3 Algorithm**
- 4 Complexity issue

Algorithm

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

In one dimension



Algorithm

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

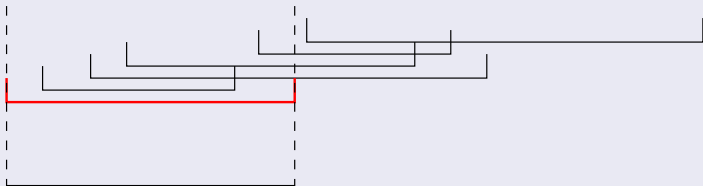
The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

In one dimension



Algorithm

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

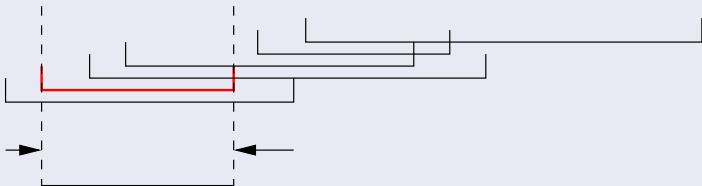
The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

In one dimension



Algorithm

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

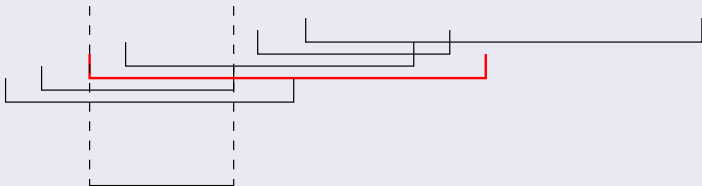
The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

In one dimension



Algorithm

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

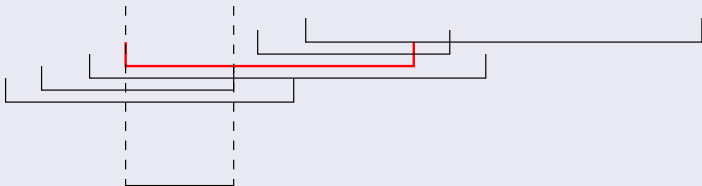
The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

In one dimension



Algorithm

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

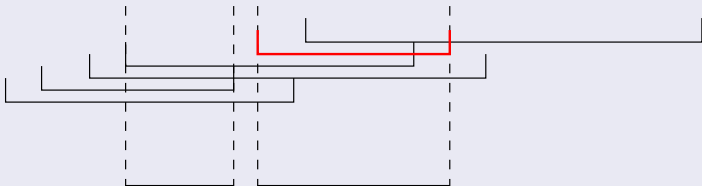
The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

In one dimension



Algorithm

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

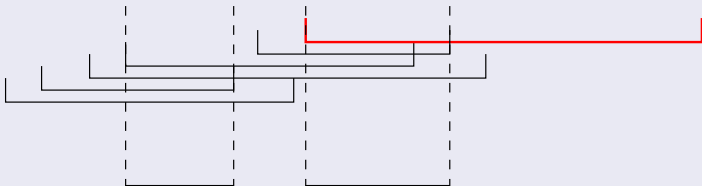
The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

In one dimension



Algorithm

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

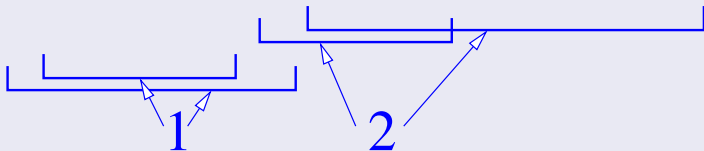
The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

In one dimension



Algorithm

A Constraint on the Number of Distinct Vectors with Application to SLAM

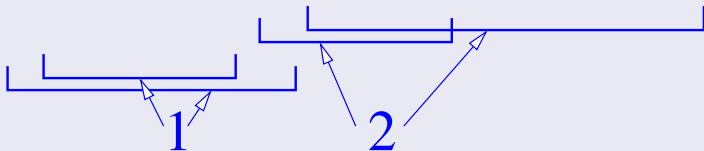
The SLAM problem

The NVector constraint

Algorithm

Complexity issue

In one dimension



This process can be repeated on every dimension.

Outline

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue

- 1 The SLAM problem
- 2 The NVector constraint
- 3 Algorithm
- 4 Complexity issue

Complexity issue

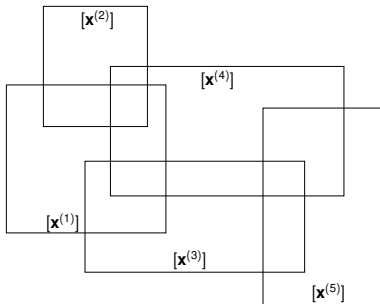
A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue



Complexity issue

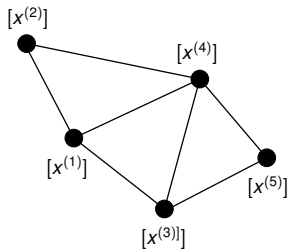
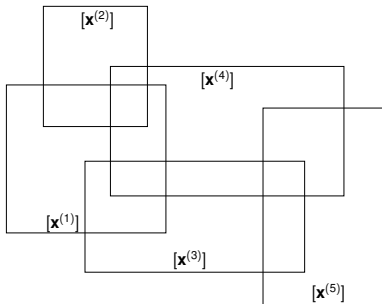
A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue



Complexity issue

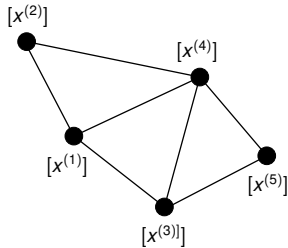
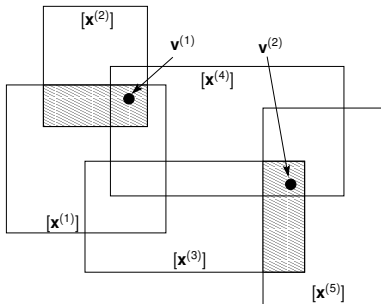
A Constraint on the Number of Distinct Vectors with Application to SLAM

The SLAM problem

The NVector constraint

Algorithm

Complexity issue



Complexity issue

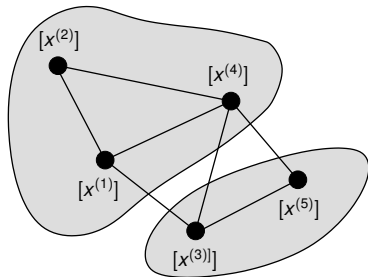
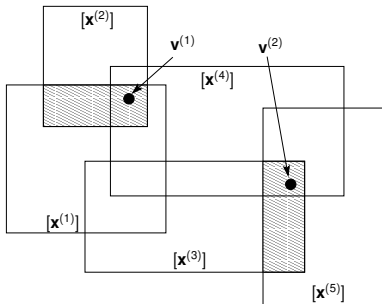
A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue



Complexity issue

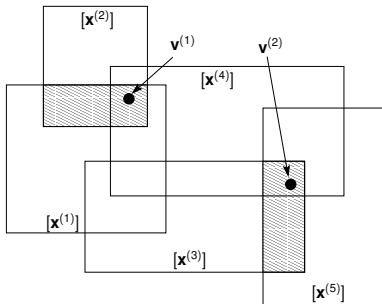
A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

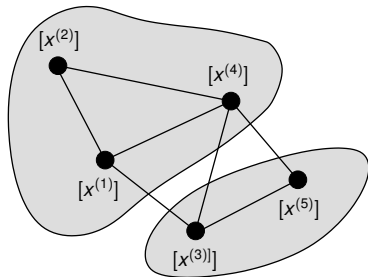
The NVector
constraint

Algorithm

Complexity
issue



Detections



Rectangle graph

Complexity issue

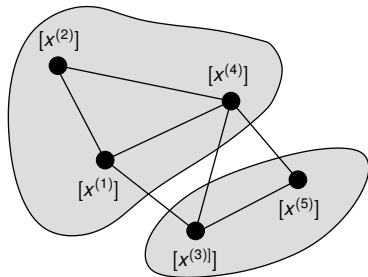
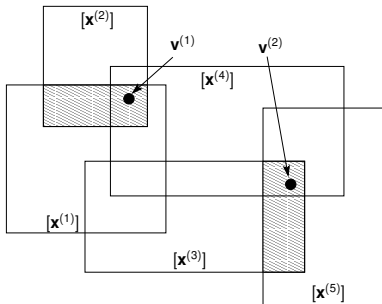
A Constraint on the Number of Distinct Vectors with Application to SLAM

The SLAM problem

The NVector constraint

Algorithm

Complexity issue



Detections

Rectangle graph

RCP

Can a rectangle graph be partitioned into n cliques ?

Complexity issue

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

The SLAM
problem

The NVector
constraint

Algorithm

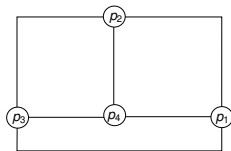
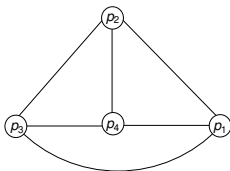
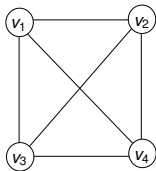
Complexity
issue

From planar vertex cover to rectangle clique partition

Complexity issue

A Constraint
on the
Number of
Distinct
Vectors with
Application to
SLAM

From planar vertex cover to rectangle clique partition



The SLAM
problem

The NVector
constraint

Algorithm

Complexity
issue