Application of a coverage control to nuvos

FL07-17-1

芥川浩之

Outline

1.Introduction

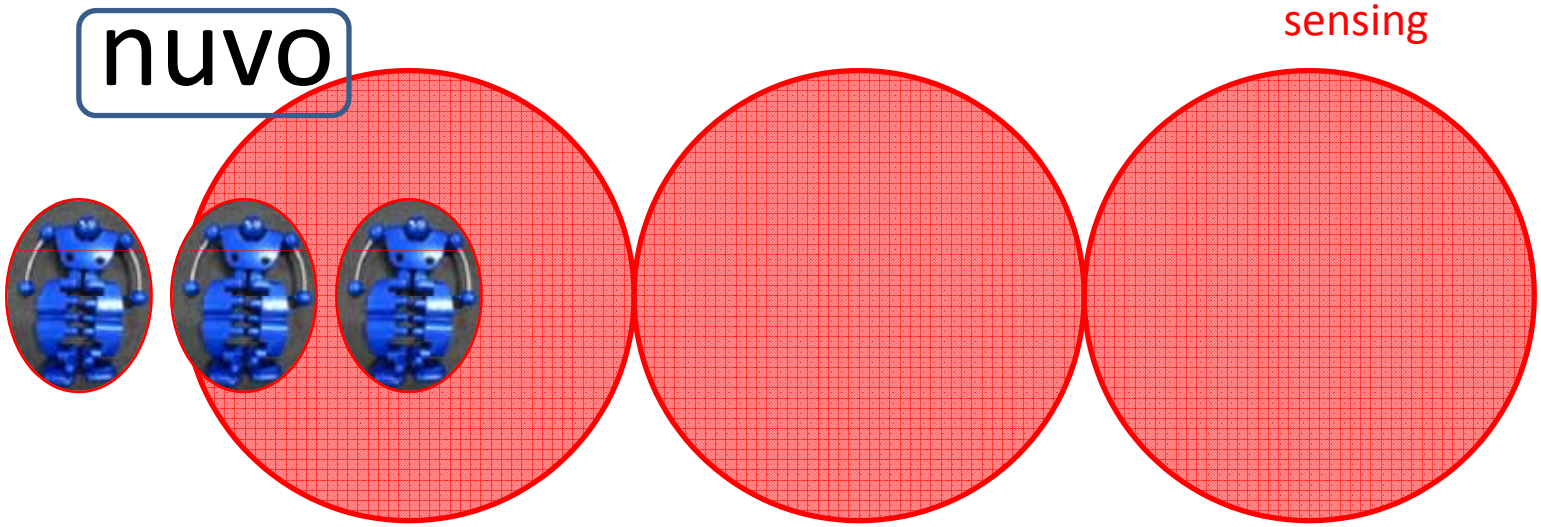
2.Voronoi cell&Llyod's Algorithm

3.Future work

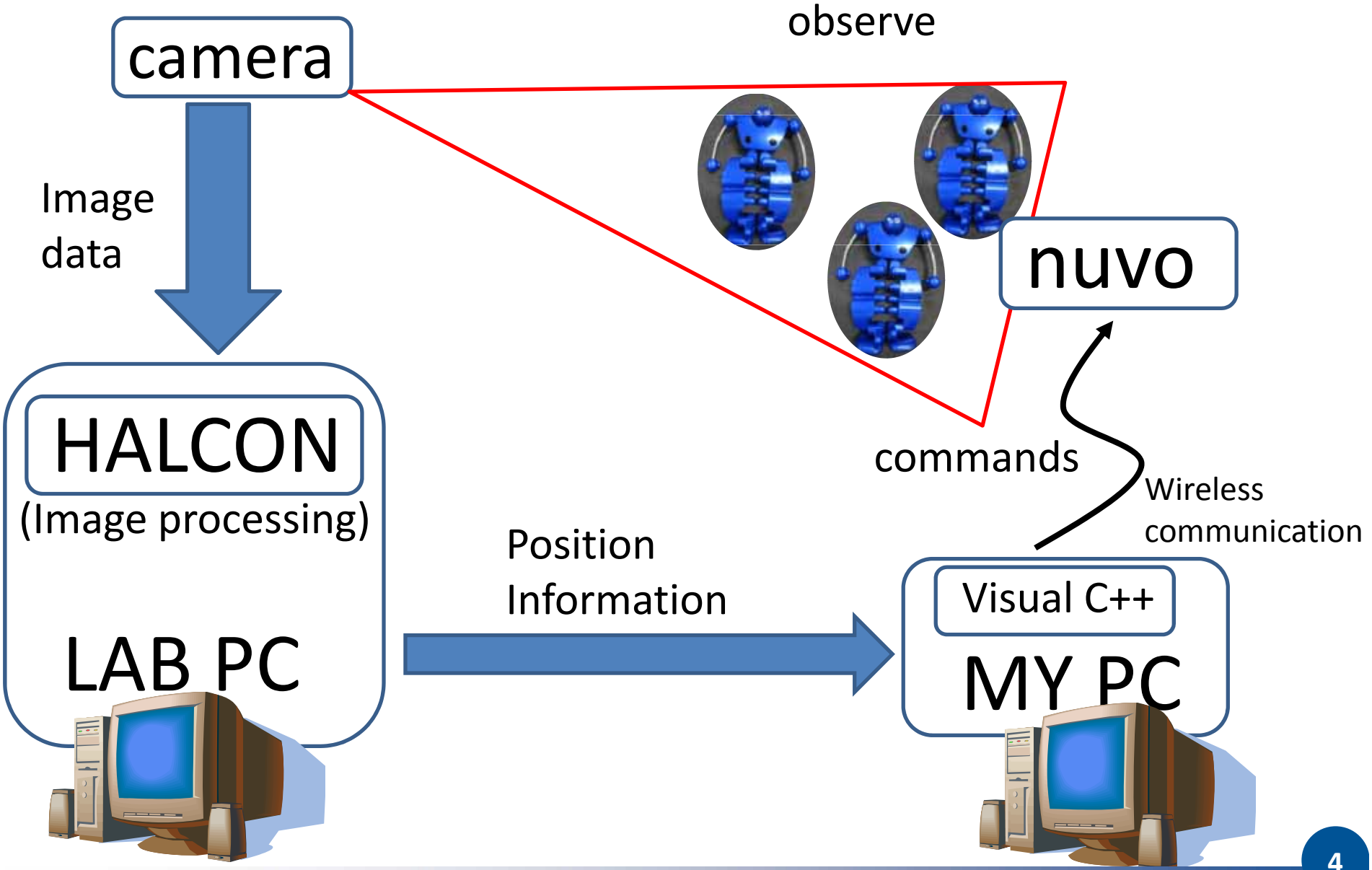
1.Introduction

Coverage control aim at performing tasks such as reconnaissance , surveillance , target tracking or environmental monitoring over a specific region

Apply to humanoid robots(nuvos)



1.Introduction



Outline

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2.Voronoi cell&Llyod's Algorithm

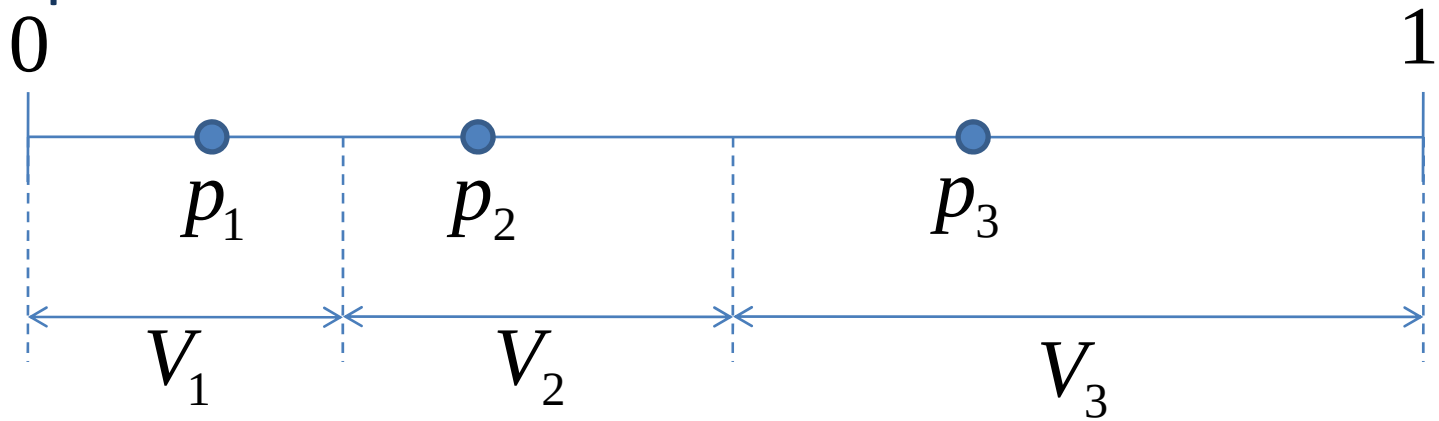
Definition :Voronoi cell

$$V_i = V(p_i) = \{p \mid d(p, p_i) \le d(p, p_j),\ j \ne i\}$$

$$d(p, p_i) = |p - p_i|$$

p_i :position V_i:voronoi cell $d(p, p_i)$:distance function

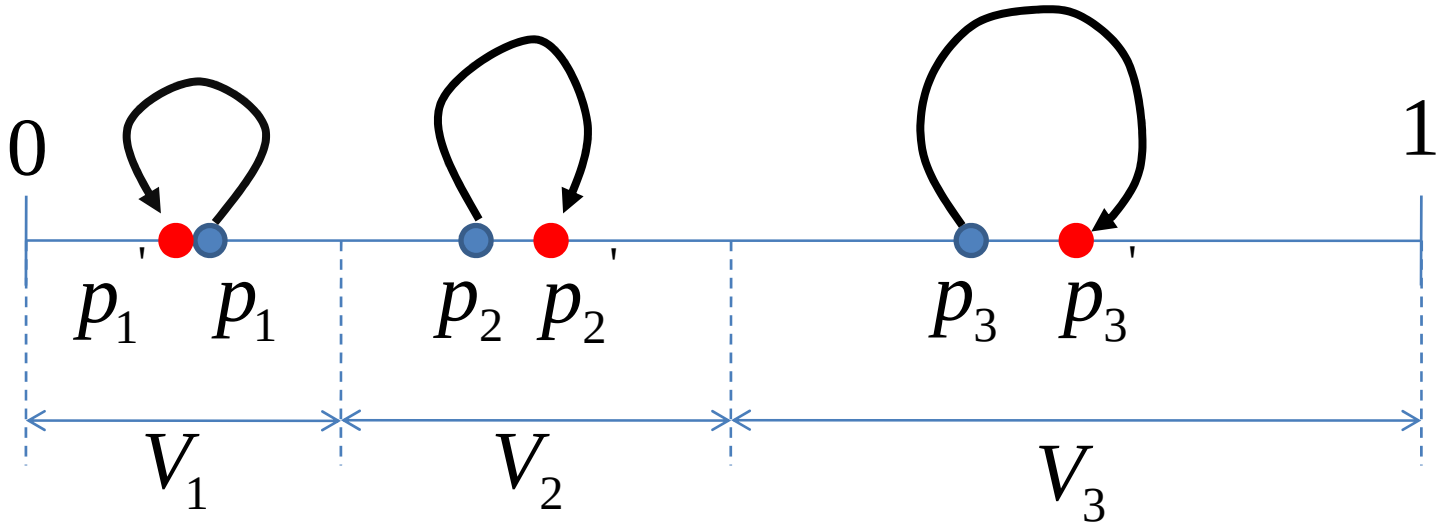
Example



$$V_1 = \left[0, \frac{p_1 + p_2}{2}\right] \quad V_2 = \left[\frac{p_1 + p_2}{2}, \frac{p_2 + p_3}{2}\right] \quad V_3 = \left[\frac{p_2 + p_3}{2}, 1\right]$$

2.Voronoi cell&Llyod's Algorithm

Llyod's Algorithm



Algorithm

1.Calcurate voronoi cells

2.Move p to the center of a voronoi cell

3.Return step 1

p will converge to $[1/6\ ,\ 1/2\ ,\ 5/6]$

2.Voronoi cell&Llyod's Algorithm

$$V_1 = \left[0, \frac{p_1 + p_2}{2}\right] \quad V_2 = \left[\frac{p_1 + p_2}{2}, \frac{p_2 + p_3}{2}\right] \quad V_3 = \left[\frac{p_2 + p_3}{2}, 1\right]$$

Calculate a center of voronoi

$$p_1' = [\frac{p_1 + p_2}{4}] \quad p_2' = [\frac{p_1 + 2p_2 + p_3}{4}] \quad p_3' = [\frac{p_2 + p_3 + 2}{4}]$$

Discrete time state space equation

$$p(k+1) = Ap(k) + b$$

$$\begin{bmatrix} p_1' \\ p_2' \\ p_3' \end{bmatrix} = \frac{1}{4}\begin{bmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 1 \end{bmatrix}\begin{bmatrix} p_1 \\ p_2 \\ p_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1/2 \end{bmatrix}$$

3.Future Work

- make Visual C++ programs for

  the coverage control (1-D) experiment

- carry out the coverage

  control (1-D) experiment