
Algorithm 2 Search-Based Rectangle Fitting

Input: range data points $X \in R^{n \times 2}$

Output: rectangle edges $\{a_i x + b_i x = c_i | i = 1, 2, 3, 4\}$

```
1:  $Q \leftarrow \emptyset$ 
2: for  $\theta = 0$  to  $\pi/2 - \delta$  step  $\delta$  do
3:    $\hat{e}_1 \leftarrow (\cos \theta, \sin \theta)$   $\triangleright$  rectangle edge direction vector
4:    $\hat{e}_2 \leftarrow (-\sin \theta, \cos \theta)$ 
5:    $C_1 \leftarrow X \cdot \hat{e}_1^T$   $\triangleright$  projection on to the edge
6:    $C_2 \leftarrow X \cdot \hat{e}_2^T$ 
7:    $q \leftarrow \text{CalculateCriterionX}(C_1, C_2)$ 
8:   insert  $q$  into  $Q$  with key  $(\theta)$ 
9: end for
10: select key  $(\theta^*)$  from  $Q$  with maximum value
11:  $C_1^* \leftarrow X \cdot (\cos \theta^*, \sin \theta^*)^T, C_2^* \leftarrow X \cdot (-\sin \theta^*, \cos \theta^*)^T$ 
12:  $a_1 \leftarrow \cos \theta^*, b_1 \leftarrow \sin \theta^*, c_1 \leftarrow \min\{C_1^*\}$ 
13:  $a_2 \leftarrow -\sin \theta^*, b_2 \leftarrow \cos \theta^*, c_2 \leftarrow \min\{C_2^*\}$ 
14:  $a_3 \leftarrow \cos \theta^*, b_3 \leftarrow \sin \theta^*, c_3 \leftarrow \max\{C_1^*\}$ 
15:  $a_4 \leftarrow -\sin \theta^*, b_4 \leftarrow \cos \theta^*, c_4 \leftarrow \max\{C_2^*\}$ 
```

Algorithm 3 Area Criterion.

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1: function CalculateArea( $C_1, C_2$ )
2:    $c_1^{max} \leftarrow \max\{C_1\}, c_1^{min} \leftarrow \min\{C_1\}$ 
3:    $c_2^{max} \leftarrow \max\{C_2\}, c_2^{min} \leftarrow \min\{C_2\}$ 
4:    $\alpha \leftarrow -(c_1^{max} - c_1^{min}) \cdot (c_2^{max} - c_2^{min})$ 
5:   return  $\alpha$ 
6: end function
```