

# **A Novel Small-cross-diamond Search Algorithm for Fast Video Coding and Videoconferencing Applications**

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Reference :

Chun-Ho Cheung and Lai-Man Po, "A Novel Small-cross-diamond Search Algorithm for Fast Video Coding and Videoconferencing Applications," *IEEE Trans. Image Processing*, vol. 1, pp. 681-684, Sep. 2002.

# Outline

- Introduction
- Small-cross-diamond Search Algorithm (SCDS)
- Example for SCDS
- Experimental Results

# Introduction

- This paper proposed a novel small-cross-diamond search
  - Improves the searching speed by up to 146%, as compared to the diamond search (DS) algorithm
- It is suitable for a wide range of video applications, like videoconferencing

# Cross and Diamond Searching Patterns

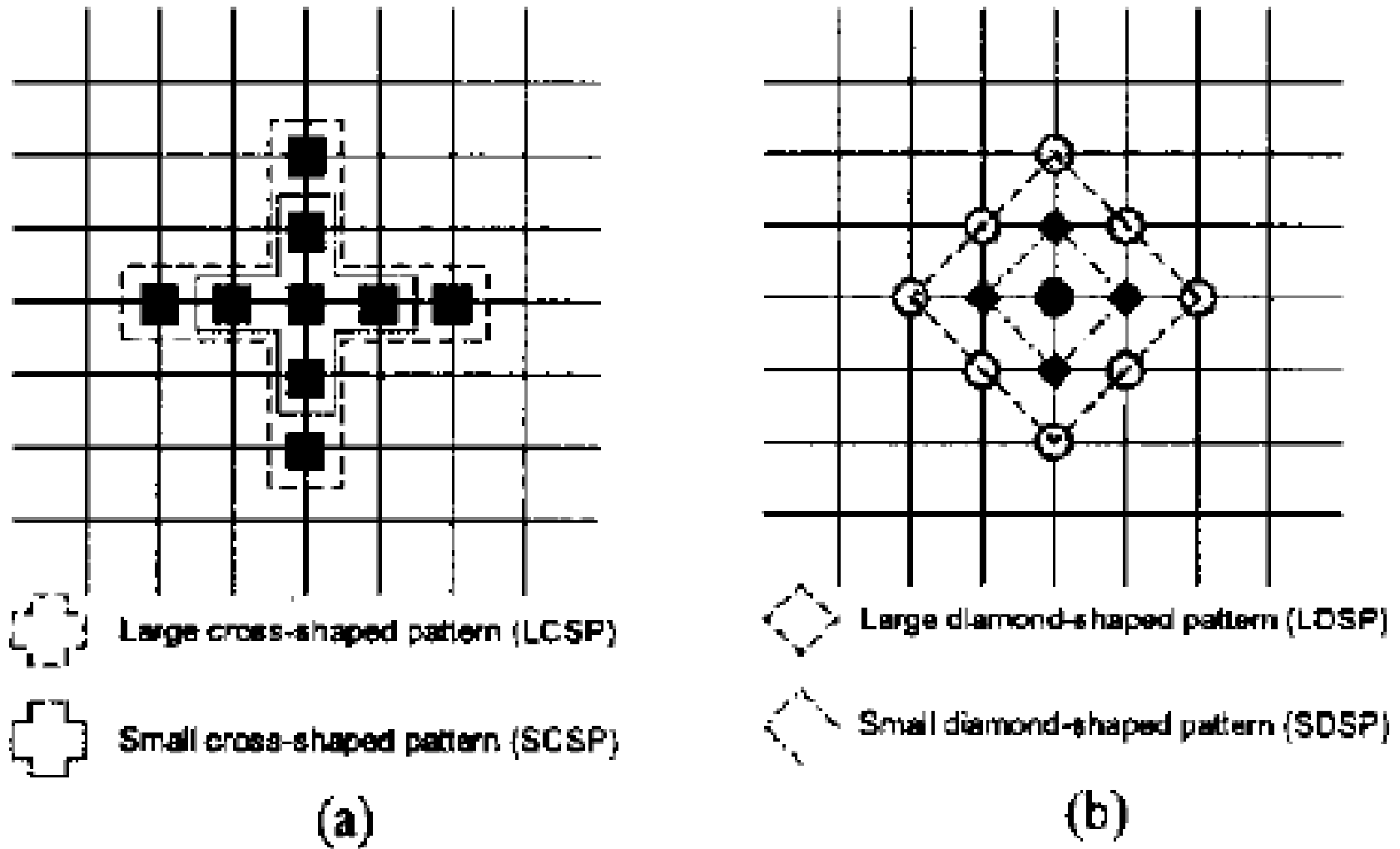


Fig. 1. Cross and Diamond Searching Patterns

# The SCDS Algorithm

- SCDS differs from DS by
  - Performing a cross-center-biased SCSP in the first step
  - Employing halfway-stop technique for quasi-stationary or stationary candidate blocks
- Below summarizes the SCDS algorithm

# Step 1

- Starting

- A minimum block distortion measure (BDM) is found from the five search points of the SCSP
- If the minimum BDM point occurs at the center of the SCSP, the search stops
- Otherwise, go to Step 2

# Example for Step 1

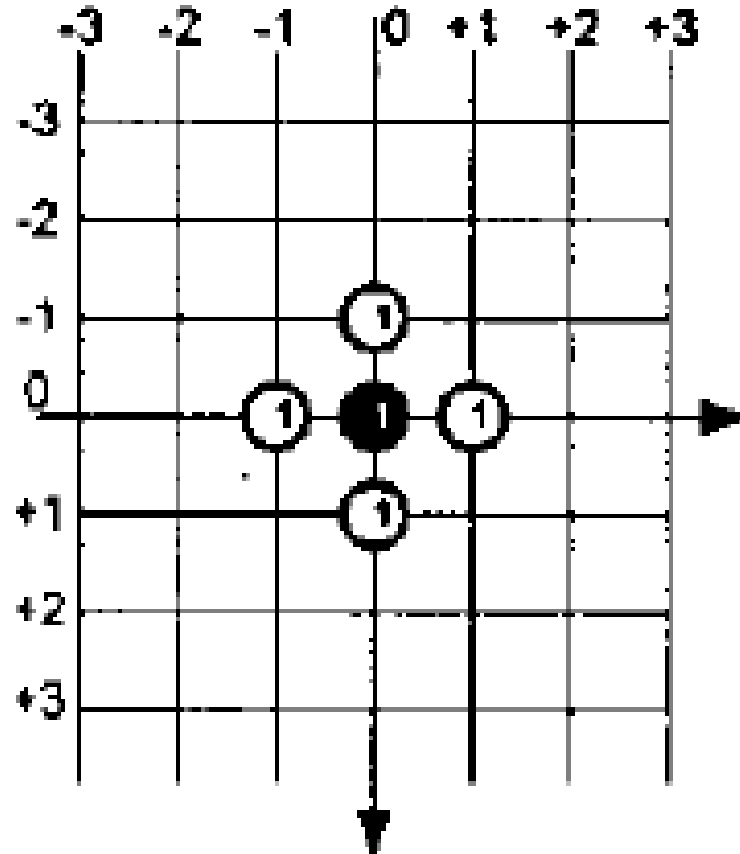


Fig. 2. First-step-stop with MV (0,0)

# Step 2

- Large Cross Searching

- The four outermost search points of the central LCSP are checked
- This step guides the possible correct direction for the subsequent step
- Go to step 3



# Step 3

## ■ Half-diamond Searching

- Two additional search points of the central LDSP closest to the current minimum of the central LCSP are checked
- If the point of the minimum BDM found in step1 coincides with the point found in this step, the search stops
- Otherwise, go to step 4

# Example for Step 3

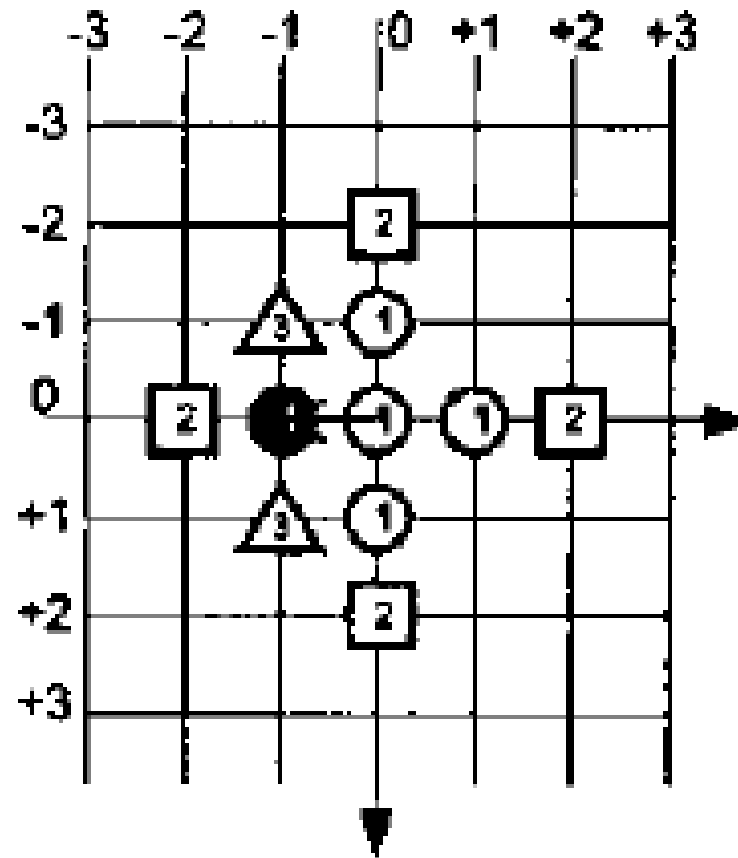


Fig. 3. Third-step-stop with MV (-1,0)

# Step 4

## ■ Searching

- A new LDSP is formed by repositioning the minimum BDM found in previous step as the center of the LDSP
- If the new minimum BDM point is still at the center of the newly formed LDSP, then go to step 5
- Otherwise, this step is repeated recursively

# Step 5

## ■ Ending

- With the minimum BDM point in the previous step as the center, a new SDSP is formed
- Identify the new minimum BDM point from the new four candidate points, which is the final solution

# Example for SCDS Algorithm

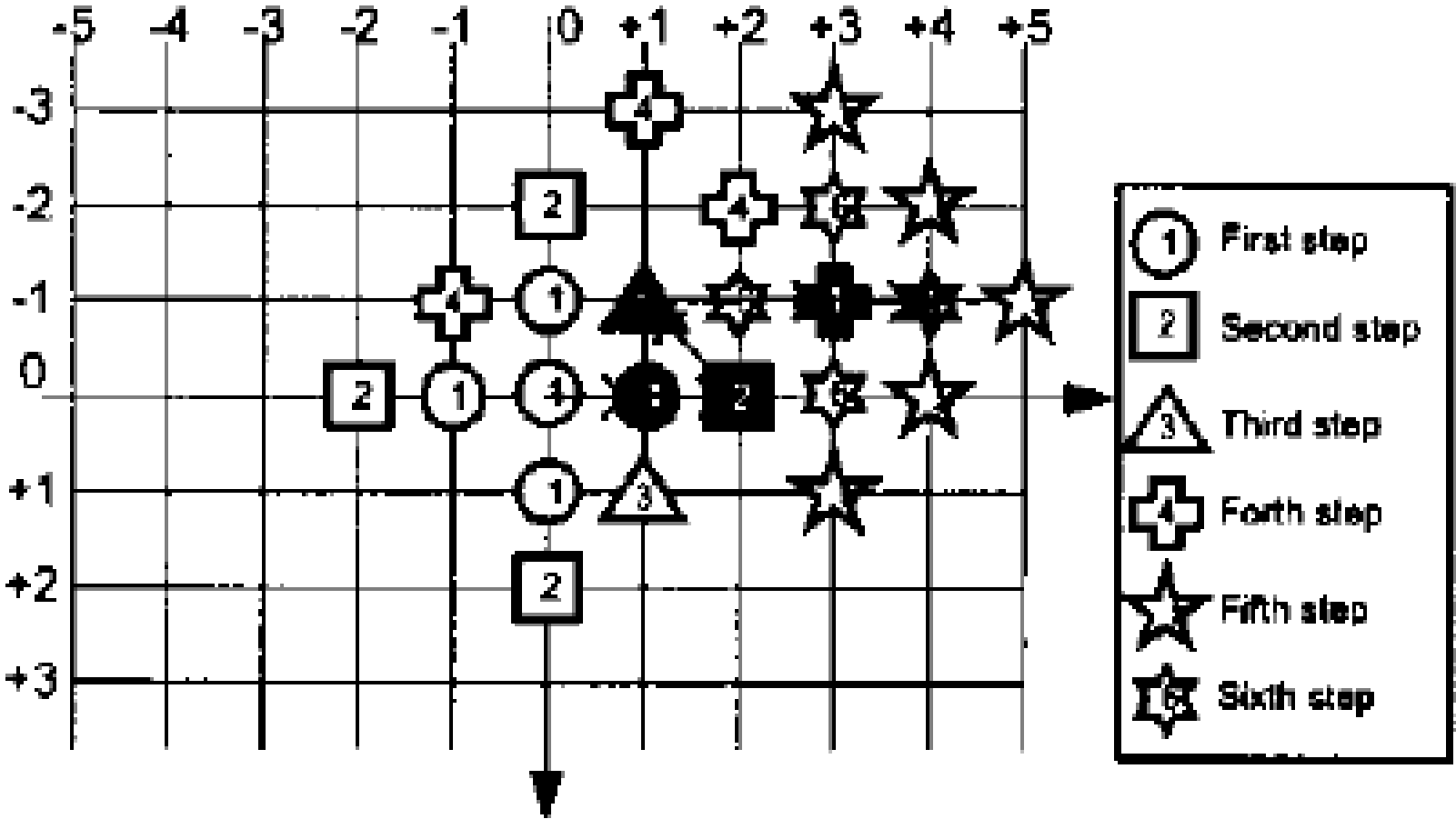


Fig. 4. SCDS algorithm example

# Experimental Results

Table 1 Performance comparison of SCDS

<b>Using QCIF sequence "grandma"</b>					
<b>BMA</b>	<b><math>N_s</math></b>	<b>SpUp</b>	<b>MAD</b>	<b>Distance</b>	<b>Prob.</b>
FS	184.556	1.000	1.031	0.000	100.000
3SS	21.519	8.577	1.032	0.174	95.8
4SS	14.836	12.440	1.032	0.176	95.67
N3SS	15.043	12.268	1.032	0.172	95.63
DS	11.684	15.796	1.032	0.176	95.79
SCDS	5.111	36.107	1.032	0.202	94.56
<b>Using MPEG-4 class A QCIF sequence "mother daughter"</b>					
<b>BMA</b>	<b><math>N_s</math></b>	<b>SpUp</b>	<b>MAD</b>	<b>Distance</b>	<b>Prob.</b>
FS	184.556	1.000	1.185	0.000	100.000
3SS	21.509	8.580	1.192	0.169	96.02
4SS	14.942	12.352	1.190	1.173	95.84
N3SS	15.301	12.062	1.188	0.152	96.36
DS	11.853	15.570	1.190	0.174	95.97
SCDS	5.644	32.700	1.192	0.190	95.12