

# **An Efficient Diamond Search for Fast Block Motion Estimation**

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# Outline

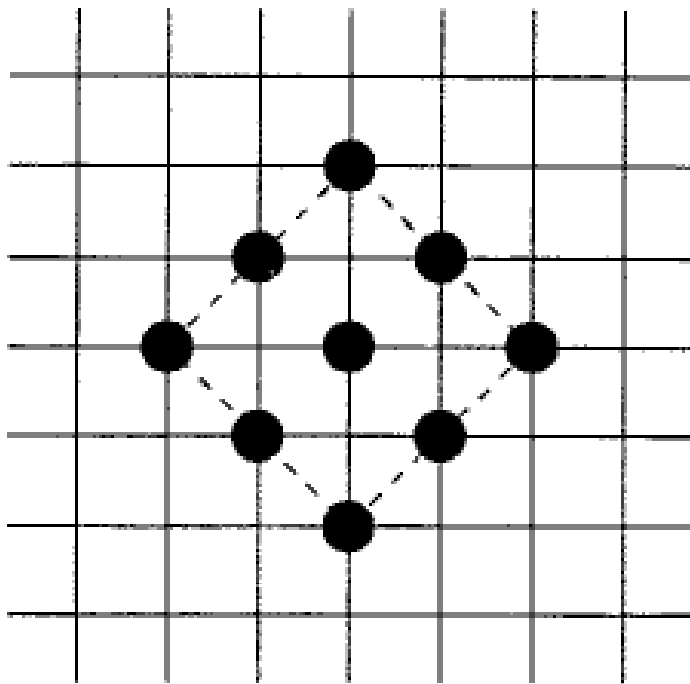
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# Introduction

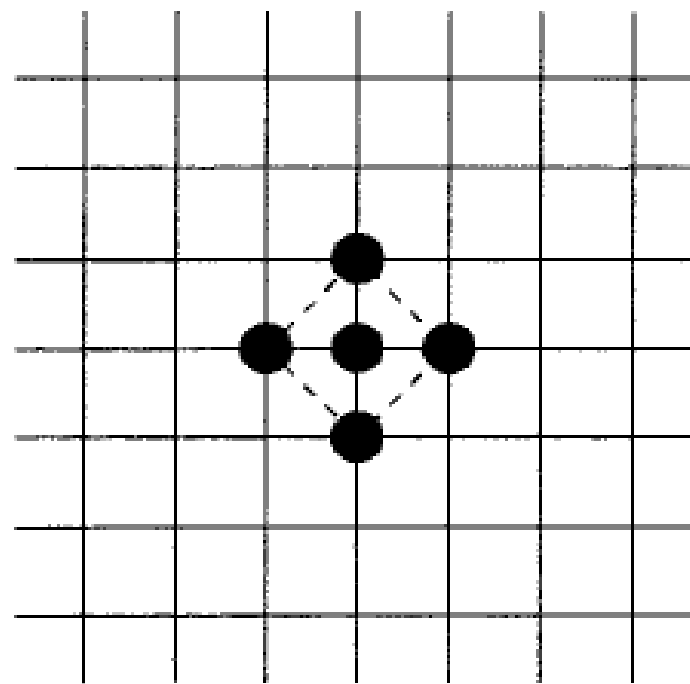
- This paper propose a new type of search pattern
  - Modified large diamond-shaped pattern
- So as to find the large motion vectors quickly

# Diamond Search

- The DS algorithm employs two search patterns as illustrated in Fig. 1



(a) Large diamond search pattern (LDSP)



(b) Small diamond search pattern (SDSP)

Fig. 1. Two search patterns

# Search Path Example

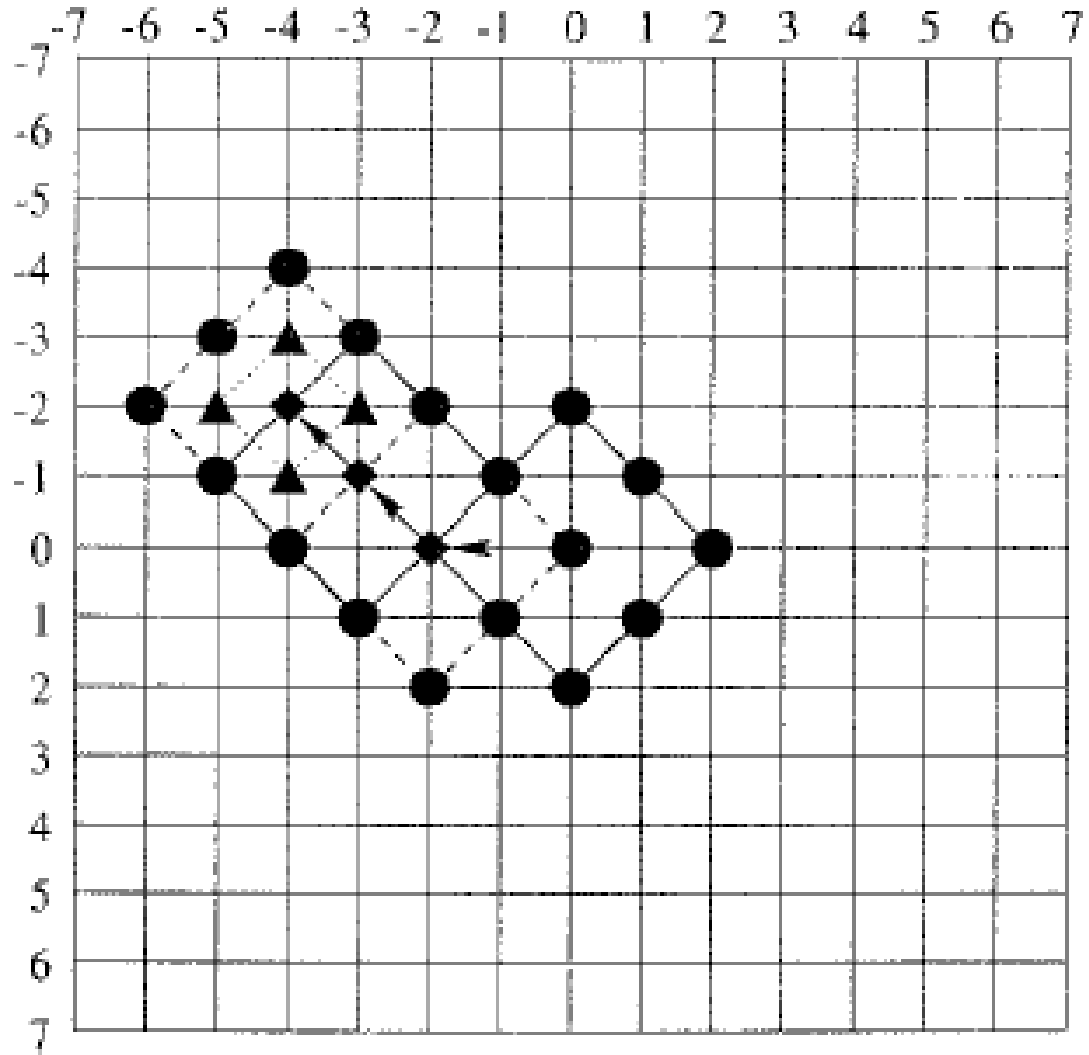


Fig. 2. Search path example

# The DS Algorithm (1/3)

- Step 1
  - The initial LDSP is centered at the origin of the search window
  - Then the 9 checking points of LDSP are tested
  - If the sum of absolute difference (SAD) point calculated is located at the center position, go to Step 3
  - Otherwise, go to Step 2

# The DS Algorithm (2/3)

- Step 2
  - The SAD point found in the previous search step is repositioned as the center point to form a new LDSP
  - If the new SAD point obtained is located at the center position, go to Step 3
  - Otherwise, recursively repeat this step

# The DS Algorithm (3/3)

- Step 3
  - Switch the search pattern from LDSP to SDSP
  - The SAD point found in this step is the final solution of the motion vector which points to the best matching block



# Three cases of checking-point

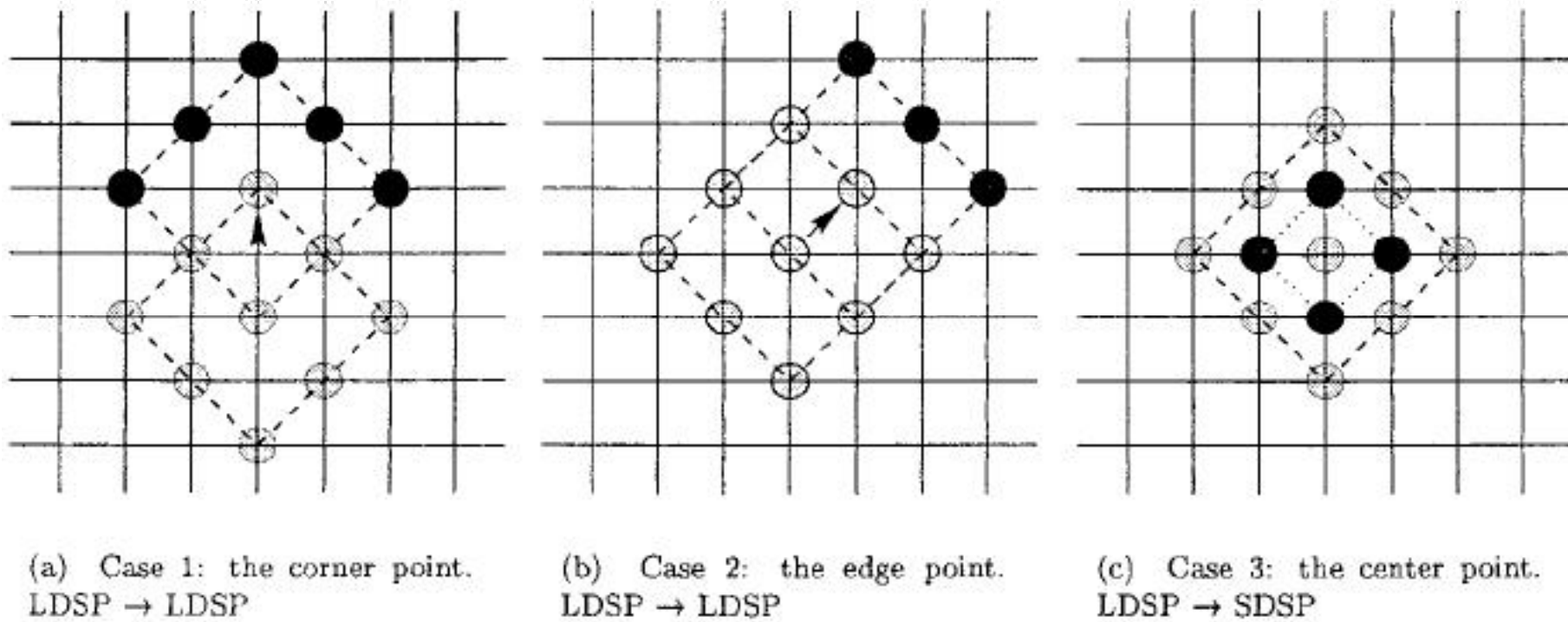


Fig. 3. Three cases of checking-point

# Modified Large Diamond-shaped Patterns

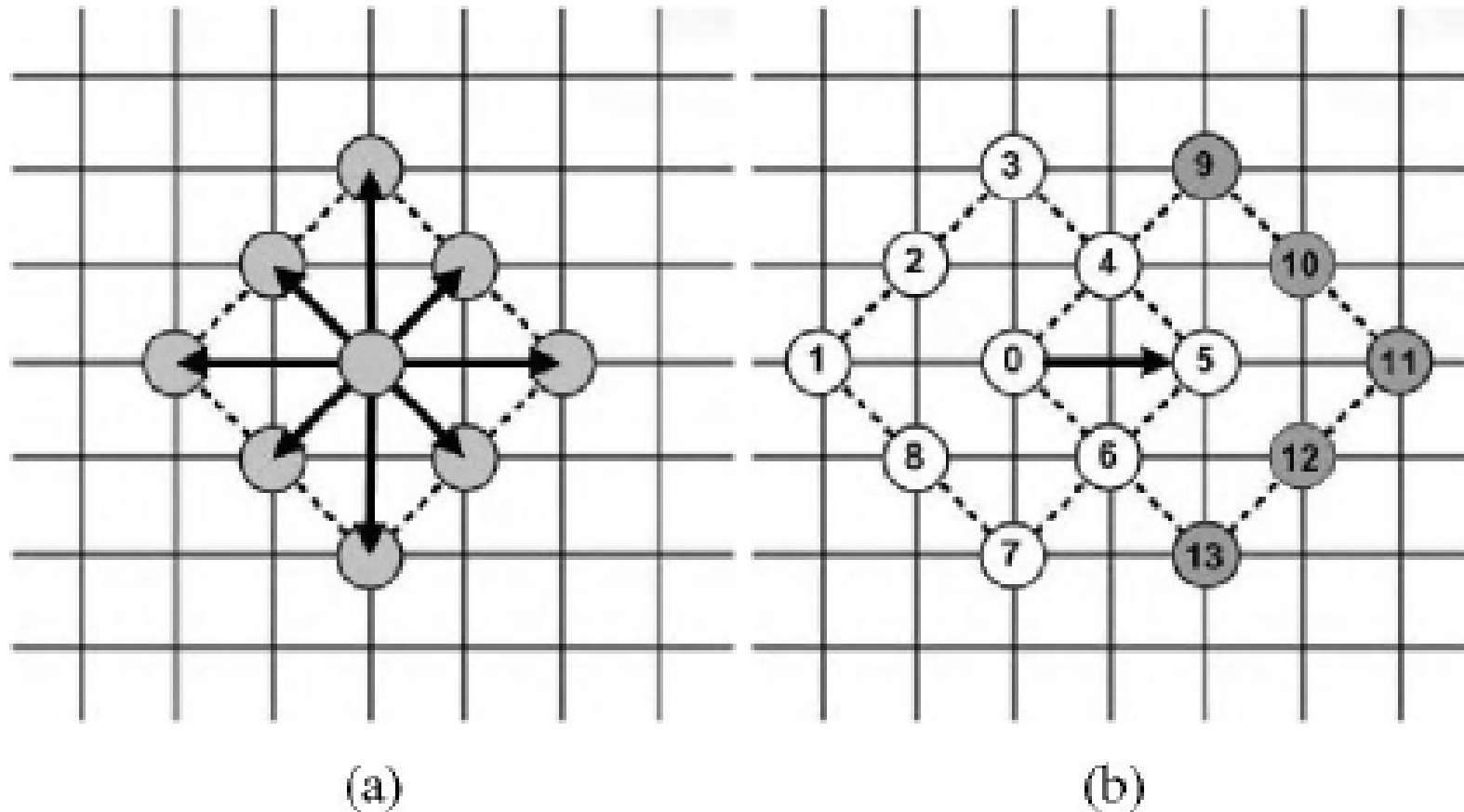


Fig. 4. (a) All possible motion directions  
(b) A horizontal motion direction of LDSP

# MLDSP for motion direction

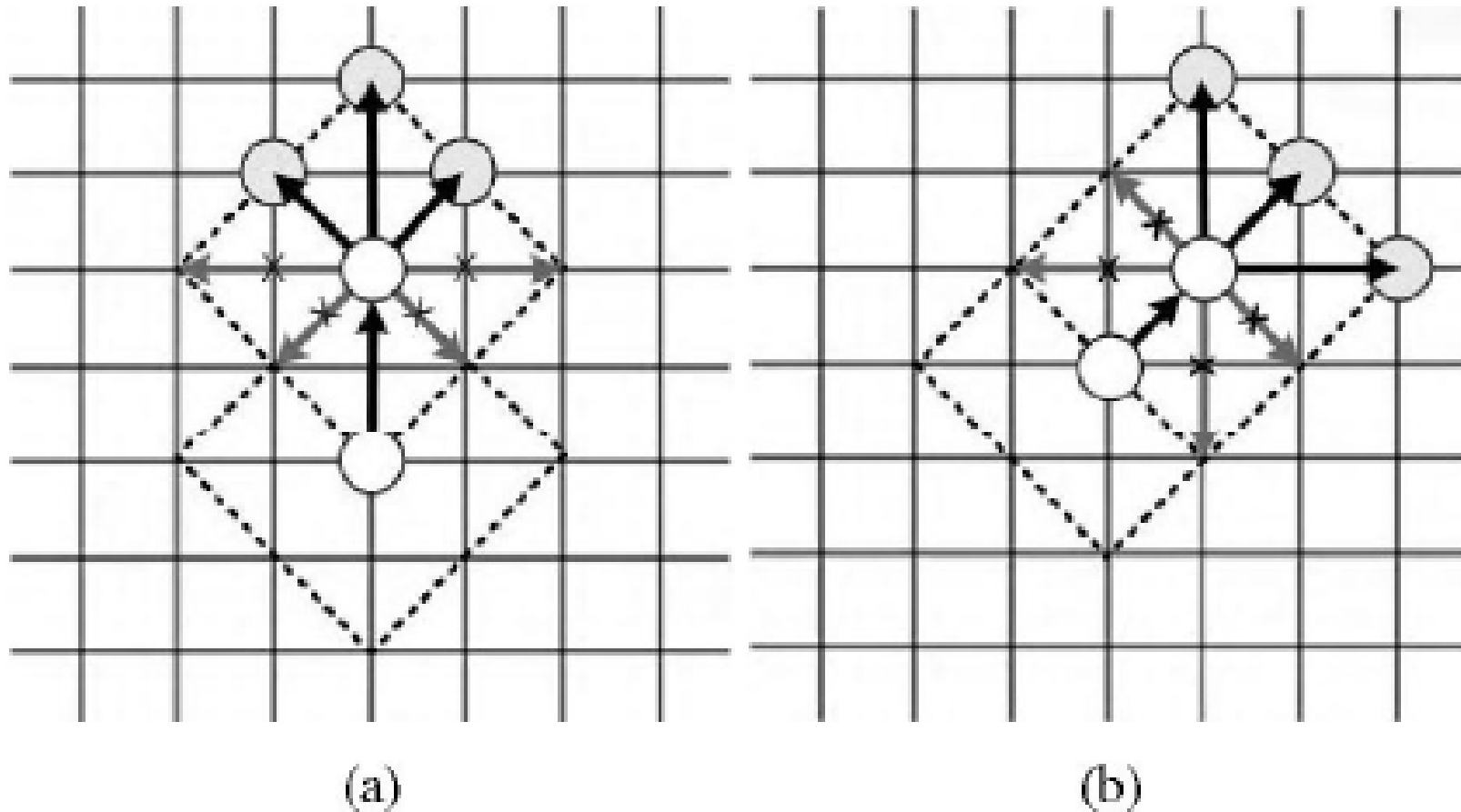


Fig. 5. (a) MLDSP for the vertical motion direction  
(b) MLDSP for the diagonal motion direction

# Experimental Results

Table 1 Probability of a winning point being on MLDSP

<i>Format</i>	<i>Sequence</i>	<i>Hit / Total</i>	<i>%</i>
QCIF	Mother&Daughter	1281 / 1438	89.08
	Carphone	4096 / 4411	92.86
	Foreman	13450 / 15026	89.51
	Suzie	955 / 1081	88.34
SIF	Football	19622 / 22229	88.27
	Garden	8852 / 9616	92.05
	Foreman	84907 / 94660	89.70
	Mobile	427 / 446	95.74
CIF	Coatguard	9331 / 9900	94.25
	Container	1131 / 1181	95.77
	Mobile	1267 / 1319	96.06
	Tennis	21687 / 25863	83.85

# Reference

- [1] S. Zhu and K. K. Ma, "A new diamond search algorithm for fast block-matching motion estimation," *IEEE Trans. Image Processing*, vol. 9, pp. 287-290, Feb. 2000.
- [2] Hwal-Suk Lee, Jik-Han Jung, and Dong-Jo Park, "An Efficient Diamond Search with Large Kite Search Patterns for Fast Block Motion Estimation ," *IEEE Trans. Image Processing*, pp. 3137 – 3141, Oct. 2006.