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BLOCK SPLITTING TYPE MORPHOLOGICAL ASSOCIATIVE MEMORY AND ITS RECALL RATE IMPROVEMENT BY MAJORITY LOGIC APPROACH

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Abstract. *A block splitting type MAM (BMAM) is one of the associative memories. The BMAM is a kind of the MAM without kernel images and is superior to other ordinary MAMs without kernel images in terms of the recall rate and the memory size. However, the perfect recall rate of the BMAM is inferior to that of the MAM using the kernel image. In order to improve the perfect recall rate, we proposed a majority logic approach for the BMAM. We paid attention to the BMAM's features: multiple outputs can be obtained from single image by using different split manners and most units contained in common to the stored pattern appear in these output. In this paper, we confirm the performance of the BMAM employing the majority logic approach by multiple autoassociation experiments and discuss the effective usage considering the memory size.*

Keywords: Morphological associative memory, Recall rate, Block splitting, Majority logic

1. **Introduction.** A memory is one of crucial brain functions and plays an important role in thinking, judgment, learning, and other higher brain functions. The mechanism is also attractive from the engineering viewpoint. An associative memory, which is one of the memory systems, recalls the most related pattern corresponding to an input pattern from the stored ones. Many associative memory models have been proposed. In 1972, Nakano, Kohonen, and Anderson proposed their associative memory models independently [1,6-7]. The most popular associative memory model is Hopfield Network [4]. The model is used for not only the associative memory but also the search method of the optimized solution such as traveling salesman problem. However, it is also known that the Hopfield network has low memory capacity and tends to trap a false-memory.

On the other hand, Ritter proposed a morphological associative memory (MAM) in 1998 [10]. The model is based on the morphological neural networks and the recalling is executed by a calculation using two matrices [2,8]. The MAM uses kernel images as the index in the recall process. It has been reported that the MAM is superior to normal associative memory models such as Hopfield network in terms of a calculation amount, a memory capacity, and a perfect recall rate [9-10]. Many applications of the MAM using the kernel image have been studied [13-15]. On the other hand, the MAM has disadvantages; 1) the kernel images are difficult to get for practical applications, 2) the perfect recall can not achieve for patterns included in corrupted kernel images, 3) size of the memory matrices is twice compared with Hopfield network.

In order to overcome the problems caused by use of the kernel images, Hattori *et al.* proposed a fast method for getting the kernel image [3] and Ida *et al.* proposed the