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APPLYING IMAGE PROCESSING AND NEURAL NETWORK TECHNIQUES TO DATA ASSOCIATION ALGORITHM

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Abstract. *Multiple-target tracking (MTT) is a prerequisite step for radar surveillance systems. Data association is the key technique used in radar MTT systems. This paper presents a new approach for data association that uses both quantity data and image information. In order to combine these two attributes, a fusion algorithm based on the competitive Hopfield neural network (CHNN) is developed to match radar measurements with existing target tracks. When target maneuvering problems are detected, an adaptive maneuvering estimator is applied. Computer simulation results indicate that the proposed approach is suitable for multiple-target tracking problems and has good performance.*
Keywords: Multiple-target tracking, Data association, Competitive Hopfield neural network

1. **Introduction.** The multiple-target tracking (MTT) algorithm plays an important role in radar surveillance systems. Data association is the key technique used for MTT systems. Many data association algorithms have been proposed. For example, the joint probabilistic data association (JPDA) method, which is suitable for a high false target density environment, was proposed in [1]. A suboptimal estimation algorithm denoted a unifying approach to MTT was developed in [2]. An approach that uses a traditional Hopfield neural network and considers the weighted objective cost and constraints in the overall energy function was presented in [3]. The problem with this approach is that the weights between the objective cost and constraints in the overall energy function are very difficult to properly determine. An improved algorithm, called the competitive Hopfield neural network, was developed in [4]. The applications of Hopfield neural network algorithm for prediction problems were presented in [5,6]. A new type of Hopfield Network with controllable synaptic weights for solving combinatorial optimization problems was addressed in [7]. Recently, the thermal image or optical equipments are improved and the image processing techniques progress significantly. This triggers the application of images on aerospace. In [8], one used single image sensor for multiple-target tracking in airport surface surveillance system.

The above data association algorithms use either only quantity data or image information to determine the correlation between the measurements and the existing targets. However, in a dense target environment, the targets are very close to each other. The measurements obtained for these close targets can confuse data association algorithms, resulting in inaccurate target association. Using more information can thus improve the accuracy of the tracking results. An approach applying both kinematic and attribute information for a target tracking algorithm that used Kalman filter as a fusion method was developed in [9]. This paper transferred attribute information to quantity data, such as