Second, we estimate the target positions at $t = 0$. We detect the peaks in the received signal envelope and recognize these peaks as the estimated target positions. Based on this process, we can then estimate the number of targets that exist when the measurement begins.

Next, we attach integer labels to the pixels at the estimated target positions and to pixels located adjacent to the target position pixels.

Finally, we attach labels to the pixels that exist at $t > 0$. Fig. 1 shows a schematic illustration of the labeling technique. Because the same target should have a similar velocity when measured at two closely spaced times, we attach the target pixel label to the pixel that minimizes the following evaluation function, F.

$$F = |v(t_i, r_i) - v(t, r)||t_i - r|, \qquad (3)$$

where i is the pixel number in the search region. Because the target position at the previous time is predicted based on the estimated velocity, we can thus limit the search region. In this study, we search triangular regions surrounded by three points: (t, r), $(t - T, r - v(t, r)T - R)$ and $(t - T, r - v(t, r)T + R)$, where T and R are constants.

(4) Experimental Setup

Fig. 2 shows the experimental setup. The radar system's center frequency is 4.2 GHz, the bandwidth 2.2 GHz, the slow-time sampling frequency 200 Hz, and the fast-time sampling frequency 16.39 GHz. The pedestrians, A and B, start to walk simultaneously. Target A walks from r = 1.0 m to r = 5.0 m and then back to the start point. Target B walks from r = 4.0 m to r = 1.0 m and back to the start point.

3. Experimental Results

Fig. 3 shows the amplitude of the received signal from the situation in which two pedestrians are walking. Fig. 4 then shows the results. The colors indicate the attached labels. The proposed method thus tracked and separated the targets and applied different labels to the different targets.

4. Conclusion

We proposed an algorithm for tracking and separation of multiple targets using the extended texture method without an iteration process. We demonstrated that the proposed method can successfully separate and track the echoes from multiple targets in an experimental study. Because the method does not require an iteration process, the method would be implemented in real time applications. The actual real time implementation of the method is an important topic in future studies.

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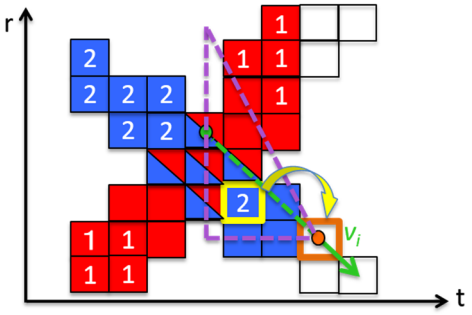

Fig. 1. Schematic illustration of the proposed labeling algorithm.

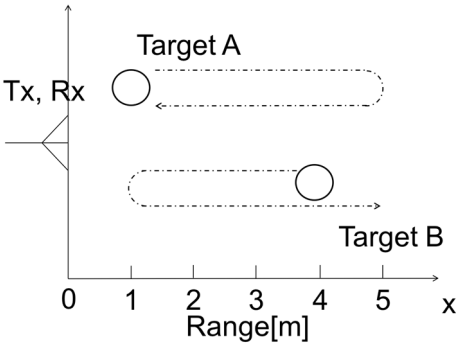

Fig. 2. System model used for the experiment.

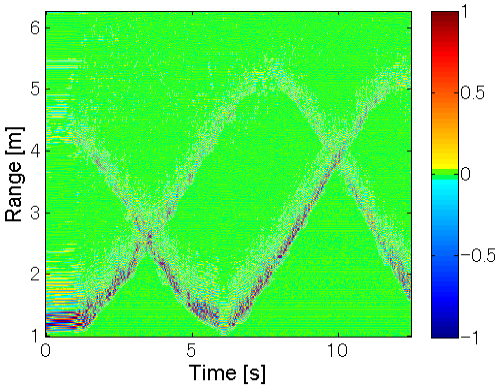

Fig. 3. Received signal from the experimental data.

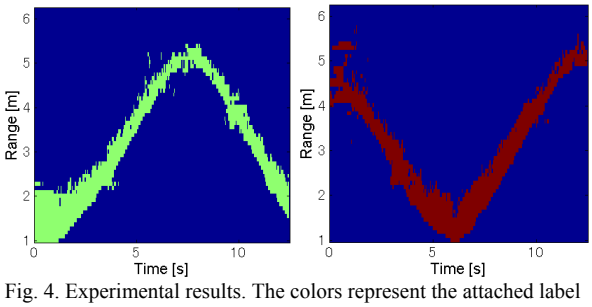

Fig. 4. Experimental results. The colors represent the attached label numbers.