



Figure 2. Segmentation examples under different FCM-based algorithms. The first row shows original RGB images

The second row shows the gray-scale value of noise corrupted images. The third row shows the segmentation result of original images. From the fourth row to bottom are segmentation result under different FCM based algorithms, and the order of algorithms is the same as that in Table 1. The Table 1 presents segmentation accuracy of various FCM algorithms, different distance measure and different spatial constraint. Figure 2 shows the result of our segmentation examples, and the segmentation accuracy of each result in Figure 2 can be found in Table I in the same place. It can be seen from our result that adaptive mean filter can effectively enhance the robustness to speckle noise and improve the segmentation quality since the segmentation result obtained with adaptive mean filter being incorporated is more similar to the ideal segmentation result. Besides, comparing algorithm with a final voting step to that without a final voting step, it is found that a final voting step can further remove the noise and improve the segmentation quality effectively. Finally, throughout comparisons between our results from Gaussian kernel distance and Euclidean distance it is reconfirmed that segmentation accuracy get enhanced under Gaussian kernel distance which is coherent to the previous study.

4. Conclusions

Given that usually the traditional FCM algorithm is not effective in image segmentation under speckle noise, this paper proposes a novel improved FCM approach to enhance the robustness to speckle noise in image. Throughout our experimental result it is confirmed that these improvements applied in our proposed method can effectively enhance the segmentation accuracy under speckle noise. First, throughout our results it is shown that implementing adaptive mean filter after mean filter to construct the spatial constraint in objective function improves the segmentation accuracy. Second, in the final step, a voting algorithm is used in our method to further remove the noise which is proven to be effective in enhancement in segmentation quality. Finally, our experimental results reconfirm that Gaussian kernel distance rather than Euclidean distance is more applicable to FCM objective function for image segmentation under speckle noise.

5. References

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