

- c) Select the initial seed node called Seed; determine the initial growth position and the initial value.
- d) Grow road region according to the selected area growing rules until there is no new growth point to join.

III. RESULTS

The selected road images in experiment are a part of search results in Google image site. In order to maximize the consistency between the experiment data and the data of intelligent vehicle collected, the experimental color images are all converted into images with the same size of 448 * 336. The experimental results are shown in figure6~8.



Figure 6. Original images



Figure 7. Abstraction of pavement



Figure 8. The boundary of road

The experiments select several color images containing variety of terrain and pavement shape to test the algorithm. The experimental results are shown as above. We can see that, the algorithm can accurately detect the road area included in color images, and the road boundary is in line with the actual situation. Among them, although there is a lot of shadow in the third image of the road, the algorithm still detects the location and extent of the road with some visible spot. It shows that the ability of the algorithm to adapt shadow is still weak, and its improvement is to become the next focus of the future study. In addition, in order to test the efficiency of the algorithm, the experiment takes 10 cycles experiment separately on the Figure 9 of the original figures. The average running time is 4.78

seconds, 6.73 seconds, 3.27 seconds. The experiments show that the implement-efficiency of the algorithm is preeminence and could meet requirements of real-time data processing during the autonomous navigation of intelligent vehicles.

IV. CONCLUSION

In order to solve the problem of autonomous navigation of intelligent vehicles in complex unknown environments, this paper studied the issue from the point of view that how to identify the surface of unstructured roads. By making full use of color and spatial information in the image, color space compression and automatic region growing are introduced in road-surface identification. The experimental results are satisfactory, and could meet the requirements of real-time characteristic in intelligent navigation at complex environments, and there are another road recognition method is supplied to road identification.

However, due to the diversity of complex environments, the algorithm should fuse other features, such as texture feature, spectrum distribution feature and so on, in order to have the ability to adapt to the shadows, illumination changes. In addition, the study of the selection method of threshold value in region growing is still the focus of future research. To sum up, for the future research work more comprehensive features information will be combined together on the identification of unstructured road pavement to improve robustness of the algorithm.

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