Zhou, Ri-Gui; Chang, Zhi-bo; Fan, Ping; Li, Wei; Huan, Tian-tian
Quantum image morphology processing based on quantum set operation.

Summary: Set operation is the essential operation of mathematical morphology, but it is difficult to complete
the set operation quickly on the electronic computer. Therefore, the efficiency of traditional morphology
processing is very low. In this paper, by adopting the method of the combination of quantum computation
and image processing, though multiple quantum logical gates and combining the quantum image storage,
quantum loading scheme and Boyer search algorithm, a novel quantum image processing method is proposed,
which is the morphological image processing based on quantum set operation. The basic operations, such as
erosion and dilation, are carried out for the images by using the quantum erosion algorithm and quantum
dilation algorithm. Because the parallel capability of quantum computation can improve the speed of the
set operation greatly, the image processing gets higher efficiency. The runtime of our quantum algorithm is
$O(\sqrt{MN})$. As a result, this method can produce better results.

Keywords: quantum morphology; quantum erosion; quantum dilation; quantum loading scheme
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