

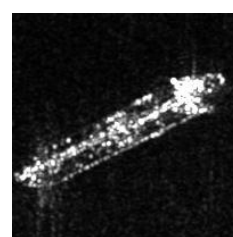
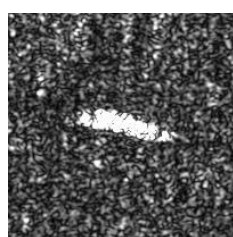
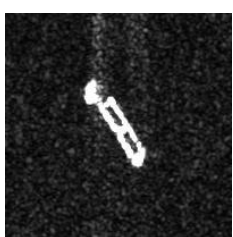
# A VESSEL STRUCTURE FEATURE RECOGNITION METHOD BASED ON HIGH RESOLUTION TERRASAR-X IMAGE

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**Abstract:** This paper presents a two-stage vessel recognition method based on structure feature of high resolution TerraSAR-X image. The vessel contains two categories, tanker and cargo ship. According to the different ship structure, the tanker includes tube showing tanker and no tube showing tanker, and the cargo ship includes closed rail cargo ship and open rail cargo ship. Because closed rail cargo ship and tube showing tanker owns holes on the vessel surface, and no tube showing tanker and open rail cargo ship have no hole, so the owning holes vessels are distinguished as one class from the rest of the ship based on whether the ship body possessing holes at the first stage. Because the tube showing tanker has an apparent tube on the head-tail line of the ship, but the rail cargo ship does not have this feature, so the tube showing tanker is distinguished from the closed rail cargo ship based on whether the longest lines of the ship existing on the middle region of the vessel as the first step of the second stage. Because the no tube showing tanker has uniform scatter and the body of the ship does not cut off line through the surface, so the no tube showing tanker is distinguished from the open rail cargo ship on the basis of this feature as the second step of the second stage. The samples of the research data are placed below as follows:



(a) open rail cargo ship    (b) closed rail cargo ship    (c) no tube tanker    (d) tube showing tanker

Fig.1 slices of tanker and cargo ship

The experimental data is TerraSAR-X image with a spacing rate of 1.25m and the studied region is Waters of the Yangtze River estuary near Shanghai. The experiment result (see Tab.1) showed the recognition rate of cargo ship and tanker is 88.89% and 81.82% and the total identification accuracy is 86.84%. This result suggested the selected structure features are robust and the recognition strategy is practicable. The paper finally analyzed the wrongly distinguished ship slices, and found out the following three points are the main reasons of wrongly recognized: ①ship wrongly

segmentation;②MER(Minimum Enclosing Rectangle)extracted inaccurately; ③azimuth smearing of ship, so the next step for the research will focus on these three aspects on one hand, and on the other hand more representative features will be dug.

**Tab.1 vessel recognition precision confusion matrix**

vessel type	cargo ship	tanker	total number	customer accuracy
cargo ship	24	3	27	88.89%
tanker	2	9	11	81.82%
total number	26	12	38	
procedure accuracy	92.30%	75.00%		total accuracy=86.84%

**Key words:** high resolution; TerraSAR-X; vessel recognition; structure feature; SAR

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