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Ship Detection in Medium Resolution SAR Images Via VGG Net

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ABSTRACT: Synthetic aperture radar (SAR) has become an important tool for many remote sensing applications due to its significant benefits of working throughout the day and in various weather conditions. In this work, propose a ship detection method for long-distance images based on VGGnet-based traditional neural networks. Major improvements include the inclusion of an in-depth Convolutionary Neural Network (DCNN) based classifier to train proposal development and model development and coastal mitigation by adopting multi-level features applicable to vessels of different sizes. The proposed method was tested with collected images and improved accuracy of detection in test results.

KEYWORDS : SAR, VGG, DCNN, KSAT

I. INTRODUCTION

As a main component in the scientific field of Earth observation (EO), ship detection has been an attractive and necessary contribution. Object detection, and therefore ship detection, has made significant progress in recent years through the adoption of intensive education. Analyzing EO images using in-depth learning to locate ships is state-of-the-art, and outline what has been studied in this thesis. Control the undesirable activities such as seaplane for safe traffic and illegal Offshore monitoring can be effectively automated using satellite remote sensing over many years. Synthetic aperture radars (SARs) have traditionally been used, and are still widely used, for ship detection functions because radar signals are mostly unaffected by weather conditions (Baumler and Hartl, 1998). Occur, and because the methods have been refined, for example, determine the size and velocity of a vessel (Dragosevic and Vachon, 2008). A detail in SAR. Optical thesis imagery, and especially super view images, are the remote sensing data used for ship detection experiments in this thesis. Kongsberg Satellite Services (KSAT) provides the raw data used for use in this thesis. This includes a selection of Super View optical satellite products and annotated ships... Annotations have been adopted in an appropriate object detection format and a complete training data set has been developed as contributed by this thesis. KSAT Supporter Systems for this purpose have been up and running for decades and they have been constantly evolving. Daily work at KSAT required reliable developers and data handling. Ship detection in high-resolution optical satellite imagery is a modern field at KSAT. The purpose of this thesis is to study the opportunities inherent in optical remote sensing, and may contribute to optical remote sensing being adopted as part of KSAT's vessel identification services.. Machine learning, and particularly deep learning, has in the later years provided state-of-the-art EO systems. Convolutional neural networks (CNNs) are the quintessential deep learning models, the main

cause of the tremendous progress, and can be adapted to fit various problems (Good fellow et al., 2016). CNN is trained on appropriate training data, it has been proven to outperform traditional algorithms in a wide variety of computer vision and image analysis problems (McAntesis et al., 2015). Knowledge about machine learning architecture and how it reacts to various data is a requirement, and allows the opportunity for analysis of potential sources of errors. Knowledge of the inherent challenges in systems and data is desired. A possible challenge in optical EO data is Rotated objects and title prediction are of specific interest in this study Even though object orientation is attractive in many applications, there is limited research work on object detection focusing on this problem (Liu et al., 2018). This is often due to limited data sets labeled with rotation. Popular benchmark data sets, such as Pascal VOC (Everingham et al., 2010), Image Net (Russakovsky et al., 2015) and MS COCO (Lin et al., 2014), have no information on object orientation. Airbus have published a data set concerning ship detection in optical satellite images (Kaggle, 2018), with a corresponding ship detection challenge, which has recently contributed to the interest in this field.

Literature survey Support vector machine: SVM is a supervised learning algorithm is widely used for classification and regression analysis. In supervised learning, a classification requires firstly the training of the classifier by means of the instances from a training set, which in this study is formed by the images used for training. Each of these instances is defined by one or more features, and a class label that represents the correct classification of each instance. The goal of SVM is to train a classifier able to predict unknown class labels of instances. In order to achieve it, SVM finds an optimal hyper plane that separates the different classes in the training set and obtains the SVM classifier. Afterwards, the SVM classifier performs the classification between the different classes of the instances from the test set, which is formed by the images to evaluate. In this approach, the aim of the SVM classifier is to perform a classification between ship and non- ship blocks on the test set images.

From a mathematical point of view, given a set of instance label pairs (x_i, y_i) , $i = 1, \dots, l$, where x_i and $y_i \in \{-1, 1\}$, SVM calculates the solution of the following optimization problem:

$$(1) \quad \min_{w, b, \xi} = \frac{1}{2} w^T w + C \sum_{i=1}^l \xi_i$$

where w is known as the weight factor, b is called the bias, C represents the regularization parameter of the error, $i = 1, \dots, l$ is the measure of misclassification, subject to

$$(2) \quad y_i(w^T \phi(x_i) + b) \geq 1 - \xi_i, \xi_i \geq 0,$$

Where ϕ is a non-linear function in the feature space

The training vectors x_i are mapped into a higher dimensional space by the function ϕ . Subsequently, a separating hyper plane with the maximal margin is calculated using the SVM.

SVM is a kernel method, which operates in a high dimensional space by computing the inner products between all pairs of the data in the feature space. This operation is performed by a kernel function, defined by $K(x_i, x_j) = \phi(x_i)^T \phi(x_j)$. In this approach, the Gaussian kernel function is used due to better performance when the number of instances is significantly higher than the number of features. The Gaussian kernel function is defined by the equation $K(x_i, x_j) = \exp(-\gamma \|x_i - x_j\|^2)$, $\gamma > 0$, where γ is the width parameter of the kernel.



Segmentation-based ship detection in port for SAR images: Zhai et al (2016) presented a novel method for in-vessel detection based on image segmentation for SAR imagery. According to the position of the ship in the port, we divide them into offshore ship and inshore ship, and various strategies are applied to locate the ship. First, we use the sea-land segmentation method to separate the SAR image into land area and sea area, and then extract the buffer area according to the beach. Second, we employ a TS-CFAR detector that has state-of-the-art performance in multiple-target conditions for offshore ship detection. Finally, for inshore ships, we propose a field-based equivalence detection to complete ship detection. The field-based saliva detection method can tolerate somewhat blunt noise.

Improving SAR images in high-speed ship detection by Yolov 3: ZHANG et al (2019) used a high-speed SAR ship detection approach by improving version 3 (YOLOv3) only once. We have experimented on a public SAR ship detection dataset (SSDD) which has been used by many other scholars. In conclusion, the experimental results indicated that our proposed improved YOLOv3 detection speed is faster than other existing methods, such as fast-paced field-related hard network (Faster R-CNN), single-shot multi-box detector (SSD), and the original YOLOv3 under the same hardware environment. Meanwhile, the detection accuracy remains basically unchanged.

Ship wake CFAR detection algorithms in SAR images based on normalized scans

Nan et al (2013) presented a novel constant false alarm rate (CFAR) ship wake detection algorithm based on the length normalized scan method in SAR images. As we all know, the boundary component of the ship's movement leads to the azimuth offset in SAR images. The starting point of the wake should be located near the ship at Azimuth. According to this physical facts, the length normalized scan can be

II. PROPOSED SYSTEM

This project adopts the idea of deep networks and presents a fast VGG-based convolutional neural network (VGG-CNN) method to detect ships from high-resolution remote sensing imagery. This section is divided into three stages.

Deep learning: Firstly, the deep learning is described with its applications. Second stage is the CNN which is the best example of deep learning and the third stage is the VGGnet of CNN which is the proposed model of ship detection. Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans: learn by example. Deep learning is a key technology behind driverless cars, enabling them to recognize a stop sign, or to distinguish a pedestrian from a lamppost. It is the key to voice control in consumer devices like phones, tablets, TVs, and hands-free speakers. Deep learning is getting lots of attention lately and for good reason. It's achieving results that were not possible before.

In deep learning, a computer model learns to perform classification tasks directly from pictures, text, or sound. Deep learning models can achieve state-of-the-art accuracy, sometimes surpassing human-level performance. The models are trained using a larger set. Label data and neural network architecture consists of several layers. In a word, accuracy. Deep learning achieves a higher level of recognition accuracy than before. It helps consumer electronics to meet user expectations in AI applications.

Deep learning applications are used in industries ranging from automated driving to medical devices. Automated driving: Automotive researchers are using deep learning to automatically detect objects such as stop signals and traffic lights. In addition, deep learning is used to detect pedestrians, which helps reduce accidents. Aerospace and Defense: Deep learning is used to identify objects from satellites that are located in areas of interest.

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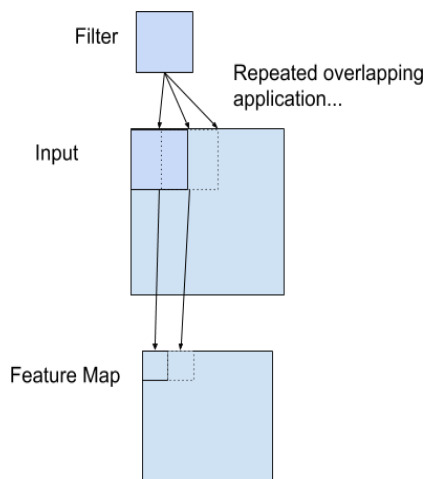


Fig 1. A Filter Applied to a Two- Dimensional Input to Create a Feature Map

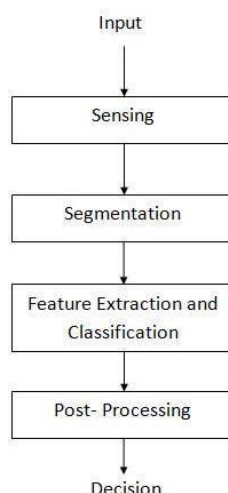


Fig 2. Pattern Recognition

Pattern recognition is the process deals with comprehension and designation of data patterns to their respective classes, based on certain features. One of the given set of classes is assigned with a label by pattern recognition to generate the output based on learning procedures. Pattern recognition process is coming through the steps such as pre-processing, segmentation, feature extraction, and classification. Removal of noise or redundancy from patterns is done in the pre-processing step, and extraction of a characteristics (features) set from the said patterns are extorted in the feature extraction step. Classification is the step plays a vital role in the recognition of each pattern based on the structural account of the images. The structural account of pattern recognition techniques is embodied.

In image processing, major features such as geometric, topological, statistical and contour-based-features are extracted. The chief aim of feature extraction is acquiring a set of features useful in human interpretation with the most relevant or non-redundant information from the original data.

Feature vectors provide the relevant features extracted from the objects and then it is used to group the objects into different classes using the classifier. Among different classes, the features are discriminative whereas it is similar within the same class.



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II. CONCLUSION

This project proposed a multitask learning framework for ship detection in MR SAR images. To explore more effective feature extractors, a task-specific designed backbone network is developed inspired by the VGG-Nets. Our experiments prove that the proposed network is powerful to extract discriminative representations for effective MR SAR ship classification. To further boost the recognition performance, the triplet similarity constraint is combined with the softmax classification error penalty forming the multitask learning prototype, which can achieve good classification performance by pulling the deep representations coming from the same class closer to each other and pushing those of different classes far apart in the learned embedding space. To improve the generalization performance of triplet CNNs in the DML, the Fisher regularization term is imposed on the deep embeddings to take full advantage of the triplets in a training batch. Hence, the global information of the pairwise distances of the deep embeddings is fully mined and more robust models learned are obtained.

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