论文摘要2023/8/14

Instance-Aware Distillation for Efficient Object Detection in Remote Sensing Images

用于遥感图像中高效目标检测的实例感知蒸馏

【目标检测】 **【实例】** 【知识蒸馏】

摘要

Practical applications ask for object detection models that achieve high performance at low overhead. Knowledge distillation demonstrates favorable potential in this case by transferring knowledge from a cumbersome teacher model to a lightweight student model. However, previous distillation methods are plagued with massive misleading background information in remote sensing images and ignore investigating the relationships between different instances. In this article, we propose an instance-aware distillation (InsDist for short) method to derive efficient remote sensing object detectors. Our InsDist combines feature-based and relation-based knowledge distillation to make the most of instance-related information in the knowledge transfer from the teacher to the student. On one hand, we propose a parameter-free masking module to decouple instance-related foreground from instance-irrelevant background in multiscale features. On the other hand, we construct the relationships between different instances to enhance the learning of intraclass compactness and interclass dispersion. The student comprehensively imitates both features and relationships from the teacher, yielding considerable effectiveness in dealing with complex remote sensing images. In addition, our InsDist can be easily built on mainstream object detectors with negligible extra cost. Extensive experiments on two large-scale remote sensing object detection datasets, namely DIOR and DOTA, show that our InsDist obtains noticeable gains over other distillation methods for both one-stage and two-stage, as well as both anchor-based and anchor-free detectors. The source code will be publicly available at https://github.com/swift1988/InsDist

实际应用要求在低开销下实现高性能的**目标检测模型**。 **知识蒸馏**通过将知识从繁琐的教师模型转移到轻量级的学生模型，在这种情况下展示了有利的潜力。 然而，以前的蒸馏方法受到遥感图像中大量误导性背景信息的困扰，而忽略了调查不同实例之间的关系。 在本文中，我们提出了一种**实例感知蒸馏（instance-aware distillation，简称InsDist）方法**来推导高效的遥感物体探测器。 我们的InsDist结合了**基于特征**和**基于关系**的知识蒸馏，以充分利用实例相关的信息从教师到学生的知识转移。 一方面，我们**提出了一个无参数掩蔽模块来解耦多尺度特征中的实例相关前景和实例无关背景**。 另一方面，我们**构建了不同实例之间的关系，以增强类内紧凑性和类间分散性的学习**。 学生全面模仿教师的特征和关系，在处理复杂的遥感图像方面取得了相当大的成效。 此外,我们的InsDist可以很容易地建立

在主流物体探测器上,额外的成本可以忽略不计. 对**DIOR和DOTA两个大规模遥感目标检测数据集**的广泛实验表明，我们的InsDist在一阶段和两阶段以及基于锚和无锚的探测器上获得了明显的收益。 源代码将在https://github.com/swift1988/InsDist

Keywords

Remote sensing 遥感

Object detection 目标检测

Detectors 探测器

Feature extraction 特征提取

Task analysis 任务分析

Behavioral sciences 行为科学

Sensors 传感器

Knowledge distillation 知识蒸馏

object detection 目标检测

remote sensing images 遥感图像

引用

C. Li, G. Cheng, G. Wang, P. Zhou and J. Han, "Instance-Aware Distillation for Efficient Object Detection in Remote Sensing Images," in IEEE Transactions on Geoscience and Remote Sensing, vol. 61, pp. 1-11, 2023, Art no. 5602011, doi: 10.1109/TGRS.2023.3238801.

Measurement of Total Dissolved Solids and Total Suspended Solids in Water Systems: A Review of the Issues, Conventional, and Remote Sensing Techniques

水系统中总溶解固体和总悬浮固体的测量：问题、常规和遥感技术的综述

【水质参数测量】**【使用传统方法测量的观测数据进行校准和验证】**

摘要

This study provides a comprehensive review of the efforts utilized in the measurement of water quality parameters (WQPs) with a focus on total dissolved solids (TDS) and total suspended solids (TSS). The current method used in the measurement of TDS and TSS includes conventional field and gravimetric approaches. These methods are limited due to the

associated cost and labor, and limited spatial coverages. Remote Sensing (RS) applications have, however, been used over the past few decades as an alternative to overcome these limitations. Although they also present underlying atmospheric interferences in images, radiometric and spectral resolution issues. Studies of these WQPs with RS, therefore, require the knowledge and utilization of the best mechanisms. The use of RS for retrieval of TDS, TSS, and their forms has been explored in many studies using images from airborne sensors onboard unmanned aerial vehicles (UAVs) and satellite sensors such as those onboard the Landsat, Sentinel-2, Aqua, and Terra platforms. The images and their spectral properties serve as inputs for deep learning analysis and statistical, and machine learning models. Methods used to retrieve these WQP measurements are dependent on the optical properties of the inland water bodies. While TSS is an optically active parameter, TDS is optically inactive with a low signal-noise ratio. The detection of TDS in the visible, near-infrared, and infrared bands is due to some process that (usually) co-occurs with changes in the TDS that is affecting a WQP that is optically active. This study revealed significant improvements in incorporating RS and conventional approaches in estimating WQPs. The findings reveal that improved spatiotemporal resolution has the potential to effectively detect changes in the WQPs. For effective monitoring of TDS and TSS using RS, we recommend employing atmospheric correction mechanisms to reduce image atmospheric interference, exploration of the fusion of optical and microwave bands, high-resolution hyperspectral images, utilization of ML and deep learning models, calibration and validation using observed data measured from conventional methods. Further studies could focus on the development of new technology and sensors using UAVs and satellite images to produce real-time in situ monitoring of TDS and TSS. The findings presented in this review aid in consolidating understanding and advancement of TDS and TSS measurements in a single repository thereby offering stakeholders, researchers, decision-makers, and regulatory bodies a go-to information resource to enhance their monitoring efforts and mitigation of water quality impairments.

这项研究全面检讨测量水质参数的工作，重点是**总溶解固体(TDS)和总悬浮固体(TSS)**。 目前用于TDS和TSS测量的方法包括**常规的现场和重量法**。 这些方法由于相关的成本和劳动力以及有限的空间复盖范围而受到限制。 然而，在过去几十年中，**遥感（RS）**应用已被用作克服这些限制的替代方案。 虽然它们也在图像中存在潜在的大气干扰，但辐射和光谱分辨率问题。 因此，用RS研究这些Wqp需要了解和利用最佳机制。 使用RS检索TDS，TSS及其形式已经在许多研究中进行了探索，使用**无人机（Uav）上的机载传感器和卫星传感器（如Landsat，Sentinel-2，Aqua和Terra平台上的传感器）的图像**。 **图像及其光谱属性**作为**深度学习分析和统计**以及**机器学习模型**的输入。 用于检索这些WQP测量值的方法取决于内陆水体的光学特性。 虽然TSS是一个光学活性参数，但TDS是低信噪比的光学非活性参数。 在可见光、近红外和红外波段中检测TDS是由于某些过程（通常）与影响光学活性WQP的TDS变化共同发生。 这项研究揭示了在评估WQPs中纳入RS和传统方法方面的显着改进。 研究结果表明，改进的时空分辨率有可能有效地检测WQPs的变化。 为了使用RS对TDS和TSS进行有效监测，我们建议采用**大气校正机制**来减少图像大气干扰，探索光学和微波波段的融合，高分辨率高光谱图像，利用ML和深度学习模型，**使用传统方法测量的观测数据进行校准和验证**。 进一步的研究可以集中于利用无人机和卫星图像开发新技术和传感器，以便对TDS和TSS进行实时原位监测。 这次审查提出的研究结

果有助于在一个单一的储存库中巩固对TDS和TSS测量的理解和进步，从而为利益相关者、研究人员、决策者和监管机构提供一个信息资源，以加强他们的监测工作和减轻水质损害。

关键词

Keywords: airborne sensors; **hyperspectral**; multispectral; optically active; remote sensing (RS); satellite sensors; total dissolved solids (TDS); total suspended solids (TSS)

关键词:机载传感器;高光谱;多光谱;光学活性;遥感(RS);卫星传感器;总溶解固体(TDS);总悬浮固体(TSS)

引用

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Polarimetry for Bionic Geolocation and Navigation Applications: A Review

仿生地理定位和导航应用的极地测量：综述

摘要

Polarimetry, which seeks to measure the vectorial information of light modulated by objects, has facilitated bionic geolocation and navigation applications. It is a novel and promising field that provides humans with a remote sensing tool to exploit polarized skylight in a similar way to polarization-sensitive animals, and yet few in-depth reviews of the field exist. Beginning with biological inspirations, this review mainly focuses on the characterization, measurement, and analysis of vectorial information in polarimetry for bionic geolocation and navigation applications, with an emphasis on Stokes-Mueller formalism. Several recent breakthroughs and development trends are summarized in this paper, and potential prospects in conjunction with some cutting-edge techniques are also presented. The goal of this review is to offer a comprehensive overview of the exploitation of vectorial information for geolocation and navigation applications as well as to stimulate new explorations and breakthroughs in the field.

极化法旨在测量由物体调制的光的矢量信息，促进了仿生地理定位和导航应用。 这是一个新颖而有前途的领域，为人类提供了一种遥感工具，以类似于极化敏感动物的方式利用极化天窗，但对该领域的深入评论很少。 从生物启发开始，本综述主要关注**仿生地理定位和导航应用极化法中矢量信息的表征，测量和分析**，重点关注**Stokes-Mueller**形式主义。 本文总结了最近的几个突破和发展趋势，并结合一些尖端技术提出了潜在的前景。 本次审查的目的是全面概述将矢量信息用于地理定位和导航应用的情况，并促进该领域的新探索和突破。

关键字

Keywords: polarimetry; bionic polarization navigation; polarized skylight; bioinstrumentation; polarization sensor

关键词:偏振;仿生偏振导航;偏振天窗;生物仪器;偏振传感器

引用

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