



Nondestructive perch target detection and size measurement from RGB-D images in recirculating aquaculture system

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Abstract

In recirculating aquaculture system, precise estimation of perch size from images is essential for developing intelligent management system. However, variations in fish postures and visual field lead to different fish sizes in RGB images, posing challenges for accurate fish detection and localization. To address the above issues, this paper proposes a nondestructive target detection and size measurement method for perch, based on depth information and RGB-D images. The details are as follows: firstly, the capture ability of perch key point features is augmented by a bi-level routing attention (BRA) mechanism. Secondly, the enhanced CSPDarknet53 to 2-Stage FPN(C2f) module and new detection layer are introduced into the model's backbone and neck, further improving the learning ability of perch features and the recognition accuracy of small-size targets. Finally, based on the detected key point coordinates, the perch size is calculated by combining the three-dimensional transformation from depth camera and measurement model. The experimental results show that the mAP@.5:.95 for key point detection reaches 86.4%, which is 3.6% higher than the baseline model, and the average relative error of perch size measurement is $\pm 5\%$. The proposed model provides an important basis for developing scientific feeding strategies and harvest plans.

Keywords Perch detection · Recirculating aquaculture system · RGB-D images · Size measurement

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Andreas Öchsner, Holm Altenbach



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Nondestructive Detection and Measurement for Homeland Security II, 2004 Nondestructive Detection and Measurement for Homeland Security II S. R. Doctor, 2004 Proceedings of SPIE offer access to the latest innovations in research and technology and are among the most cited references in patent literature **Structural Health Monitoring of Civil Infrastructure Systems** Vistasp M. Karbhari, Farhad Ansari, 2009-08-25 Structural health monitoring is an extremely important methodology in evaluating the health of a structure by assessing the level of deterioration and remaining service life of civil infrastructure systems This book reviews key developments in research technologies and applications in this area of civil engineering It discusses ways of obtaining and analysing data sensor technologies and methods of sensing changes in structural performance characteristics It also discusses data transmission and the application of both individual technologies and entire systems to bridges and buildings With its distinguished editors and international team of contributors Structural health monitoring of civil infrastructure systems is a valuable reference for students in civil and structural engineering programs as well as those studying sensors data analysis and transmission at universities It will also be an important source for practicing civil engineers and designers engineers and researchers developing sensors network systems and methods of data transmission and analysis policy makers inspectors and those responsible for the safety and service life of civil infrastructure Reviews key developments in research technologies and applications Discusses systems used to obtain and analyse data and sensor technologies Assesses methods of sensing changes in structural performance

Sensor Technologies for Civil Infrastructures, Volume 1 Jerome P. Lynch, Hoon Sohn, Ming L. Wang, 2014-04-26 Sensors are used for civil infrastructure performance assessment and health monitoring and have evolved significantly through developments in materials and methodologies Sensor Technologies for Civil Infrastructure Volume I provides an overview of sensor hardware and its use in data collection The first chapters provide an introduction to sensing for structural performance assessment and health monitoring and an overview of commonly used sensors and their data acquisition systems Further chapters address different types of sensor including piezoelectric transducers fiber optic sensors acoustic emission sensors and electromagnetic sensors and the use of these sensors for assessing and monitoring civil infrastructures Developments in technologies applied to civil infrastructure performance assessment are also discussed including radar technology micro electro mechanical systems MEMS and nanotechnology Sensor Technologies for Civil Infrastructure provides a standard reference for structural and civil engineers electronics engineers and academics with an interest in the field Describes sensing hardware and data collection covering a variety of sensors Examines fiber optic systems acoustic emission piezoelectric sensors electromagnetic sensors ultrasonic methods and radar and millimeter wave technology Covers strain gauges micro electro mechanical systems MEMS multifunctional materials and nanotechnology for sensing and vision based sensing and lasers Sensor Technologies for Civil Infrastructures Jerome P. Lynch, Hoon Sohn, Ming L.

Wang,2022-07-19 Sensor Technologies for Civil Infrastructure Volume 2 Applications in Structural Health Monitoring Second Edition provides an overview of sensor applications and a new section on future and emerging technologies Part one is made up of case studies in assessing and monitoring specific structures such as bridges towers buildings dams tunnels pipelines and roads The new edition also includes sensing solutions for assessing and monitoring of naval systems Part two reviews emerging technologies for sensing and data analysis including diagnostic solutions for assessing and monitoring sensors unmanned aerial systems and UAV application in post hazard event reconnaissance and site assessment Includes case studies in assessing structures such as bridges buildings super tall towers dams tunnels wind turbines railroad tracks nuclear power plants offshore structures naval systems levees and pipelines Reviews future and emerging technologies and techniques including unmanned aerial systems LIDAR and ultrasonic and infrared sensing Describes latest emerging techniques in data analysis such as diagnostic solutions for assessing and monitoring sensors and big data analysis

Flexonics for Manufacturing and Robotics Jiajie Guo,Kok-Meng Lee,2018-12-31 This book presents the theoretical research and application results of a study on flexible mechatronics flexonics Formulating distributed models in both time and spatial domains using a geometric approach it presents a simple yet practical field based sensing method for robotics and manufacturing and illustrates its applications with examples such as exoskeletons mobile sensor network and intelligent sensing The book is of interest to researchers engineers and graduate students in robotics manufacturing and automation engineering who wish to learn the core principles theories technologies and applications of flexonics

Structural Sensing, Health Monitoring, and Performance Evaluation D. Huston,2010-09-21 Structural health monitoring SHM uses one or more in situ sensing systems placed in or around a structure providing real time evaluation of its performance and ultimately preventing structural failure Although most commonly used in civil engineering such as in roads bridges and dams SHM is now finding applications in other engineering envir

Counterterrorist Detection Techniques of Explosives Jehuda Yinon,2011-10-13 The detection of hidden explosives has become an issue of utmost importance in recent years While terrorism is not new to the international community recent terrorist attacks have raised the issue of detection of explosives and have generated a great demand for rapid sensitive and reliable methods for detecting hidden explosives Counterterrorist Detection Techniques of Explosives covers recent advances in this area of research including vapor and trace detection techniques chemiluminescence mass spectrometry ion mobility spectrometry electrochemical methods and micromechanical sensors such as microcantilevers and bulk detection techniques neutron techniques nuclear quadrupole resonance x ray diffraction imaging millimeter wave imaging terahertz imaging and laser techniques This book will be of interest to any scientists involved in the design and application of security screening technologies including new sensors and detecting devices which will prevent the smuggling of bombs and explosives Covers latest advances in vapor and trace detection techniques and bulk detection techniques Reviews both current techniques and those in advanced stages of development

Techniques that are described in detail including its principles of operation as well as its applications in the detection of explosives *Index of Conference Proceedings* British Library. Document Supply Centre, 2003

Existing and Potential Standoff Explosives Detection Techniques National Research Council, Division on Earth and Life Studies, Board on Chemical Sciences and Technology, Committee on the Review of Existing and Potential Standoff Explosives Detection Techniques, 2004-05-14 Existing and Potential Standoff Explosives Detection Techniques examines the scientific techniques currently used as the basis for explosives detection and determines whether other techniques might provide promising research avenues with possible pathways to new detection protocols This report describe the characteristics of explosives bombs and their components that are or might be used to provide a signature for exploitation in detection technology considers scientific techniques for exploiting these characteristics to detect explosives and explosive devices discusses the potential for integrating such techniques into detection systems that would have sufficient sensitivity without an unacceptable false positive rate and proposes areas for research that might be expected to yield significant advances in practical explosives and bomb detection technology in the near mid and long term

Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure and Homeland Security H. Felix Wu, Peter J. Shull, 2007 Proceedings of SPIE present the original research papers presented at SPIE conferences and other high quality conferences in the broad ranging fields of optics and photonics These books provide prompt access to the latest innovations in research and technology in their respective fields Proceedings of SPIE are among the most cited references in patent literature

Artificial Intelligence Enabled Businesses Sweta Dixit, Vishal Jain, Mohit Maurya, Geetha Subramaniam, 2025-01-22 This book has a multidimensional perspective on AI solutions for business innovation and real life case studies to achieve competitive advantage and drive growth in the evolving digital landscape Artificial Intelligence Enabled Businesses demonstrates how AI is a catalyst for change in business functional areas Though still in the experimental phase AI is instrumental in redefining the workforce predicting consumer behavior solving real life marketing dynamics and modifications recommending products and content foreseeing demand analyzing costs strategizing managing big data enabling collaboration of cross entities and sparking new ethical social and regulatory implications for business Thus AI can effectively guide the future of financial services trading mobile banking last mile delivery logistics and supply chain with a solution oriented focus on discrete business problems Furthermore it is expected to educate leaders to act in an ever more accurate complex and sophisticated business environment with the combination of human and machine intelligence The book offers effective efficient and strategically competent suggestions for handling new challenges and responsibilities and is aimed at leaders who wish to be more innovative It covers the early stages of AI adoption by organizations across their functional areas and provides insightful guidance for practitioners in the suitable and timely adoption of AI This book will greatly help to scale up AI by leveraging interdisciplinary collaboration with cross functional

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Intelligent Coatings for Corrosion Control Atul Tiwari, Lloyd Hihara, James Rawlins, 2014-10-25 Intelligent Coatings for Corrosion Control covers the most current and comprehensive information on the emerging field of intelligent coatings The book begins with a fundamental discussion of corrosion and corrosion protection through coatings setting the stage for deeper discussion of the various types of smart coatings currently in use and in development outlining their methods of synthesis and characterization and their applications in a variety of corrosion settings Further chapters provide insight into the ongoing research current trends and technical challenges in this rapidly progressing field Reviews fundamentals of corrosion and coatings for corrosion control before delving into a discussion of intelligent coatings useful for researchers and grad students new to the subject Covers the most current developments in intelligent coatings for corrosion control as presented by top researchers in the field Includes many examples of current and potential applications of smart coatings to a variety of corrosion problems **Science and Technology of Terrorism and Counterterrorism, Second Edition** Mark A. Prelas, Dabir S. Viswanath, Sudarshan K. Loyalka, 2010-08-10 Traditionally resources on terrorism and counterterrorism tend to focus on the social behavioral and legal aspects of the subject with minimal emphasis on the scientific and technological aspects Taking into account these practical considerations the second edition of Science and Technology of Terrorism and Counterterrorism discusses the nature of terrorism and the materials used by terrorists It describes how intelligence professionals and law enforcement personnel can detect and destroy these materials and how they can deal with terrorist groups This volume begins by introducing the shift in analysis of terrorist attacks after September 11 2001 and summarizes selected case studies It discusses the origin and nature of terrorism and the factors involved in diplomacy Covering a broad range of topics the book examines Aerosol dispersion of toxic materials Bioterrorism and the manufacture detection and delivery of biological agents Agricultural terrorism Nuclear terrorism and nuclear weapons systems threats and safeguards Chemical terrorism including manufacture detection delivery and decontamination Cyber terrorism Personal protective equipment The role of government at federal state and local levels The role of international agencies and their resources capabilities and responsibilities The National Infrastructure Protection Plan As terrorist activities increase globally it is critical that those charged with protecting the public understand the myriad of ways in which terrorists operate While

we cannot predict where when and how terrorists will strike our vigilance in staying abreast of the terrorist threat is the only way to have a fighting chance against those who seek to destroy our world *Multi-spectral and Intelligent Sensing* Liting Wang,Xiaoming Tao,Lu Sun,Wentao Shen,2024-10-15 This book provides a concise overview of intelligent technologies for vision and sensing with a particular focus on their applications in various multispectral configurations including safety monitoring in rural areas Within the realm of intelligent perception and contemporary healthcare the book emphasizes the real time monitoring analysis and prediction of vital signals using biomedical optical sensors This approach aims to offer more adaptable and personalized services within the medical health management domain Furthermore the book delves into the comprehensive comprehension of physiological signals and additional data sources such as environmental and motion data The goal is to enhance the breadth and depth of data analysis providing more integrated support for the life and health sector Additionally the book explores the implementation of edge intelligence algorithms at the sensor level to enable real time analysis enhancing the efficiency of sensor data processing and utilization Detailed explanations of the configuration and deployment of an active vision camera system featuring an integrated edge algorithm are provided to elucidate the coordination and communication mechanisms of edge intelligence technology across multiple edge devices A specific application case is then presented the universal camera jamming system which underscores the benefits of intelligent sensing fusion for tasks such as attitude and position recognition as well as self feedback excitation jamming The book underscores the pervasive and seamless integration of smart sensing in both current and future lifestyles spanning from active vision cameras to diverse applications across multiple spectrums Its insights are poised to stimulate innovation and application within the realms of smart vision and sensing including a comprehensive analysis of future healthcare paradigms

Structural Health Monitoring of Long-Span Suspension Bridges You Lin Xu,Yong Xia,2011-08-31 Long span suspension bridges cost billions In recent decades structural health monitoring systems have been developed to measure the loading environment and responses of these bridges in order to assess serviceability and safety while tracking the symptoms of operational incidents and potential damage This helps ensure the bridge functions properly during a long service life and guards against catastrophic failure under extreme events Although these systems have achieved some success this cutting edge technology involves many complex topics that present challenges to students researchers and engineers alike Systematically introducing the fundamentals and outlining the advanced technologies for achieving effective long term monitoring Structural Health Monitoring of Long Span Suspension Bridges covers The design of structural health monitoring systems Finite element modelling and system identification Highway loading monitoring and effects Railway loading monitoring and effects Temperature monitoring and thermal behaviour Wind monitoring and effects Seismic monitoring and effects SHMS based rating method for long span bridge inspection and maintenance Structural damage detection and test bed establishment These are applied in a rigorous case study using more than ten years worth of data to the Tsing Ma

suspension bridge in Hong Kong to examine their effectiveness in the operational performance of a real bridge The Tsing Ma bridge is the world's longest suspension bridge to carry both a highway and railway and is located in one of the world's most active typhoon regions Bridging the gap between theory and practice this is an ideal reference book for students researchers and engineering practitioners *Sensors and Instrumentation, Aircraft/Aerospace and Energy Harvesting , Volume 8* Evro Wee Sit,Chad Walber,Patrick Walter,Alfred Wicks,2025-08-07 Sensors and Instrumentation Volume 8 Proceedings of the 36th IMAC A Conference and Exposition on Structural Dynamics 2018 the eighth volume of nine from the Conference brings together contributions to this important area of research and engineering The collection presents early findings and case studies on fundamental and applied aspects of Sensors and Instrumentation including papers on Sensor Applications Accelerometer Design Accelerometer Calibration Sensor Technology Energy Harvesting Technology Aircraft Aerospace Technology *Design and Computation of Modern Engineering Materials* Andreas Öchsner,Holm Altenbach,2014-07-01 The idea of this monograph is to present the latest results related to design and computation of engineering materials and structures The contributions cover the classical fields of mechanical civil and materials engineering up to biomechanics and advanced materials processing and optimization The materials and structures covered can be categorized into modern steels and titanium alloys composite materials biological and natural materials material hybrids and modern joining technologies Analytical modelling numerical simulation the application of state of the art design tools and sophisticated experimental techniques are applied to characterize the performance of materials and to design and optimize structures in different fields of engineering applications **Advances in Imaging and Electron Physics** ,2012-10-22 This special volume of Advances in Imaging and Electron Physics details the current theory experiments and applications of neutron and x ray optics and microscopy for an international readership across varying backgrounds and disciplines Edited by Dr Ted Cremer these volumes attempt to provide rapid assimilation of the presented topics that include neutron and x ray scatter refraction diffraction and reflection and their potential application Contributions from leading authorities Informs and updates on all the latest developments in the field

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