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Fruit Grading Using Digital Image Processing Techniques

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Abstract: New safe and fast methods for grading of fruits have important place in agricultural economy. At the present time traditional grading methods have still been used broadly. But high costs and some inconsistencies guide post harvesting industry to automation applications in classification operations.
Recently, enterprises incline towards to automation systems for increasing working capacity and decreasing working costs. Inconsistencies associated with manual grading decrease when automated grading systems are used. Thus, error rate and costs decrease while speed increases.
As known; size, shape, color and tissue are base criteria in the classification process. In this study, automatic apple grading by size and color using digital cameras and computerized image processing techniques were studied. The assembled system has achieved basic tasks but it needs to be developed further.
Key words: Image process, Digital image process, Machine vision, Fruit classification

Bilgisayarlı Görüntü İşleme Yöntemleri ile Elma Taşnifi

Özet: Meyvelerin güvenilir ve hızlı bir şekilde sınıflandırılması için geliştirilen yeni yöntemler, tarımsal endüstride teknik ve ekonomik açıdan önemli bir yere sahiptir. Günümüzde halen yaygın olarak el ile sınıflandırma yöntemi kullanılmaktadır. El ile yapılan sınıflandırmadaki yüksek maliyet ve ölçü tutarsızlıkları hasat sonrası endüstriyi sınıflama operasyonlarında otomasyon uygulamasına gitmeye yönlendirmektedir.
Son yıllarda işletmeler iş kapasitelerini arttırmak ve işletme maliyetlerini düşürmek amacıyla otomasyon sistemlerine yönelmektedir. Otomatik sınıflandırma ile meyve tasnifi sayesinde el ile sınıflandırmada yaşanabilecek insan faktöründen kaynaklanan tutarsızlıklar en aza inerek hata oranı büyük ölçüde düşmekte, hız artmakta ve maliyet azalmaktadır.
Bilindiği gibi geleneksel yöntemlerle elmaların sınıflandırılmasında boyut, şekil, renk ve doku gibi özellikler sınıflandırmanın temel kriterleridir. Bu çalışmada dijital kameralar ve bilgisayarlı görüntü işleme teknikleri kullanılarak elmaların otomatik olarak boy ve renk ayrımı yapılmaya çalışılmıştır. Elde edilen düzenek temel olarak işlevlerini yerine getirmekle birlikte geliştirmeye açıktır.
Anahtar kelimeler: Görüntü işleme, Sayısal Görüntü işleme, Makine görüsü, Meyve tasnifi.

INTRODUCTION

Summary of Literature

In the studies of non destructive fruit classification apple (Bern *et al.*, 2002; Bennedsen *et al.*, 2005; Rehkugler *et al.*, 1986), tomato (Wolfe *et al.*, 1989), orange (Pla *et al.*, 1993), wild myrtle and pepper (Wolfe *et al.*, 1983), prune (Delwiche *et al.*, 1993), wild grass (Hegger *et al.*, 1983), potato (McClure *et al.*, 1988) was examined.

To detect the fruit in front of camera, in some studies images taking from the camera are processing continuously (Hegger *et al.*, 1983, 1984) on the other hand some studies use sensor (Shropshire *et al.*, 1988).

Various studies have been done on the colors of fruit. Bern (2002), make color classification using RGB color components and CIE chromaticity with Matlab, make size classification with form factor and box structure methods.

McClure (1988) works with white potatoes to detect size and shape information, Rehkugler and Throop (1986) works with "Red Delicious" apples to detect defects of apples. Monochrome camera was used in both studies. At the end of works greens and other scars of potatoes creases and blemishes (reddish brown) of apples couldn't detected with

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Recent Advances in Postharvest Technologies, Volume 2 Noureddine Benkeblia,2024-09-10 The elapsing time from producer to consumer has significantly increased as a result of food marketing and trade globalization Consequently maintaining quality along the food value chain is becoming a significant challenge Postharvest losses are considered a major component of food loss and waste in the supply chain from farmers to consumers due to improper handling storage transport preservation techniques and spoilage Postharvest science aims to extend the shelf life of fresh and perishable commodities and to reduce heavy losses thereby contributing to food security While significant progresses have been made in postharvest preservation and shelf life extension the continuous development of emerging technologies have changed our vision on postharvest science Furthermore recent advancements in molecular engineering of horticultural crops for quality improvement the development of genomics transcriptomics proteomics and metabolomics have led to a better understanding of the physiology and the biochemistry of the senescence processes resulting in better preservation and improved production of fresh crops This two volume work focuses on innovative technologies that extend and preserve shelf life of fruits and vegetables Volume 1 offers a review on the state of the art modern technologies in the postharvest filed The accompanying Volume 2 explores advanced and novel technologies after harvest particularly the application of nanotechnologies to packaging materials **Modern Techniques for Agricultural Disease Management and Crop Yield Prediction** Pradeep, N.,Kautish, Sandeep,Nirmala, C.R.,Goyal, Vishal,Abdellatif, Sonia,2019-08-16 Since agriculture is one of the key parameters in assessing the gross domestic product GDP of any country it has become crucial to transition from traditional agricultural practices to smart agriculture New agricultural technologies provide numerous opportunities to maximize crop yield by recognizing and analyzing diseases and other natural variables that may affect it Therefore it is necessary to understand how computer assisted technologies can best be utilized and adopted in the conversion to smart agriculture Modern Techniques for Agricultural Disease Management and Crop Yield Prediction is an essential publication that widens the spectrum of computational methods that can aid in agriculture disease management weed detection and crop yield prediction Featuring coverage on a wide range of topics such as soil and crop sensors swarm robotics and weed detection this book is ideally designed for environmentalists farmers botanists agricultural engineers computer engineers scientists researchers practitioners and students seeking current research on technology and techniques for agricultural diseases and predictive trends Computational Intelligence and Image Processing in Agriculture Jay Kumar Pandey,Mritunjay Rai,Tanmay Sarkar,2025-11-27 Revolutionizing Agricultural Quality Control with AI Image Processing and Computational Intelligence Techniques As the global demand for high quality sustainable agricultural products increases advanced technology becomes critical in meeting these challenges Computational Intelligence and Image Processing in Agriculture explores how innovative technologies are transforming agricultural quality evaluation Combining foundational concepts with

practical applications this comprehensive text delves into innovative techniques to improve accuracy efficiency and sustainability in quality control Addressing key challenges faced by researchers practitioners and industry professionals contributions from leading experts in AI agriculture and computational intelligence provide a deep understanding of technologies such as deep learning computer vision and AI driven robotics Real world examples step by step tutorials and code snippets make the concepts accessible and actionable while coverage of emerging trends and future directions highlights the evolving landscape of agricultural technology Offering interdisciplinary insights and practical tools to modernize evaluation techniques reduce waste enhance food safety and meet the growing demands of sustainable farming practices this book Addresses challenges and solutions for real time monitoring systems in agriculture Highlights cutting edge applications such as AI driven robotics and LiDAR in farming Emphasizes sustainability and environmental impact through technological innovation Offers detailed coverage of image analysis algorithms for quality control Discusses ethical and environmental implications of technology in agriculture This book is ideal for advanced undergraduate and graduate courses in agricultural engineering computer science and AI applications It is also an essential reference for professionals including agricultural scientists AI practitioners and quality control experts **Handbook of Research on AI-Equipped IoT Applications in High-Tech Agriculture** Khang, Alex,2023-08-02 The agriculture industry is facing significant challenges in meeting the increasing demand for food while also ensuring sustainable development Traditional agricultural methods are not equipped to meet the demands of the modern world To overcome these challenges the Handbook of Research on AI Equipped IoT Applications in High Tech Agriculture provides an in depth analysis of the opportunities and challenges for AI powered management tools and IoT equipped techniques for the high tech agricultural ecosystem The Handbook of Research on AI Equipped IoT Applications in High Tech Agriculture explores advanced methodologies models techniques technologies and applications along with the concepts of real time supporting systems to help agricultural producers adjust plans or schedules for taking care of their farms Additionally it discusses the role of IoT technologies and AI applications in agricultural ecosystems and their potential to improve product quality and market competitiveness The book includes discussions on the application of blockchain biotechnology drones robotics data analytics and visualization in high tech agriculture It is an essential reference for anyone interested in the future of high tech agriculture including agricultural analysts investment analysts scholars researchers academics professionals engineers and students **International Conference on Wireless, Intelligent, and Distributed Environment for Communication** Isaac Woungang,Sanjay Kumar Dhurandher,2018-04-17 This book presents the proceedings of the International Conference on Wireless Intelligent and Distributed Environment for Communication WIDECOM 2018 organized by SRM University NCR Campus New Delhi India February 16 18 2018 The conference focuses on challenges with respect to the dependability of integrated applications and intelligence driven security threats against the platforms supporting these applications The WIDECOM 2018 proceedings

features papers addressing issues related to the new dependability paradigms design control and management of next generation networks performance of dependable network computing and mobile systems protocols that deal with network computing mobile ubiquitous systems cloud systems and Internet of Things IoT systems The proceeding is a valuable reference for researchers instructors students scientists engineers managers and industry practitioners in industry in the aforementioned areas The book s structure and content is organized in such a manner that makes it useful at a variety of learning levels Presents the proceedings of the International Conference on Wireless Intelligent and Distributed Environment for Communication WIDECOM 2018 organized by SRM University NCR Campus New Delhi India February 16 18 2018 Includes an array of topics related to new dependability paradigms design control and management of next generation networks performance of dependable network computing and mobile systems protocols that deal with network computing mobile ubiquitous systems cloud systems and Internet of Things IoT systems Addresses issues related to the design and performance of dependable network computing and systems and to the security of these systems **Communication and Intelligent Systems** Harish Sharma,Vivek Shrivastava,Kusum Kumari Bharti,Lipo Wang,2023-07-24 This book gathers selected research papers presented at the Fourth International Conference on Communication and Intelligent Systems ICCIS 2022 organized by National institute of Technology Delhi India during December 19 20 2022 This book presents a collection of state of the art research work involving cutting edge technologies for communication and intelligent systems Over the past few years advances in artificial intelligence and machine learning have sparked new research efforts around the globe which explore novel ways of developing intelligent systems and smart communication technologies The book presents single and multi disciplinary research on these themes in order to make the latest results available in a single readily accessible source The book is presented in two volumes Emerging Research in Data Engineering Systems and Computer Communications P. Venkata Krishna,Mohammad S. Obaidat,2020-02-10 This book gathers selected papers presented at the 2nd International Conference on Computing Communications and Data Engineering held at Sri Padmavati Mahila Visvavidyalayam Tirupati India from 1 to 2 Feb 2019 Chiefly discussing major issues and challenges in data engineering systems and computer communications the topics covered include wireless systems and IoT machine learning optimization control statistics and social computing Machine Learning and Artificial Intelligence for Smart Agriculture Chuanlei Zhang,Dong Sun Park,Sook Yoon,Shanwen Zhang,2023-02-09 Control Applications in Post-harvest and Processing Technology 1998 I. Farkas,1998 The aim of the CAPPT 98 workshop was to provide a forum for presentation and discussion of recent advances on control applications in post harvest and processing technology The sponsors were International Society of Horticultural Sciences ISHS International Commission of Agricultural Engineering CIGR European Society of Agricultural Engineers EurAgEng Gouml douml llodblac University of Agricultural Sciences and Hungarian Academy of Sciences National Committee for Technological Development Hungary The venue of the workshop was the Hotel Eacute ben in Budapest and also the Campus

of the Gouml douml llodblac University of Agricultural Sciences Progress in Mechatronics and Information Technology Keon Myung Lee,Prasad Yarlagadda,Yang Ming Lu,2013-11-15 Selected peer reviewed papers from the 2013 International Conference on Mechatronics and Information Technology ICMIT 2013 October 19 20 2013 Guilin China Applications of Digital Image Processing ,1999 Proceedings of the International Conference Postharvest Unlimited, Downunder 2004 D. J. Tanner,Brian P. F. Day,2005 **Automatic Detection of Surface Blemishes on Apples Using Digital Image Processing** Gerald L. Graf,1982 **Optics for Natural Resources, Agriculture, and Foods** ,2006 Controlled Environment Production System for Sustainable Agricultural Production ,2006 *Transactions of the ASAE.* American Society of Agricultural Engineers,1995 **International Conference on Intelligent Manufacturing** Ji Zhou,1995 **Digital Signal Processing Applications** ,2000 *Second International Peach Symposium* Donald Claude Coston,1989 Contains symposium and conference papers from four previously published volumes 1985 1998 Palm Mech 2010 ,2010

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