



RESEARCH ARTICLE

Prediction of ROP Zones Using Deep Learning Algorithms and Voting Classifier Technique

Nazar Salih^{1,2} · Mohamed Ksantini² · Nebras Hussein³ · Donia Ben Halima² · Ali Abdul Razzaq⁴ · Sohaib Ahmed⁴

Received: 30 January 2023 / Accepted: 11 May 2023
© The Author(s) 2023

Abstract

Retinopathy of prematurity (ROP) can cause blindness in premature neonates. It is diagnosed when new blood vessels form abnormally in the retina. However, people at high risk of ROP might benefit significantly from early detection and treatment. Therefore, early diagnosis of ROP is vital in averting visual impairment. However, due to a lack of medical experience in detecting this condition, many people refuse treatment; this is especially troublesome given the rising cases of ROP. To deal with this problem, we trained three transfer learning models (VGG-19, ResNet-50, and EfficientNetB5) and a convolutional neural network (CNN) to identify the zones of ROP in preterm newborns. The dataset to train the model contains 1365 fundus images from the ROP screening. This dataset was gathered from the Private Clinic Al-Amal Eye center in Baghdad, Iraq. The models above are ensemble through voting classifier techniques to increase the performance. The proposed method had an overall accuracy of 88.82 percent when employing the voting classifier. On the other hand, EfficientNetB5 has outperformed other models in terms of accuracy with 87.27%.

Keywords Artificial intelligence · Machine learning · Deep learning · Deep convolutional neural networks · Voting classifier · Retinopathy of prematurity · Fundus images

Abbreviations

ROP	Retinopathy of prematurity
AI	Artificial intelligence
ICROP	International classification of retinopathy of prematurity
RETCAM	Retinal camera
DL	Deep learning
ML	Machine learning
CNN	Convolutional neural network
DCNN	Deep convolutional neural network
DNN	Deep neural network
AUC	Area under the curve
ROC	Receiver operating characteristics

KIDROP	Karnataka internet-assisted diagnosis of retinopathy of prematurity
VGG	Visual geometry group
GA	Genetic algorithm
GPU's	Graphics processing units
SVM	Support vector machine
Tele- ROP	Telemedical retinopathy of prematurity

1 Introduction

In 1940, Terry was the primary researcher to define and characterize retinopathy of prematurity (ROP) as retrolental fibroplasia caused by a retinal detachment behind the lens [1]. Since then, it has been generally accepted that this is the primary cause of childhood blindness worldwide [2–4]. As a result, with the advent of neonatal intensive care units, there has been an increase in the percentage of newborns that survive birth at a gestational age of fewer than 37 weeks [2]. As many as 15 million infants are born each year prematurely worldwide [3]. These days, ROP is a major public health issue [4]. Some significant causes of ROP-related blindness are a paucity of ophthalmologists trained to diagnose and treat the disease and a lack of delayed screening [4]. If

✉ Nazar Salih
nazar.s2009@yahoo.com

¹ National School of Electronic and Telecommunications, University of Sfax, Sfax, Tunisia

² Control and Energies Management Laboratory (CEM-Lab), National Engineering School of Sfax, University of Sfax, Sfax, Tunisia

³ Biomedical Engineering Department, Al-Khwarizmi College of Engineering University of Baghdad, Baghdad, Iraq

⁴ Ibn AL Haitham Teaching Eye Hospital, Baghdad, Iraq

Read 326 F2004 Rop

Lingsheng Yao



Read 326 F2004 Rop:

Getting the books **Read 326 F2004 Rop** now is not type of inspiring means. You could not forlorn going later book stock or library or borrowing from your connections to edit them. This is an completely simple means to specifically get guide by on-line. This online broadcast Read 326 F2004 Rop can be one of the options to accompany you past having further time.

It will not waste your time. resign yourself to me, the e-book will categorically expose you extra business to read. Just invest little times to entry this on-line publication **Read 326 F2004 Rop** as capably as review them wherever you are now.

https://crm.avenza.com/About/scholarship/default.aspx/nevada_climbing_guide_book.pdf

Table of Contents Read 326 F2004 Rop

1. Understanding the eBook Read 326 F2004 Rop
 - The Rise of Digital Reading Read 326 F2004 Rop
 - Advantages of eBooks Over Traditional Books
2. Identifying Read 326 F2004 Rop
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Read 326 F2004 Rop
 - User-Friendly Interface
4. Exploring eBook Recommendations from Read 326 F2004 Rop
 - Personalized Recommendations
 - Read 326 F2004 Rop User Reviews and Ratings
 - Read 326 F2004 Rop and Bestseller Lists
5. Accessing Read 326 F2004 Rop Free and Paid eBooks
 - Read 326 F2004 Rop Public Domain eBooks

- Read 326 F2004 Rop eBook Subscription Services
- Read 326 F2004 Rop Budget-Friendly Options
- 6. Navigating Read 326 F2004 Rop eBook Formats
 - ePub, PDF, MOBI, and More
 - Read 326 F2004 Rop Compatibility with Devices
 - Read 326 F2004 Rop Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Read 326 F2004 Rop
 - Highlighting and Note-Taking Read 326 F2004 Rop
 - Interactive Elements Read 326 F2004 Rop
- 8. Staying Engaged with Read 326 F2004 Rop
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Read 326 F2004 Rop
- 9. Balancing eBooks and Physical Books Read 326 F2004 Rop
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Read 326 F2004 Rop
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Read 326 F2004 Rop
 - Setting Reading Goals Read 326 F2004 Rop
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Read 326 F2004 Rop
 - Fact-Checking eBook Content of Read 326 F2004 Rop
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

Read 326 F2004 Rop Introduction

In the digital age, access to information has become easier than ever before. The ability to download Read 326 F2004 Rop has revolutionized the way we consume written content. Whether you are a student looking for course material, an avid reader searching for your next favorite book, or a professional seeking research papers, the option to download Read 326 F2004 Rop has opened up a world of possibilities. Downloading Read 326 F2004 Rop provides numerous advantages over physical copies of books and documents. Firstly, it is incredibly convenient. Gone are the days of carrying around heavy textbooks or bulky folders filled with papers. With the click of a button, you can gain immediate access to valuable resources on any device. This convenience allows for efficient studying, researching, and reading on the go. Moreover, the cost-effective nature of downloading Read 326 F2004 Rop has democratized knowledge. Traditional books and academic journals can be expensive, making it difficult for individuals with limited financial resources to access information. By offering free PDF downloads, publishers and authors are enabling a wider audience to benefit from their work. This inclusivity promotes equal opportunities for learning and personal growth. There are numerous websites and platforms where individuals can download Read 326 F2004 Rop. These websites range from academic databases offering research papers and journals to online libraries with an expansive collection of books from various genres. Many authors and publishers also upload their work to specific websites, granting readers access to their content without any charge. These platforms not only provide access to existing literature but also serve as an excellent platform for undiscovered authors to share their work with the world. However, it is essential to be cautious while downloading Read 326 F2004 Rop. Some websites may offer pirated or illegally obtained copies of copyrighted material. Engaging in such activities not only violates copyright laws but also undermines the efforts of authors, publishers, and researchers. To ensure ethical downloading, it is advisable to utilize reputable websites that prioritize the legal distribution of content. When downloading Read 326 F2004 Rop, users should also consider the potential security risks associated with online platforms. Malicious actors may exploit vulnerabilities in unprotected websites to distribute malware or steal personal information. To protect themselves, individuals should ensure their devices have reliable antivirus software installed and validate the legitimacy of the websites they are downloading from. In conclusion, the ability to download Read 326 F2004 Rop has transformed the way we access information. With the convenience, cost-effectiveness, and accessibility it offers, free PDF downloads have become a popular choice for students, researchers, and book lovers worldwide. However, it is crucial to engage in ethical downloading practices and prioritize

personal security when utilizing online platforms. By doing so, individuals can make the most of the vast array of free PDF resources available and embark on a journey of continuous learning and intellectual growth.

FAQs About Read 326 F2004 Rop Books

What is a Read 326 F2004 Rop PDF? A PDF (Portable Document Format) is a file format developed by Adobe that preserves the layout and formatting of a document, regardless of the software, hardware, or operating system used to view or print it. **How do I create a Read 326 F2004 Rop PDF?** There are several ways to create a PDF: Use software like Adobe Acrobat, Microsoft Word, or Google Docs, which often have built-in PDF creation tools. Print to PDF: Many applications and operating systems have a "Print to PDF" option that allows you to save a document as a PDF file instead of printing it on paper. Online converters: There are various online tools that can convert different file types to PDF. **How do I edit a Read 326 F2004 Rop PDF?** Editing a PDF can be done with software like Adobe Acrobat, which allows direct editing of text, images, and other elements within the PDF. Some free tools, like PDFescape or Smallpdf, also offer basic editing capabilities. **How do I convert a Read 326 F2004 Rop PDF to another file format?** There are multiple ways to convert a PDF to another format: Use online converters like Smallpdf, Zamzar, or Adobe Acrobats export feature to convert PDFs to formats like Word, Excel, JPEG, etc. Software like Adobe Acrobat, Microsoft Word, or other PDF editors may have options to export or save PDFs in different formats. **How do I password-protect a Read 326 F2004 Rop PDF?** Most PDF editing software allows you to add password protection. In Adobe Acrobat, for instance, you can go to "File" -> "Properties" -> "Security" to set a password to restrict access or editing capabilities. Are there any free alternatives to Adobe Acrobat for working with PDFs? Yes, there are many free alternatives for working with PDFs, such as: LibreOffice: Offers PDF editing features. PDFsam: Allows splitting, merging, and editing PDFs. Foxit Reader: Provides basic PDF viewing and editing capabilities. **How do I compress a PDF file?** You can use online tools like Smallpdf, ILovePDF, or desktop software like Adobe Acrobat to compress PDF files without significant quality loss. Compression reduces the file size, making it easier to share and download. **Can I fill out forms in a PDF file?** Yes, most PDF viewers/editors like Adobe Acrobat, Preview (on Mac), or various online tools allow you to fill out forms in PDF files by selecting text fields and entering information. Are there any restrictions when working with PDFs? Some PDFs might have restrictions set by their creator, such as password protection, editing restrictions, or print restrictions. Breaking these restrictions might require specific software or tools, which may or may not be legal depending on the circumstances and local laws.

Find Read 326 F2004 Rop :

nevada climbing guide book

~~new holland 570 baler owners manual~~

new headway elementary third edition

new holland header parts manual cr970

networking windows field guide

new holland 516 manual

neurotransmitters module regulation answers

new holland l220 manual

new holland 310 baler parts manual

new holland 1045 bale wagon service manual

nevermind nouvelles grunge et noires

new english file uppermediate workbook answer key

new headway intermediate fourth edition workbook key

new holland ls160 manual

new holland 849 baler repair manual

Read 326 F2004 Rop :

STAAR Algebra 1 Practice Test Questions STAAR Algebra 1 Practice Test Questions. Prepare with our STAAR Study Guide and Practice Questions. Print or eBook. Guaranteed to raise your score. Math with Ms. Jones at AHHS - Algebra 1 EOC Review A website that has 29 pages of review for the STAAR EOC test. [http ...](http://...) Algebra 1 STAAR Review 1 Algebra 1 STAAR Review 2 Algebra 1 EOY Test (Not Texas). Staar algebra 1 review GOOGLE FORMS STAAR ALGEBRA 1 EOC Review Reporting Category 5 TEST PREP ... This is the 2019 STAAR released test spread out over one week of instruction. There ... Algebra IPractice Assessment 3 A graph of a quadratic function is shown. What are the x-intercepts of the function? Shade the TWO correct circles that represent the points. Algebra I. Staar algebra review Algebra 1 STAAR EOC Review Practice Foldable Booklet BUNDLE. Created by. Algebra Accents. These FIVE Independent Practice Booklets are specifically aligned ... STAAR Review - Algebra I Algebra I. STAAR released test- use for practice/preparation. [staar-eoc-testalgi.pdf](#). File Size: 3368 kb. File Type: pdf. Download File. Tuesday, 4/29/14 ... STAAR Algebra I May 2021 Released Read each question carefully. For a multiple-choice question, determine the best answer to the question from the four answer choices provided.

For a. Algebra I EOC STAAR Review Activities The ESC-18 Math Team has created a variety of activities where students practice and apply important grade-level TEKS aligned topics to cement their learning. STAAR Algebra 1 Test Prep - Tutoring - MathHelp.com Our STAAR Algebra 1 test prep course is an online study guide with video tutoring and practice tests covering the exact questions on the exam. The Uses of Excess in Visual and Material Culture, 1600- ... This volume examines a range of material, including diamonds, ceramics, paintings, dollhouses, caricatures, interior design and theatrical performances. Each ... The Uses of Excess in Visual and Material Culture, 1600- ... Aug 28, 2014 — This volume examines a range of material - including ceramics, paintings, caricatures, interior design and theatrical performances - in various ... (PDF) Introduction: The Uses of Excess | Julia Skelly Introduction: The Uses of Excess. Profile image of Julia Skelly Julia Skelly. 2014, The Uses of Excess in Visual and Material Culture, 1600-2010. See Full PDF The uses of excess in visual and material culture, 1600- ... Introduction: the uses of excess / Julia Skelly -- All that glitters: diamonds and constructions of nabobery in British portraits, 1600-1800 / Romita Ray ... The Uses of Excess in Visual and Material Culture, 1600 ... Title: The Uses of Excess in Visual and Material ... Publisher: Ashgate. Publication Date: 2014. Binding: Hardcover. Condition: Very Good. The Uses of Excess in Visual and Material Culture ... The Uses of Excess in Visual and Material Culture, 16002010 by Skelly New-, ; Condition. Brand New ; Quantity. 3 available ; Item Number. 312791398798 ; PublishedOn. The Uses of Excess in Visual and Material Culture, 1600 ... This volume examines a range of material, including diamonds, ceramics, paintings, dollhouses, caricatures, interior design and theatrical performances. Each ... The Uses Of Excess In Visual And Material Culture, 1600- ... Buy the book The Uses Of Excess In Visual And Material Culture, 1600-2010 by julia skelly,skelly julia at Indigo. Julia Skelly The Uses of Excess in Visual and Material Culture, 1600-2010 (Hardcover). Now\$15400. current price Now \$154.00. \$178.36. Was \$178.36. The Uses of Excess in ... Uses of Excess in Visual and Material Culture, 1600-2010 Although the idea of excess has often been used to degrade, many of the essays in this collection demonstrate how it has also been used as a strategy for ... Chicken Nutrition Covers theory of poultry nutrition making it easier to recognise problems. Including info on different species, vitamins, minerals, anatomy, health and enzymes. Chicken Nutrition: A Guide for Nutritionists... by Rick Kleyn This is the most up to date, complete and practical guide to chicken nutrition that you can buy. It covers the underlying theory of poultry nutrition making ... Chicken Nutrition: A guide for nutritionists and poultry ... Oct 10, 2022 — PDF | On Oct 10, 2022, Rick Kleyn published Chicken Nutrition: A guide for nutritionists and poultry professionals | Find, read and cite all ... Chicken Nutrition: A Guide for Nutritionists and Poultry ... Chicken Nutrition: A Guide for Nutritionists and Poultry Professionals by Rick Kleyn (2013-01-01) [unknown author] on Amazon.com. Chicken Nutrition: A Guide for Nutritionists and Poultry ... This is the most up to date, complete and practical guide to chicken nutrition that you can buy. It covers the underlying theory of poultry nutrition making ... Chicken Nutrition - A Guide For Nutritionists and Poultry ... Chicken Nutrition: A Guide for Nutritionists and Poultry Professionals Alerta. by Rick Kleyn

About this book: This is the most up to date, complete and ... Chicken Nutrition: A Guide for Nutritionists and Poultry ... Title, Chicken Nutrition: A Guide for Nutritionists and Poultry Professionals ; Author, Rick Kleyn ; Publisher, Context, 2013 ; ISBN, 189904342X, 9781899043422. Foreword by S Leeson · 2013 — Chicken Nutrition. A guide for nutritionists and poultry professionals. I. Kleyn, F.J.. ISBN 978-1-899043-42-2. © Context 2013. All rights ... Chicken Nutrition: A Guide for Nutritionists and Poultry ... This is the most up to date, complete and practical guide to chicken nutrition that you can buy. It covers the underlying theory of poultry nutrition making it ... Chicken nutrition : a guide for nutritionists and poultry ... Chicken nutrition : a guide for nutritionists and poultry professionals | WorldCat.org.