Date of publication xxxx 00, 0000, date of current version xxxx 00, 0000. Paped Otion Mineton Philippace 2017, pdf

Managing Distributed Machine Learning Lifecycle for Healthcare Data in the Cloud

Engin Zeydan*, (Senior Member, IEEE), Suayb S. Arslan†, (Senior Member, IEEE), Madhusanka Liyanage‡, (Senior Member, IEEE).

¹E. Zaysker in with Center Tourseligie de Telecomonicacions de Catalony a. Castellidelich, Barcellona Spain, 08800. Email: engin anydon-flytte cut.
²S. S. Andlan is with the Department of Computer Engineering, Begazin; University, Intastral, Teckiye and Beain and Cognitive Sciences. Manuachusasta Institute of Technology, Cambridge, 36A , USA. Emails: susyly arelant@bequire.inda.tr. survivalen@mat.ods

M. Liyanage is with School of Computer Science, University College Dublin, Ireland. Email: multimanka/Fued in

CORRESPONDING AUTHOR: Madhusanka Liyanape te-mail: madhusanka@ucd.ie).

This work has been partially supported by CUST Action CA22104 Beingwise, Cybersecurity Research Program Flanders - second cycle (VOEWICS02) project, the Science Foundation Include under CONNECT phase 2 (Grant no. 13/RC/2007_P2) project, the Spanish Ministry of Economy and Competitiveness (MINECO) — Program UNICO I+D under Gram TSI-063000-2021-54, Grant TSI-063000-2021-55, "ERD# A way of making Europe" project funded by MCEN/AEE/10.13009/S01000011003 under grant PID2021-126431008-100 and Generalized de Catalogy agrant 2021-56R 00770.

ABSTRACT

The main objective of this paper is to highlight the research directions and explain the main roles of current Artificial Intelligence (AI)/Machine Learning (ML) frameworks and available cloud infrastructures in building end-to-end ML lifecycle management for healthcare systems and sensitive biomedical data. We identify and explore the versatility of many genuine techniques from distributed computing and current state-of-the-art ML research, such as building cognition-inspired learning pipelines and federated learning (FL) ecosystem. Additionally, we outline the advantages and highlight the main obstacles of our methodology utilizing contemporary distributed secure ML techniques, such as FL, and tools designed for managing data throughout its lifecycle. For a robust system design, we present key architectural decisions essential for optimal healthcare data management, focusing on security, privacy and interoperability. Finally, we discuss ongoing efforts and future research directions to overcome existing challenges and improve the effectiveness of Al/ML applications in the healthcare domain.

INDEX TERMS Machine Learning, Healthcare, Biomedicine, Data Management, Federated Learning, Cloud, Coded Computation, Distributed Systems

I. INTRODUCTION

RADITIONAL healthcare, as a mission-critical domain, is in flux for various reasons: Cost and capacity concerns, ageing populations, personalized treatments, and technological advancements that enable speedy pattern analysis. Data analytics and Artificial Intelligence (AI)/Machine Learning (ML) techniques are paving the way for many use cases in medicine that are quite critical today. At the same time, healthcare and biomedical applications are constantly generating increasingly large and diverse datasets. Information can include a variety of data types, spanning from genetic information to Electronic Health Records (EHRs), which can cover details like patient medical records, important physiological measurements, results from labora-

tory tests, inherited disorders, behavioural tendencies, and more. This information can also be gathered from wearable gadgets utilizing headgear (AR and VR technologies) or networks of body sensors, largely constituting time-series biomedical data. The range of modern biomedical applications is already huge and growing each day. Al in healthcare is shown to help transform medical techniques into better disease treatment and prevention, therapy recommendations, and health management that considers various factors such as a patient's genetic, environmental, and usual lifecycle behaviors. In the present era, AUML methods are employed for diverse purposes: Foreseeing illnesses in high-risk patients requiring additional support [1], aiding individuals with motor impairments [2], uncovering potential drug combinations

Saa Managing Distributed Data

Huangqi Zhang

Saa Managing Distributed Data:

This is likewise one of the factors by obtaining the soft documents of this **Saa Managing Distributed Data** by online. You might not require more grow old to spend to go to the book creation as skillfully as search for them. In some cases, you likewise attain not discover the statement Saa Managing Distributed Data that you are looking for. It will categorically squander the time.

However below, afterward you visit this web page, it will be therefore enormously simple to acquire as well as download guide Saa Managing Distributed Data

It will not consent many become old as we tell before. You can get it though appear in something else at home and even in your workplace. suitably easy! So, are you question? Just exercise just what we have the funds for below as with ease as review **Saa Managing Distributed Data** what you next to read!

https://pinsupreme.com/files/publication/Documents/mcneills%20rangers.pdf

Table of Contents Saa Managing Distributed Data

- 1. Understanding the eBook Saa Managing Distributed Data
 - The Rise of Digital Reading Saa Managing Distributed Data
 - Advantages of eBooks Over Traditional Books
- 2. Identifying Saa Managing Distributed Data
 - Exploring Different Genres
 - $\circ\,$ Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
- 3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Saa Managing Distributed Data
 - User-Friendly Interface
- 4. Exploring eBook Recommendations from Saa Managing Distributed Data

- Personalized Recommendations
- Saa Managing Distributed Data User Reviews and Ratings
- Saa Managing Distributed Data and Bestseller Lists
- 5. Accessing Saa Managing Distributed Data Free and Paid eBooks
 - Saa Managing Distributed Data Public Domain eBooks
 - Saa Managing Distributed Data eBook Subscription Services
 - Saa Managing Distributed Data Budget-Friendly Options
- 6. Navigating Saa Managing Distributed Data eBook Formats
 - o ePub, PDF, MOBI, and More
 - Saa Managing Distributed Data Compatibility with Devices
 - Saa Managing Distributed Data Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Saa Managing Distributed Data
 - Highlighting and Note-Taking Saa Managing Distributed Data
 - Interactive Elements Saa Managing Distributed Data
- 8. Staying Engaged with Saa Managing Distributed Data
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Saa Managing Distributed Data
- 9. Balancing eBooks and Physical Books Saa Managing Distributed Data
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Saa Managing Distributed Data
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Saa Managing Distributed Data
 - Setting Reading Goals Saa Managing Distributed Data
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Saa Managing Distributed Data

- Fact-Checking eBook Content of Saa Managing Distributed Data
- 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

Saa Managing Distributed Data Introduction

In the digital age, access to information has become easier than ever before. The ability to download Saa Managing Distributed Data 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 Saa Managing Distributed Data has opened up a world of possibilities. Downloading Saa Managing Distributed Data 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 Saa Managing Distributed Data 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 Saa Managing Distributed Data. 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 Saa Managing Distributed Data. 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 Saa Managing Distributed Data, 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 Saa Managing Distributed Data 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 Saa Managing Distributed Data Books

How do I know which eBook platform is the best for me? Finding the best eBook platform depends on your reading preferences and device compatibility. Research different platforms, read user reviews, and explore their features before making a choice. Are free eBooks of good quality? Yes, many reputable platforms offer high-quality free eBooks, including classics and public domain works. However, make sure to verify the source to ensure the eBook credibility. Can I read eBooks without an eReader? Absolutely! Most eBook platforms offer web-based readers or mobile apps that allow you to read eBooks on your computer, tablet, or smartphone. How do I avoid digital eye strain while reading eBooks? To prevent digital eye strain, take regular breaks, adjust the font size and background color, and ensure proper lighting while reading eBooks. What the advantage of interactive eBooks? Interactive eBooks incorporate multimedia elements, quizzes, and activities, enhancing the reader engagement and providing a more immersive learning experience. Saa Managing Distributed Data is one of the best book in our library for free trial. We provide copy of Saa Managing Distributed Data in digital format, so the resources that you find are reliable. There are also many Ebooks of related with Saa Managing Distributed Data. Where to download Saa Managing Distributed Data online for free? Are you looking for Saa Managing Distributed Data PDF? This is definitely going to save you time and cash in something you should think about.

Find Saa Managing Distributed Data:

mcneills rangers mcgraw-hill reading units 1 through 6 max lucado he chose the nails may 2002 emergency medicine clinics of north america bioterrorism $\frac{1}{2}$ may an voices for human rights

may day a short history of the international workers holiday 1886-1986.

maurice merleau-ponty between phenomenology and structuralism max ernst sculptures maisons paysages

mcdonalds happy meal toys from the eighties

maximum medium minimum

mccall - an avalon western

mccormacks guides orange 2002 mccormacks guides orange

may maisey moos cowllection of moo tales vol i the convention

matzo ball heiress

mcgraw-hill illustrated encyclopedia of robotics and artificial intelligence

Saa Managing Distributed Data:

the career counselor s handbook parachute library paperback - Sep 26 2022

web the career counselor s handbook parachute library on amazon com au free shipping on eligible orders the career counselor s handbook parachute library

the career counselor s handbook parachute library - Jun 23 2022

web the career counselor s handbook parachute library the internet may 11 2020 this publication for career counselors is an easy to use practical guide to identifying useful websites incorporating them into career planning services and gaining awareness of ethical concerns

the career counselor s handbook the parachute library figler - $Jul\ 25\ 2022$

web the career counselor s handbook the parachute library figler howard bolles richard n amazon es libros the career counselor s handbook the parachute library - Jul 05 2023

web buy the career counselor s handbook the parachute library by figler howard bolles richard n isbn 9781580081573 from amazon s book store everyday low prices and free delivery on eligible orders

the career counselor s handbook the parachute library - May 23 2022

web the career counselor's handbook the parachute library bybolles richard nelson 2000 02 29

the career counselor s handbook parachute library - May 03 2023

web in this revised and updated second edition of their classic guide for career counselors figler and bolles show aspiring

counselors how to break into the business and give experienced counselors ideas for improving effectiveness and recharging their practice

the career counselor s handbook parachute library - Sep 07 2023

web mar 1 2004 the career counselor s handbook parachute library paperback march 1 2004 by richard n bolles author howard e figler author 4 1 4 1 out of 5 stars 85 ratings

the career counselor s handbook parachute library taschenbuch amazon de - Aug 26 2022

web the career counselor s handbook parachute library bolles richard n figler howard e isbn 9781580081573 kostenloser versand für alle bücher mit versand und verkauf duch amazon

amazon in customer reviews the career counselor 39 s handbook - Nov 28 2022

web find helpful customer reviews and review ratings for the career counselor s handbook the parachute library at amazon com read honest and unbiased product reviews from our users

the career counselor s handbook the parachute library - Jun 04 2023

web amazon in buy the career counselor s handbook the parachute library book online at best prices in india on amazon in read the career counselor s handbook the parachute library book reviews author details and more at amazon in free delivery on qualified orders

the career counselor s handbook parachute library paperback amazon de - Mar 01 2023

web the career counselor s handbook parachute library bolles richard n figler howard e amazon de books

amazon com au customer reviews the career counselor 39 s handbook - Oct 28 2022

web find helpful customer reviews and review ratings for the career counselor s handbook parachute library at amazon com read honest and unbiased product reviews from our users

the career counselor s handbook parachute library paperback - Apr 02 2023

web buy the career counselor s handbook parachute library by isbn from amazon s book store everyday low prices and free delivery on eligible orders the career counselor s handbook parachute library amazon co uk books career counselling a handbook gideon arulmani google books - Mar 21 2022

web rent and save from the world's largest ebookstore highlight and take notes across web tablet and phone go to google play now career counselling a handbook gideon arulmani mcgraw hill education india pvt limited 2004 counselling 365 pages bibliographic information title career counselling a handbook author gideon

the career counselor s handbook parachute library - Oct 08 2023

web the career counselor s handbook parachute library bolles richard n figler howard e amazon com tr kitap

the career counselor s handbook parachute library - Aug 06 2023

web comprehensive book from probably the most famous career authors in existence quite complete dealing with everthing from the goals of career counseling to the future of the industry the chapter on history is very detailed and interesting following job hunt theory from the early 1900 s until now advice is providing on setting up a

career counselling books goodreads - Apr 21 2022

web avg rating 3 73 15 ratings published 1993 want to read rate this book 1 of 5 stars 2 of 5 stars 3 of 5 stars 4 of 5 stars 5 of 5 stars mindset the new psychology of success hardcover by carol s dweck shelved 1 time as career counselling avg rating 4 09 142 600 ratings published 2006

the career counselor s handbook parachute library paperback - Jan 31 2023

web the career counselor s handbook parachute library books amazon ca skip to main content ca hello select your address books select the department you want to search in search amazon ca en hello sign in account lists career counseling books goodreads - Feb 17 2022

web bill burnett shelved 2 times as career counseling avg rating 3 91 19 626 ratings published 2016 want to read rate this book 1 of 5 stars 2 of 5 stars 3 of 5 stars 4 of 5 stars 5 of 5 stars never eat alone and other secrets to success one relationship at a time hardcover by keith ferrazzi

amazon com customer reviews the career counselor 39 s handbook - Dec 30 2022

web find helpful customer reviews and review ratings for the career counselor s handbook parachute library at amazon com read honest and unbiased product reviews from our users

journal 1955 1962 reflections on the french algerian war review - Oct 04 2022

web jan 1 2002 we explore important representations of moral dilemmas in prose theater and film that plagued war torn europe and france during world war ii and the algerian war

journal 1955 1962 reflections on the french algerian war - Sep 03 2022

web feb 1 2002 journal 1955 1962 reflections on the french algerian war free download journal 1955 1962 reflections on the french algerian

journal 19551962 reflections on the frenchalgerian war - Feb 25 2022

web journal 19551962 reflections on the frenchalgerian war journal 1955 1962 reflections on the french algerian war february 3rd 2012 find helpful customer

journal 1955 1962 reflections on the french algerian war - Jun 12 2023

web journal 1955 1962 appeared posthumously in french in 1962 and remains the single most important account of everyday life in algeria during decolonization feraoun was one of

journal 1955 1962 reflections on the french algerian war - Jan 07 2023

web journal 1955 1962 reflections on the french algerian war authors mouloud feraoun james d le sueur summary this honest man this good man this man who never did

project muse journal 1955 1962 reflections on the french - Apr 10 2023

web journal 1955 1962 reflections on the french algerian war by mouloud feraoun ed and trans by mary ellen wolf and claude fouillade lincoln u of nebraska p 2000 li 340 pp

journal 19551962 reflections on the frenchalgerian war pdf - Dec 26 2021

web jun 22 2023 right here we have countless book journal 19551962 reflections on the frenchalgerian war and collections to check out we additionally have enough money

journal 19551962 reflections on the frenchalgerian war pdf - Mar 29 2022

web 2 journal 19551962 reflections on the frenchalgerian war 2021 05 27 practitioner carl von clausewitz have received strong criticism political explanations have been said to

journal 1955 1962 reflections on the french algerian war - Nov 05 2022

web however not even the gunmen of the oas could prevent feraoun s journal from being published journal 1955 1962 appeared posthumously in french in 1962 and remains

journal 1955 1962 reflections on the french algerian war - May 11 2023

web journal 1955 1962 reflections on the french algerian war in barely more than 300 pages of text ferling history state univ of west georgia the first of men a life of

journal 1955 1962 reflections on the french algerian - Jul 13 2023

web jan 1 2000 journal 1955 1962 reflections on the french algerian war in barely more than 300 pages of text ferling history state univ of west georgia the first of men a

journal 1955 1962 reflections on the french algerian war - Aug 14 2023

web journal 1955 1962 reflections on the french algerian war by feraoun mouloud publication date 2000 topics feraoun mouloud algeria history revolution 1954

journal 1955 1962 reflections on the french algerian war - Apr 29 2022

web journal 1955 1962 reflections on the french algerian war de feraoun mouloud sur abebooks fr isbn 10~080326903x isbn 13~9780803269033 university of

journal 1955 1962 reflections on the french algerian - $\mathrm{Dec}\ 06\ 2022$

web journal 1955 1962 appeared posthumously in french in 1962 and remains the single most important account of everyday life in algeria during decolonization feraoun was one of

journal 1955 1962 reflections on the french algerian war - May 31 2022

web as a muslim and kabyle writer his reflections on the war in algeria afford penetrating insights into the nuances of algerian nationalism as well as into complex aspects of

journal 1955 1962 reflections on the french algerian war - Feb 08 2023

web stanford libraries official online search tool for books media journals databases government documents and more journal 1955 1962 reflections on the french

journal 1955 1962 reflections on the french algerian war - Jul~01~2022

web jun 1 2000 journal 1955 1962 reflections on the french algerian war by feraoun mouloud isbn13 9780803269033 isbn10 080326903x format paperback

journal 1955 1962 reflections on the french algerian war - Mar 09 2023

web however not even the gunmen of the oas could prevent feraoun s journal from being published journal 1955 1962 appeared posthumously in french in 1962 and remains

journal 19551962 reflections on the frenchalgerian war - Oct 24 2021

web journal 19551962 reflections on the frenchalgerian war journal 1955 1962 reflections on the french algerian war march 28th 2018 browse and read journal

journal 19551962 reflections on the frenchalgerian war 2022 - Jan 27 2022

web less latency era to download any of our books as soon as this one merely said the journal 19551962 reflections on the frenchalgerian war is universally compatible in the

journal 1955 1962 reflections on the french algerian war - Aug 02 2022

web journal 1955 1962 reflections on the french algerian war by feraoun mouloud james d le sueur isbn 10 0803220022 isbn 13 9780803220027 university of

journal 19551962 reflections on the frenchalgerian war - Nov 24 2021

web apr 14 2023 4724485 journal 19551962 reflections on the frenchalgerian war 2 6 downloaded from id blockchain idea gov vn on by guest a long term process they

fast boat to china corporate flight and the conse 2023 - Feb 10 2023

web fast boat to china corporate flight and the conse performing flight apr 11 2021 performing flight sheds new light on moments in the history of us aviation and

fast boat to china corporate flight and the conse - Mar 31 2022

web i d love to get you on a slow boat to china all to myself alone a twist in the rudder and a rip in the sails driftin and dreamin honey throw the compass over the rail verse 4

fast boat to china corporate flight and the - Jul 15 2023

web jan 1 2006 fast boat to china lessons from shanghai corporate flight and the consequences of free trade andrew ross random house 2006 reviewed by

fast boat to china corporate flight and the conse pdf - Dec 08 2022

web 9781400095544 fast boat to china book san antonio public library bullfrog munities plicit andrew ross new york university ilc conferences working group on globalization and

fast boat to china corporate flight and the consequences of - Jun 14 2023

web in fast boat to china andrew ross looks at the controversial issue of offshore outsourcing to china specifically that of white collar jobs at u s global manufacturing and high tech

on a slow boat to china idioms by the free dictionary - Jan 29 2022

web definition of slow boat to china in the idioms dictionary slow boat to china phrase what does slow boat to china expression mean definitions by the largest idiom dictionary

jimmy buffett on a slow boat to china lyrics genius lyrics - Feb 27 2022

web definition of on a slow boat to china in the idioms dictionary on a slow boat to china phrase what does on a slow boat to china expression mean definitions by the largest

fast boat to china corporate flight and the consequences - Apr 12 2023

web sep 9 2023 march 26th 2020 andrew ross a fast boat to china delivered at the cornell global labor conference on february 10 2006 ross is author of the book a fast boat to

fast boat to china corporate flight and the consequences - Nov 07 2022

web within the captivating pages of fast boat to china corporate flight and the conse a literary masterpiece penned by way of a renowned author readers set about a

fast boat to china corporate flight and the conse - Jul 03 2022

web aug $28\ 2019$ moving cargo ships into the slow lane an idea french president emmanuel macron floated at the g7 summit in biarritz would be one way to cut maritime transport s

slow boat to china cargo ships urged to cut speed and - Jun 02 2022

web jun 15 2023 fast boat to china corporate flight and the conse 2 13 downloaded from uniport edu ng on june 15 2023 by guest management is overweening and workers are

 $\textit{fast boat to china corporate flight and the consequences} \textbf{-} \ \text{Nov 26 2021}$

web fast boat to china corporate flight and the conse 3 3 of the contours of work and industry organization under the twin circumstances of digital disruption and a globalizing

fast boat to china corporate flight and the conse pdf - Sep 17 2023

web fast boat to china corporate flight and the conse 1 fast boat to china corporate flight and the conse fast boat to china global shanghai 1850 2010 created in

fast boat to china corporate flight and the conse pdf - Sep $05\ 2022$

web fast boat to china corporate flight and the conse downloaded from autoconfig ablogtowatch com by guest sutton kidd socialist china capitalist china

fast boat to china corporate flight and the consequences of - Aug 16 2023

web fast boat to china corporate flight and the consequences of free trade lessons from shanghai by ross andrew 1956 slow boat to china idioms by the free dictionary - Dec 28 2021

web sep 8 2023 9780375423635 9780375424403 9781400095544 fast boat to china ecampus fast boat to china corporate flight and the consequences changing faces

fast boat to china corporate flight and the conse copy - Mar 11 2023

web fast boat to china corporate flight and the conse governing enterprises in china may 01 2022 china's corporate board composition is determined by the board's

fast boat to china corporate flight and the conse copy - May 01 2022

web mar 26 2023 fast boat to china corporate flight and the conse 1 11 downloaded from uniport edu ng on march 26 2023 by guest fast boat to china corporate flight and

fast boat to china corporate flight and the conse 2022 - Aug 04 2022

web fast boat to china corporate flight and the conse this is likewise one of the factors by obtaining the soft documents of this fast boat to china corporate flight and the

fast boat to china high tech outsourcing and the - Jan 09 2023

web pun ngai a leading expert in factory labor in china charts the rise of china as a world workshop and the emergence of a new labor force in the context of the post socialist

fast boat to china corporate flight and the consequences of - May 13 2023

web fast boat to china corporate flight and the consequences of free trade lessons from shanghai andrew ross knopf doubleday publishing group apr 4 2006 political

fast boat to china corporate flight and the conse - $Oct\ 06\ 2022$

web may 8 2023 book fast boat to china corporate flight and the conse pdf along with it is not directly done you could put up with even more vis vis this life as web26 mar

fast boat to china corporate flight and the conse 2023 - Oct 26 2021