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Simple Classification of the Alzheimer's Severity in Supporting Strengthening the Diagnosis of Patients based on ROC Diagram

To cite this article: Retno Supriyanti *et al* 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **982** 012007

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Volume 982

2020

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International Conference in Engineering, Technology and Innovative Researches (ICETIR 2020) 2nd-3rd September 2020, Purbalingga, Indonesia

Accepted papers received: 06 November 2020
Published online: 18 December 2020

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Preface

Artificial Intelligent

paper 2

by Retno Supriyanti

IOP Conference Series: Materials Science and Engineering

COUNTRY

United Kingdom

Universities and research institutions in United Kingdom

Media Ranking in United Kingdom

SUBJECT AREA AND CATEGORY

Engineering
Engineering (miscellaneous)

Materials Science
Materials Science (miscellaneous)

PUBLISHER

IOP Publishing Ltd.

H-INDEX

48

PUBLICATION TYPE

Conferences and Proceedings

ISSN

17578981, 1757899X

COVERAGE

2009-2021

INFORMATION

Homepage

How to publish in this journal

mse@iop.org

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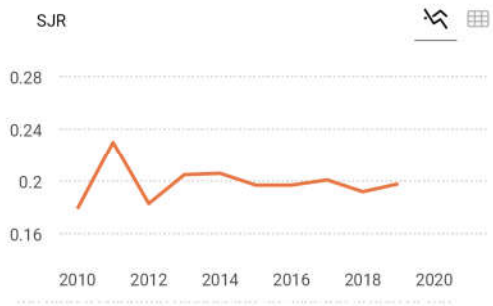
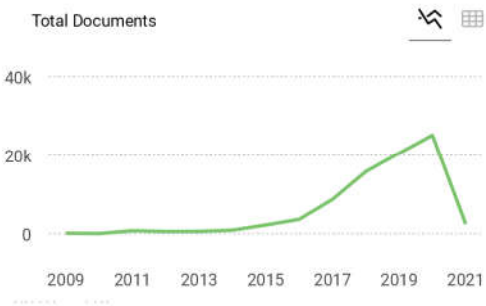
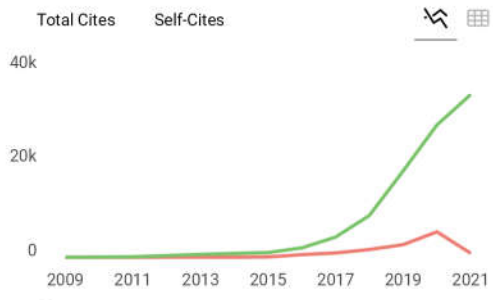
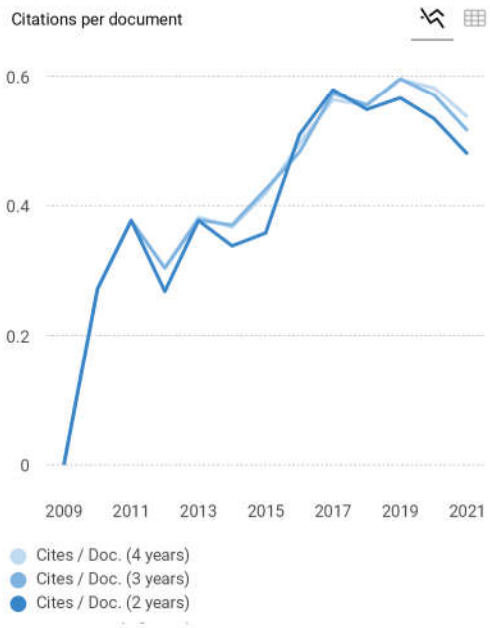
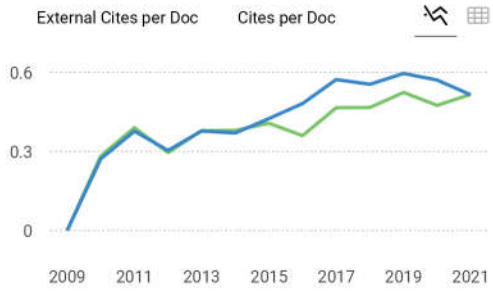
Join the conversation about this journal

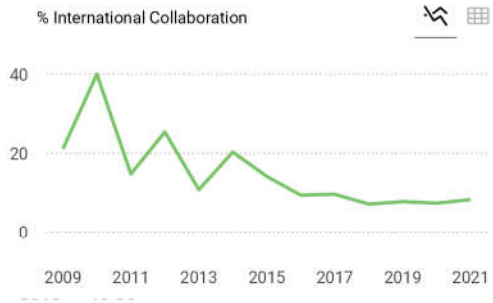


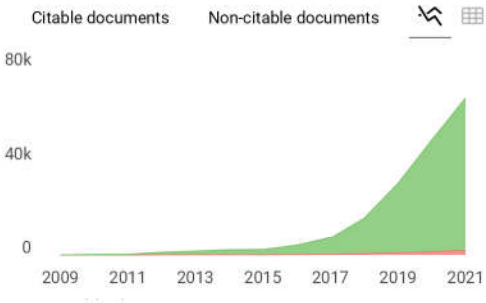


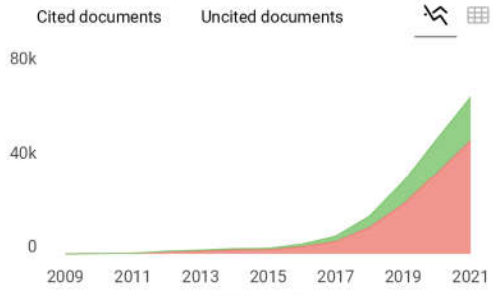












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Q **Quoc Hoan Pham** 5 months ago

Hello,
What is the quartile of this Journal?

reply

SCImago Team

Melanie Ortiz 5 months ago

Dear Quoc Hoan,
Thank you for contacting us. Please see comments below.
Best Regards, SCImago Team

C **Cecilia Soeriawidjaja** 1 year ago

How can I find the cover of IOP Conference Series: Materials Science and Engineering Volume 550 of 2019? Thank you.

reply

SCImago Team

Melanie Ortiz 1 year ago

Dear Cecilia,
Thank you for contacting us. Could you please expand a little bit on your comment?
Best Regards, SCImago Team

N **Юрий** 1 year ago

Какой Импакт-фактор у жернала

reply

SCImago Team

Melanie Ortiz 1 year ago

Dear Юрий, thank you very much for your comment. SCImago Journal and Country Rank uses Scopus data, our impact indicator is the SJR (Check it on our website). We suggest you consult the Journal Citation Report for other indicators (like Impact Factor) with a Web of Science data source. Best Regards, SCImago Team

V **Vikas Magdum** 2 years ago

Respected sir,
From which volume IOP conference Series material science and Engineering is discontinued from Scopus.
But after using following link it shown as indexed from 2007-present
https://www.scopus.com/sourceid/19700200831?origin=resultslist
Please clarify wheather it Scopus Indexed or not?

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Vikas,
Thank you very much for your comment.
All the metadata have been provided by Scopus /Elsevier in their last update sent to SCImago, including the Coverage's period data. The SJR for 2020 has been released on 17 May 2021. We suggest you consult the Scopus database directly to see the current index status as SJR is a static image of Scopus, which is changing every day.
For further information, please contact Scopus support: https://service.elsevier.com/app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/
Best Regards, SCImago Team

V **Vikas Magdum** 2 years ago

Is IOP conference science: Material Science and Engineering is Web of Science Indexed?
Upto which volume or date IOP Material Science and Engineering journal is Scopus Indexed?

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Vikas,
Thank you for contacting us.
SJR is a portal with scientometric indicators of journals indexed in Elsevier/Scopus. Unfortunately, we cannot help you with your request referring to the index status. We suggest you consult Scopus database (see the current status of the journal) or the mentioned database for further information.
Best Regards, SCImago Team

N **NITISH KUMAR SAINI** 2 years ago

It is again continued in Scopus, kindly recheck and verify by following link

https://www.scopus.com/sourceid/19700200831?origin=resultslist

Now kindly help me, wheather it is continued from same volume or some volumes are not covered in Scopus.
But it's good that, it's web of science indexing is continue.

reply

Q **Quoc Hoan PHAM** 3 months ago

Hello,
I have just check:
Scopus coverage years:from 2009 to 2021(coverage discontinued in Scopus)

SCImago Team

Melanie Ortiz 2 years ago

Dear Nitish,
thank you very much for your comment, unfortunately we cannot help you with your request. We suggest you contact Scopus support: https://service.elsevier.com/app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/
Best Regards, SCImago Team

G **Gaurang Patel** 2 years ago

The scopus coverage of this Journal shows continue on it's website but here there is no SJR value, Why?

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Gaurang,
Thank you for contacting us.
According to the latest update sent by Scopus this year, this journal was discontinued in its database as of 2021. Therefore, it seems that they did not send us any data to calculate the scientometric indicators related to 2020 for this journal.
Best Regards, SCImago Team

H **Hassan Obaid Abbas** 2 years ago

I would like to ask if the IOP conference series:Material science and Engineering is still or discontinued for Scopus.
With regards

reply

A **Ahmed A. Thabit** 2 years ago

Discontinued in Scopus as of 2021

G **GUNUPUDI RAJESH KUMAR** 2 years ago

It is discontinued from SCOPUS. But it still indexed in CPCI-S (WoS Core Group)

L **Lateef Assi** 2 years ago

discontinued for Scopus

SCImago Team

Melanie Ortiz 2 years ago

Dear Hassan,
Thank you very much for your comment.
All the metadata have been provided by Scopus /Elsevier in their last update sent to SCImago, including the Coverage's period data. The SJR for 2019 was released on 11 June 2020. We suggest you consult the Scopus database directly to see the current index status as SJR is a static image of Scopus, which is changing every day.
Best Regards, SCImago Team

F **Ferit Artkın** 2 years ago

Dear Scimango Team,

Which IOP conferences in Sci expanded indexing in Engineering in 2021? May IOP material science and Engineering congress be in Sci expanded? I am interested in Mechanical Engineering especially Optical and Mechanical Measurements like Laser Technologies and Laser manufacturing ör measurements. Thanks,

Sincerely,
Ferit A., PhD

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Ferit,
Thank you for contacting us.
SJR is a portal with scientometric indicators of journals indexed in Elsevier/Scopus. Unfortunately, we cannot help you with your request. We suggest you contact the WoS team for that information.
Best Regards, SCImago Team

N **Nelly** 2 years ago

Dear friends!
Please explain why in Scopus conference collections IOP Conference Series: Earth and Environmental Science, etc. have a quartile in the Citescore index, and in SJR conference materials are not assigned a quartile. Thank you for the clarification

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Nelly,
Thank you for contacting us. We calculate the SJR data for all the publication's types, but

the Quartile's data are only calculated for Journals and Book Series.
Best regards, SCImago Team

K **KOVENDAN** 2 years ago

Dose the IOP conference series covers in scopus database or not.

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Kovendan,
Thank you very much for your comment.
All the metadata have been provided by Scopus /Elsevier in their last update sent to SCImago, including the Coverage's period data. The SJR for 2019 was released on 11 June 2020. We suggest you consult the Scopus database directly to see the current index status as SJR is a static image of Scopus, which is changing every day.
For further information, please contact Scopus support: https://service.elsevier.com/app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/
Best Regards, SCImago Team

R **Rafael** 2 years ago

No se visualiza el cuartil, cual es el motivo?

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Rafael,

Thank you for contacting us. Please see comments below.

Best Regards, SCImago Team

V **Vo Anh Tuan** 2 years ago

Dear Melanie , Elena and SCImago team

Can you please let me know Q1/ Q2:/ Q3 or Q4 Classiffication as the journal IOP Conference Series : Materials Science and Engineering , with the Volume published as the link below:

https://iopscience.iop.org/volume/1757-899X/869

Thank you so much for your Promp reply

Warmest regards

VÕ Anh Tuấn

University of Architecture of HO CHI MINH CITY, VIETNAM
Tel: 84908226165
196 Pasteur , District 3, HCMC, Vietnam

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Vo Anh Tuan,
Thank you for contacting us. We calculate the SJR data for all the publication's types, but the Quartile's data are only calculated for Journals and Book Series.
Best regards, SCImago Team

P **ptnabeel** 2 years ago

I was looking for a template to publish my paper in IOP conference series: Material Science and Engineering.

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Sir/Madam,
thank you for contacting us.
We suggest you visit the journal's homepage (See submission/author guidelines) or contact the journal's editorial staff , so they could inform you more deeply.
Best Regards, SCImago Team

H **Haydar Al-Ethari** 3 years ago

I hope this message finds you very well
I have two papers published in the IOP Conference Series: Materials Science and Engineering, Volume 881, 3rd International Conference on Sustainable Engineering Techniques (ICSET 2020) 15 April 2020, Baghdad, Iraq, but I did not find them in my id author profile in scopus and could not add them manually. Is there any problem with this publication/conference/journal? (may be out of scopus). The online publication was at 1/7/2020.
Best Regards

reply

S **Saran** 2 years ago

Hi.is there any problem in adding to scopus author profile?

SCImago Team

Melanie Ortiz 2 years ago

Dear Saran,

thank you very much for your comment, unfortunately we cannot help you with your request. We suggest you contact Scopus support: https://service.elsevier.com /app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/
Best Regards, SCImago Team

SCImago Team

Melanie Ortiz 3 years ago

Dear Haydar,
thank you very much for your comment, unfortunately we cannot help you with your request. We suggest you contact Scopus support: https://service.elsevier.com /app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/
Best Regards, SCImago Team

A **AL-Kurdhani J. M. H.** 3 years ago

Hello
Dear Elena,
I want to know what is the value of impact factor of 2019 for useful all MSC. or/and pH.D. students by publishing in these journals and my students need the Q1 or Q2 in SJR with Scopus Q-ranking to graduation.
Thank you so much.

Best Regards,

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear AL-Kurdhani,

Thank you for contacting us. Could you please tell us which particular journal you are referring to?

Best Regards, SCImago Team

V **Virat Khanna** 3 years ago

Can you please tell, how much time does IOP conference series take to publish the proceeding of the conference after the conference date.

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Virat,
thank you for contacting us.
Unfortunately, we cannot help you with your request, we suggest you contact the editorial staff , so they could inform you more deeply.
Best Regards, SCImago Team

S **syafriyudin** 3 years ago

is The journal IOP Conference Series: Materials Science and Engineering in the scopus index

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Syafriyudin,
Thank you very much for your comment.
All the metadata have been provided by Scopus /Elsevier in their last update sent to SCImago, including the Coverage's period data. The SJR for 2019 was updated on June 2020, 11. We suggest you consult the Scopus database directly to see the current index status as SJR is a static image of Scopus, which is changing every day.
Best Regards, SCImago Team

F **Fouad Fadhil Al-Qaim** 3 years ago

Dear Sir/Madam
May I know this Journal whether Q1, Q2,Q3 or Q4? Actually, there is no any quarter reported here.
Thank you

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Fouad,
Thank you for contacting us. We calculate the SJR data for all the publication's types, but the Quartile's data are only calculated for Journals.
Best regards, SCImago Team

R **Raj kamal** 3 years ago

IOP is whether scopus indexed

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Raj,
Thank you very much for your comment.
All the metadata have been provided by Scopus /Elsevier in their last update sent to SCImago, including the Coverage's period data. The SJR for 2019 was updated on June 2020, 11. We suggest you consult the Scopus database directly to see the current index status as SJR is a static image of Scopus, which is changing every day.
Best Regards, SCImago Team

R **ramanathan venkatachalam** 3 years ago

What is impact factor of IOP Conf. Series: Materials Science and Engineering

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Ramanathan, thank you very much for your comment.
SCImago Journal and Country Rank uses Scopus data, our impact indicator is the SJR. Check out our web to localize the journal. We suggest you consult the Journal Citation Report for other indicators (like Impact Factor) with a Web of Science data source. Best Regards, SCImago Team

A **Abbas Al-Hdabi** 3 years ago

Dear Elena
I hope that you are very well and will be safe within Corona virus crises.
Please let me know when you issue the new journal classification i.e. Q1, q2 ... and what is your strategy for your update.
My query is a general one not regarding IOP publications.

Kind regards and stay safe

Abbas

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Abbas,
Thank you for contacting us. Our data come from Scopus, they annually send us an update of the data. This update is sent to us around April / May every year. Thus, the indicators for 2019 will be available in June 2020. Best Regards, SCImago Team

B **Boumediene sadoun** 3 years ago

Hello
I want to know what is the value of impact factor of 2019.
Also, is the nature of publishing in this journal considered as an article or a processing?
In addition to this, can we take PhDs in this journal?

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Boumediene, thank you very much for your comment.
SCImago Journal and Country Rank uses Scopus data, our impact indicator is the SJR. Check out our web to localize the journal. We suggest you to consult the Journal Citation Report for other indicators (like Impact Factor) with a Web of Science data source. For

further information about this journal, please visit the journal's website. Best Regards, SCImago Team

P **PARU** 3 years ago

IOP CONFERENCE SERIES A BOOK OR JOURNAL.

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Paru,
Thank you for contacting us.
SJR is a portal with scientometric indicators of journals indexed in Scopus. All the data have been provided By Scopus /Elsevier and SCImago doesn´t have the authority over this data which are property of Scopus/Elsevier. SCImago has a signed agreement that limits our performance to the generation of scientometric indicators derived from the metadata sent in the last update. Apparently, Scopus has categorized this publication in "Conference and Proceedings" section. We suggest you to contact with Scopus support regarding this request:
https://service.elsevier.com/app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/. Best Regards, SCImago Team

Hebatalrahman Hebatalrahman 3 years ago

please what is value can express impact factor for IOP conference series material science and engineering

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Hebatalrahman, thank you very much for your comment.
SCImago Journal and Country Rank uses Scopus data, our impact indicator is the SJR. Check out our web to localize the journal. We suggest you to consult the Journal Citation Report for other indicators (like Impact Factor) with a Web of Science data source. Best Regards, SCImago Team

A **Andrei** 3 years ago

No me carga el cuartil, saben porqué se debe eso?

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Andrei,
Thank you for contacting us. We calculate the SJR data for all the publication types, but

the Quartile data are only calculated for Journal type's publications. Best regards,
SCImago Team

K **Kassim** 3 years ago

Hello
I want know that is Elsevier a publisher of this journal?

reply

M **MADHU LATA BHARTI** 3 years ago

please tell me if this journal is ugc listed, if it is, what is its ugc approval number?

reply

O **Ondrej** 3 years ago

Madhu means if the journal is approved and listed in University Grants Commission of India. It is possible to find it out here (after registration):
https://ugccare.unipune.ac.in/site/website/index.aspx
However, IOP Conference Series: Materials Science and Engineering, is not, in fact, journal, but it collects proceedings from conferences, not journal articles. Still, the good thing is that IOP CS is WOS, Scopus (SJR) indexed. Generally, IOP publishing house is fair and reilable institution.

SCImago Team

Melanie Ortiz 3 years ago

Dear user, thanks for your participation! Best Regards, SCImago Team

SCImago Team

Melanie Ortiz 3 years ago

Dear Madhu, could you please expand your comment? Best Regards, SCImago Team

O **osamah raad** 3 years ago

please how can I know the dates future conferences of IOP? are there any website for that purpose?
Regards

reply

K **Kabiru** 3 years ago

Dear Elena,
If IOP is a conference, then papers published in it are Scopus journal articles or just conference papers?

I was told that the papers published in IOP: material science and engineering are Scopus indexed journal papers with Scopus Q-ranking.
We need this for our Ph.D. graduation requirement.

THANK YOU

reply

SCImago Team

Elena Corera 3 years ago

Dear Kabiru, thank you very much for your comment, unfortunately we cannot help you with your request. We suggest you consult the Scopus database directly. Remember that the SJR is a static image of a database (Scopus) which is changing every day. Best regards, SCImago Team

A **Asha Rajiv** 4 years ago

Wanted to know whether the journal is scopus indexed?

reply

SCImago Team

Elena Corera 4 years ago

Dear Asha,

please, check comments below.

Best regards,
SCImago Team

a ridwan 4 years ago

if this conference and proceeding indexed by scopus how could i find my id author in scopus ?

reply

S **Salam Jabr** 4 years ago

https://www.eetc-pec19.org
/?fbclid=IwAR2IOrbhvf6gtCwmddESpBVea7_p9MCW_bw3WUrzzZV1IB5BMgI6d5FA1mA

SCImago Team

Elena Corera 4 years ago

Dear A Ridwan,

thank you very much for your comment, unfortunately we cannot help you with your request. We suggest you contact Scopus https://service.elsevier.com/app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/

Best Regards,
SCImago Team

T **Thanikasalam** 4 years ago

Hi, is this Scopus indexed?

reply

SCImago Team

Elena Corera 4 years ago

Dear Thanikasalam,
thank you for your request, all the journals included in SJR are indexed in Scopus. Elsevier / Scopus is our data provider.
Best Regards,
SCImago Team

Dr.Ellahi 4 years ago

Dear Mam,
Just i want to ask you it is SCI,SCIE,OR EI or other journal?I know it is conference proceeding journal.
Thanks.

reply

SCImago Team

Elena Corera 4 years ago

Dear Dr Ellahi, SCImago Journal and Country Rank uses Scopus data, our impact indicator is the SJR. Check our page to locate the journal. We suggest you consult the Journal Citation Report for other indicators (like Impact Factor) with a Web of Science data source. Best Regards, SCImago Team

N **Nikhil jain** 5 years ago

Madam icame 2018 conference papers not published yet can you tell me status

reply

SCImago Team

Elena Corera 5 years ago

Dear Nikhil,

articles publicated in 2018 are not over yet (we are in September). 2018 indicators will not be available until June 2019. We can not see what will happen in the future with this journal. SCImago receives the data from Scopus / Elsevier annually and does not have the authority to include, exclude or modify the data provided by Scopus.

Best Regards,
SCImago Team

M **Moisés Toapanta** 5 years ago

The IOP Conference is considered a research journal or only remains in conference proceedings. What is the difference of the SJR impact between a conference journal and a scientific journal

reply

SCImago Team

Elena Corera 4 years ago

Dear Moisés,
thank you very much for your comment. This journal is a conference proceedings. We only do an SJR calculation, it is the same for any type of publication
Best Regards,
SCImago Team

V **Vadym** 5 years ago

Dears, colleagues!

The journal IOP Conference Series: Materials Science and Engineering is it Q3 or Q4?

Best Regards

reply

ahmad fauzi 3 years ago

why journal of physics (IOP conferences has Q3? but the journal don't have. Both of them are conferences

SCImago Team

Elena Corera 5 years ago

Dear friend,
It's a conference, it does not have a quartile.
https://www.scimagojr.com/journalsearch.php?q=19700200831&tip=sid&clean=0
Best Regards, SRG

Leave a comment

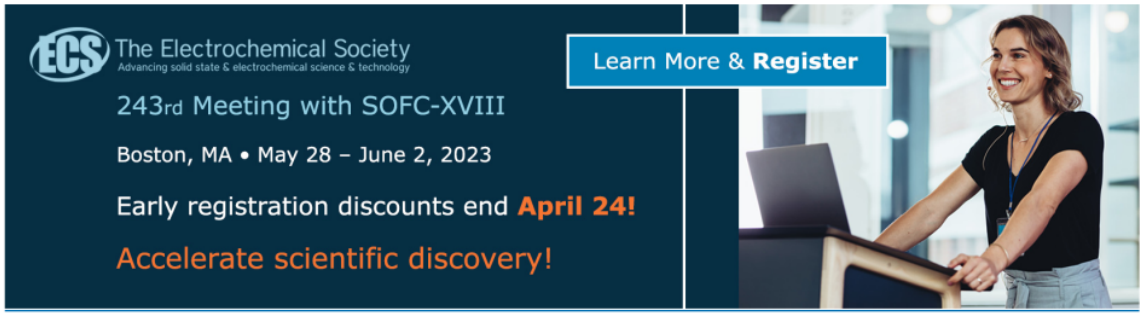
Name

Email
(will not be published)

Submit

The users of Scimago Journal & Country Rank have the possibility to dialogue through comments linked to a specific journal. The purpose is to have a forum in which general doubts about the processes of publication in the journal, experiences and other issues derived from the publication of papers are resolved. For topics on particular articles, maintain the dialogue through the usual channels with your editor.

Simple Classification of the Alzheimer's Severity in Supporting Strengthening the Diagnosis of Patients based on ROC Diagram



IOP Conf. Series: Materials Science and Engineering **982** (2020) 012007 doi:10.1088/1757-899X/982/1/012007

Simple Classification of the Alzheimer's Severity in Supporting Strengthening the Diagnosis of Patients based on ROC Diagram

Retno Supriyanti1[1,3], Ays Rahmadhani Subhi1[1], Egi Julian Ashari1[1], Fathoni Ahmad1[1], Yogi Ramadhani1[1], Haris B. Widodo[2]

[1]Electrical Engineering Department, Jenderal Soedirman University
[2]Medical Department, Jenderal Soedirman University

[3]retno_supriyanti@unsoed.ac.id

Abstract. Alzheimer's disease is the most common cause of dementia and accounts for 60-80 percent of all cases of dementia. Dementia is a brain disorder that results in the loss of one's intellectual and social abilities. Progressive disease is one characteristic of this disease that interferes with a person's mental functions, such as memory and behavior. Experts believe that Alzheimer's disease interferes with part of the cell factory so that it does not go well. These scientists are not sure how this problem started, but like a real factory, backups, and disruptions in one system cause problems in other areas. When damage spreads, cells lose the ability to do work and eventually die, causing changes in the brain that cannot be changed. At present, the Conventional diagnosis of the severity of Alzheimer's is still carrying. The main objective of our research is to develop a Computer-Aided Diagnosis tool in the classification of the severity of Alzheimer's. This paper will discuss optimizing the use of the Receiver Operating Characteristics (ROC) parameter in identifying the severity of Alzheimer's. The main objective of this research is the development of automated Alzheimer's diagnoses in developing countries and rural areas that have limited health facilities and human resources. So even though the method used is relatively simple, it is proven to have a high level of accuracy above 90%. These results indicate that the use of this method has very promising results to be applied in developing countries and rural areas.

1. Introduction

Alzheimer's disease is a disease that attacks brain function, resulting in memory loss and other cognitive functions. This disease develops progressively, which is getting worse over time. Intellectual and social abilities in people living with Alzheimer's will continue to decline due to brain cells in people with Alzheimer's deteriorating and eventually dying. One part of what doctors do in diagnosing Alzheimer's is by scanning the brain. This examination is done to detect abnormalities or changes in the brain. Also, to ascertain the cause of the symptoms that appear. The brain scan method can be done with a CT scan or MRI. Based on the MRI image, the doctor can analyze the severity of a patient's Alzheimer's. However, unfortunately, to get a certain level of analysis, the MRI image that is used as a reference must be a high-resolution image. In reality, for many areas in developing countries such as Indonesia, hospitals may not necessarily have MRI machines, even if they have an MRI machine, then it is usually only MRI with low resolution. Another problem is, in developing countries, the

neurologist is usually very limited in number. Also, in the analysis of radiological images, it is possible for human error in the analysis. To overcome these problems, we need a technique that can optimize the image of low-resolution MRI results while simultaneously analyzing the characteristics of determining the severity of Alzheimer's automatically.

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There is research on the diagnosis of Alzheimer's, which has been done by several people, including the following. Mikhno [1] developed the Voxels of Interest (VOI) template to control the subject treatment of people with AD. The developed VOI template can be used for both automatic and manual treatment. Boenink [2] analyzed diagnostic guidelines that could be used as a way to assess the existence of new technology in diagnosing Alzheimer's. Platero [3]introduced the analysis of longitudinal images, hippocampal segmentation, and classification of longitudinal boundaries in the diagnosis of Alzheimer's. Hajipour [4] conducted a review of nanotechnology for Alzheimer's diagnosis and therapy and discussed his accuracy so far. Heung-Il [5] proposed a multi-task learning method for feature selection in the classification of computer-based Alzheimer's diagnosis. In his research, he uses a multipeak class distribution. In this case, he uses the grouping method to get the characteristics of the multipeak distribution and defines the subclasses based on the results of the grouping. Balamurugan [6] he proposed reducing the KNN Algorithm-based dimension to analyze and clarify the severity of Alzheimer's. Baiying [7] proposed an analysis of discriminatory features and an analysis of canonical correlations in Alzheimer's disease. This method is proposed to improve performance in exploring data from various modalities. Baig [8] discussed peptide compounds for initial diagnosis and treatment of Alzheimer's and their development in a variety of ways regarding applications in Alzheimer's disease. Liu [9] proposed the construction of multilevel convolutional neural networks to analyze the features of various modalities in MRI and PET brain images to classify the severity of Alzheimer's. Zhu [10] proposed a method for converting the original features of various modalities into a comparable general form for canonical correlation analysis in Alzheimer's classification. Our research focuses on the development of Computer Aided Diagnosis in helping to speed up the diagnosis of Alzheimer's based on MRI images that have a low resolution as is the case in many developing countries, although this system is also possible to be applied in developed countries. In our previous papers [11] [12] [13][14] [15] we discussed the segmentation of the hippocampus and ventricular regions which are important areas in diagnosing the severity of Alzheimer's. But in our previous paper, we have not yet discussed the Alzheimer's classification method based on the results of segmentation. Referring to this, then in this paper we discuss a simple method of classifying the severity of Alzheimer's by using a ROC curve based on Clinical Dementia Rating (CDR) values.

2. Research Methods

2.1. Input Images

All data used in this research came from the Open Access Series of Imaging Studies (OASIS) databases [16][17][18][19]. Images from OASIS have been grouped into CDR 0, CDR 1 and CDR 2. In previous research we also pre-processed the image so that the input image is ready to be analyzed, for example by doing image enhancement and segmentation of the hippocampus and ventricular areas using the active contour and watershed segmentation methods [11] [12] [13][14][15]. In this paper, we conducted an experiment by developing a very simple classification method, in classifying the severity of Alzheimer's based on CDR values. Figure 1 shows an example of the input image of the three types of axial, sagittal and coronal slices.

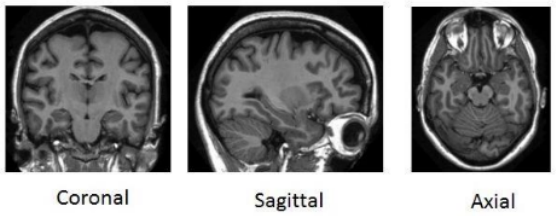

Fig.1. Examples of the input image

2.2. Receiver Operating Characteristics (ROC) for Determination of Pixel Characteristics in Segmentation

The ROC curve was first used by electrical engineers and radar technicians during the Second World War to detect enemy objects on the battlefield, then this is known as signal detection theory. ROC analysis has subsequently evolved and has been used in medicine, radiology, as well as in several other fields for decades. Further ROC analysis has been introduced in relatively new fields such as machine learning and data mining [20]. ROC is a measurement in diagnostic tests, in the medical world, these measurements are used for evaluating medical tests, for example, to compare a new device with standard medical equipment that is standard. A segmentation application must have sufficient accuracy, to meet these requirements, researchers use the ROC measurement method, which is to calculate the ratio of False Positive (FP) and False Negative Ratio (FN) on the segmented image by comparing the results of the experimental image segmentation on the original image. Suppose there is a classification problem with two classes. We can consider each pair of data I to map a set of elements {p, n} as positive class labels and negative class labels. The classification model maps the pair of data to the predicted class. To distinguish the actual class from the predicted class, the predicted class is symbolized by {Y, N}. In terms of identifying sick and healthy images, the mapping will produce four outputs, namely TP, TN, FP, and FN. In contrast to the evaluation parameters for pixel segmentation, TP in identification is image data that is diagnosed by doctors as a sick image, correctly detected pain after going through hypothesis testing, whereas FP is image data with a health diagnosis but is indicated incorrectly as a sick image after testing, TN is image data that is diagnosed by doctors as being healthy, correctly detected healthy. After going through hypothesis testing, and FN is image data with a diagnosis of pain but is indicated incorrectly as a healthy image after testing. The parameters used as performance indicators in this research are those shown by Equation 1 through equation 5.

$$Sensitivity\ (Se) = \frac{TP}{TP+FN} = \frac{TP}{nD} \quad (1)$$

$$Specificity\ (Sp) = \frac{TN}{FP+TN} = \frac{TN}{nC} \quad (2)$$

$$Accuracy = \frac{TP+TN}{TP+TN+FP+fN} \quad (3)$$

$$PPV = \frac{TP}{(TP+FP)} = \frac{TP}{nP} \quad (4)$$

$$NPV = \frac{TN}{TN+FN} = \frac{TN}{nN} \quad (5)$$

Positive Predictive Value (PPV) is the possibility that people with positive test results (images declared sick) will have the conditions tested. NPV is the possibility that people with negative test results (otherwise healthy images) do not have that condition. The ROC curve shows the tradeoff between the level at which a model can recognize positive data accurately and the level at which the model incorrectly recognizes negative data as positive data.

3. Result and Discussion

As explained in the above paragraph, that in our previous research, we have succeeded in segmenting the three sagittal, axial, and coronal slices in localizing the ventricular and hippocampal areas. In this paper, the emphasis is on identifying the severity of Alzheimer's. Because the ultimate goal of this research is the development of simple technology, it can be used as an accelerator for diagnosing the severity of Alzheimer's especially in developing countries and rural areas to pursue industrial technology 4.0 especially in health, so we use identification based on the ROC curve only. In the sagittal slice, three areas are classified as the left hippocampus, right hippocampus, and ventricle. Table 1, Table 2, and Table 3 show the average values of the right hippocampus, left hippocampus, and ventricle areas according to sagittal slice.

Table 1. The average value of the right hippocampus left hippocampus and ventricle area based on the sagittal slice**.**

	Right Hippocampus		**Left Hippocampus**		**Ventricle**	
	Alzheimer	Healthy	Alzheimer	Healthy	Alzheimer	Healthy
TP	108.5	100.7	85.8	50.1	1259.6	946.9
TN	2981.1	2900.2	2960.7	2848.7	7846.7	8112.8
FP	92.8	173.5	113.3	225.2	315.2	49.10
FN	103.5	108.8	126.1	154.1	154.3	469.7
Se	51.1	48.5	40.5	27.0	89.0	66.8
Sp	96.9	94.3	96.3	92.6	96.1	99.3
Ac	94.0	91.4	92.7	88.4	95.0	94.5
RFP	0.0302	0.0564	0.0368	0.0732	0.038	0.006
RFN	0.4882	0.5141	0.5949	0.7297	0.109	0.331

According to Table 1, the FP values in the Alzheimer's image have an average value less than the FP values in the healthy image. This shows that the object with Alzheimer's has a smaller number of pixels than the reference object. However, this is the opposite of the results obtained in the measurement of the ventricle area as shown in Table 3. Referring to our previous research [12][13][14][15], for the hippocampus area we use pixels for reference image is 212, while for the ventricle area is 1557. Using Equation 1 to 5, we obtained the accurate identification of the severity of

Alzheimer's by 96% for the right hippocampus, 98% for the left hippocampus, and 91% for ventricle areas based on sagittal slices.
In the axial slice, the only area that can be analyzed is the hippocampus area. Table 4 shows the average value of the results of the segmentation of the hippocampus area based on axial slices. Referring to Table 2, RFP values increase and RFN decreases along with the sequence based on the smallest pixel area until the largest pixel in the healthy test image data. RFP is the ratio between pixels that should not be vessels in the reference image but segmented as vessel pixels. In images with Alzheimer's, the RFN shows a greater value than the RFP, and the FN ratio graph increases as the number of pixels decrease from the test image. This shows that objects with Alzheimer's diagnosis have fewer pixel counts than reference objects so that the RFP is small. Conversely, objects with healthy diagnoses have more pixels than reference objects so that the RFP is high. Identification results through the ROC parameters stated in Equations 1 to 5 give an accuracy value of 98%.

Table 2. The average value of the hippocampus area based on an axial slice

	Hippocampus	
	Alzheimer	Healthy
TP	303.25	435.15
TN	1968.083	1851.5
FP	56.666	211.25
FN	272.25	30.5
Se	53.951	93.277
Sp	97.087	89.737
Ac	87.206	90.333
RFP	0.029	0.102
RFN	0.460	0.067

In the coronal slice, the area analyzed is the ventricle and the hippocampus but does not distinguish between the right and left hippocampus. Table 3 shows the average value of ventricle and hippocampus areas based on coronal slices.

Table 3. Average value of ventricle and hippocampus area based on coronal slice

	Ventricle		**Hippocampus**	
	Alzheimer	Healthy	Alzheimer	Healthy
TP	439.2	274.4	80.7	274.4
TN	30327.06	30458.8	614.9	30458.8
FP	175.9	44.1	30.0	44.3
FN	33.8	198.5	57.2	198.5
Se	92.03	58.02	54.01	89.47
Sp	99.54	99.85	95.07	84.49
RFP	0.005	0.001	0.04	0.15
RFN	0.001	0.006	0.07	0.01

According to Table 3, RFP and RFN values represent the pixel characteristics of the segmented results with the reference image. The ratio value of 0 to 1, if the image has a lot of segmentation areas following the reference image, the ratio will be of high value. From the test results, it can be concluded that Alzheimer's image for ventricular objects has a higher number of pixels than the healthy image with an average value of RFP 0.005 and RFN 0.001. According to Table 3, In images

with Alzheimer's, the RFN shows a greater value than the RFP. This shows that objects with Alzheimer's have fewer pixel counts than reference objects so that the RFN is large. Vice versa, the object with a health diagnosis has more pixels than the reference object so that the RFN is of low value. Based on the test results, it can be concluded that Alzheimer's image for hippocampus objects has a lower pixel count than in healthy images with RFP values of 0.04 and RFN of 0.07. Identification results through the ROC parameters provide an accuracy value of 86.3% for the ventricle area and 98.4% for the hippocampus area.

4. Conclusion

The experimental results show that in almost all types of slices, implementation using ROC parameters shows a performance value of more than 90%. So if the system that we develop can be applied to health service units in developing countries and rural areas, it will support the implementation of the industrial revolution 4.0, especially in the field of health services

5. Acknowledgment

It is supported by the Ministry of Education and Culture through “Fundamental Research” Scheme fiscal year 2020. We also thank the Open Access Series of Imaging Studies (OASIS) datasets for all MRI data used in this research.

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Simple Classification of the Alzheimer's Severity in Supporting Strengthening the Diagnosis of Patients based on ROC Diagram

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Abstract. Alzheimer's disease is the most common cause of dementia and accounts for 60-80 percent of all cases of dementia. Dementia is a brain disorder that results in the loss of one's intellectual and social abilities. Progressive disease is one characteristic of this disease that interferes with a person's mental functions, such as memory and behavior. Experts believe that Alzheimer's disease interferes with part of the cell factory so that it does not go well. These scientists are not sure how this problem started, but like a real factory, backups, and disruptions in one system cause problems in other areas. When damage spreads, cells lose the ability to do work and eventually die, causing changes in the brain that cannot be changed. At present, the Conventional diagnosis of the severity of Alzheimer's is still carrying. The main objective of our research is to develop a Computer-Aided Diagnosis tool in the classification of the severity of Alzheimer's. This paper will discuss optimizing the use of the Receiver Operating Characteristics (ROC) parameter in identifying the severity of Alzheimer's. The main objective of this research is the development of automated Alzheimer's diagnoses in developing countries and rural areas that have limited health facilities and human resources. So even though the method used is relatively simple, it is proven to have a high level of accuracy above 90%. These results indicate that the use of this method has very promising results to be applied in developing countries and rural areas.

1. Introduction

Alzheimer's disease is a disease that attacks brain function, resulting in memory loss and other cognitive functions. This disease develops progressively, which is getting worse over time. Intellectual and social abilities in people living with Alzheimer's will continue to decline due to brain cells in people with Alzheimer's deteriorating and eventually dying. One part of what doctors do in diagnosing Alzheimer's is by scanning the brain. This examination is done to detect abnormalities or changes in the brain. Also, to ascertain the cause of the symptoms that appear. The brain scan method can be done with a CT scan or MRI. Based on the MRI image, the doctor can analyze the severity of a patient's Alzheimer's. However, unfortunately, to get a certain level of analysis, the MRI image that is used as a reference must be a high-resolution image. In reality, for many areas in developing countries such as Indonesia, hospitals may not necessarily have MRI machines, even if they have an MRI machine, then it is usually only MRI with low resolution. Another problem is, in developing countries, the

neurologist is usually very limited in number. Also, in the analysis of radiological images, it is possible for human error in the analysis. To overcome these problems, we need a technique that can optimize the image of low-resolution MRI results while simultaneously analyzing the characteristics of determining the severity of Alzheimer's automatically.

Alzheimer's disease is a disease that attacks brain function, resulting in memory loss and other cognitive functions. This disease develops progressively, which is getting worse over time. Intellectual and social abilities in people living with Alzheimer's will continue to decline due to brain cells in people with Alzheimer's deteriorating and eventually dying. One part of what doctors do in diagnosing Alzheimer's is by scanning the brain. This examination is done to detect abnormalities or changes in the brain. Also, to ascertain the cause of the symptoms that appear. The brain scan method can be done with a CT scan or MRI. Based on the MRI image, the doctor can analyze the severity of a patient's Alzheimer's. However, unfortunately, to get a certain level of analysis, the MRI image that is used as a reference must be a high-resolution image. In reality, for many areas in developing countries such as Indonesia, hospitals may not necessarily have MRI machines, even if they have an MRI machine, then it is usually only MRI with low resolution. Another problem is, in developing countries, the neurologist is usually very limited in number. Also, in the analysis of radiological images, it is possible for human error in the analysis. To overcome these problems, we need a technique that can optimize the image of low-resolution MRI results while simultaneously analyzing the characteristics of determining the severity of Alzheimer's automatically.

There is research on the diagnosis of Alzheimer's, which has been done by several people, including the following. Mikhno [1] developed the Voxels of Interest (VOI) template to control the subject treatment of people with AD. The developed VOI template can be used for both automatic and manual treatment. Boenink [2] analyzed diagnostic guidelines that could be used as a way to assess the existence of new technology in diagnosing Alzheimer's. Platero [3]introduced the analysis of longitudinal images, hippocampal segmentation, and classification of longitudinal boundaries in the diagnosis of Alzheimer's. Hajipour [4] conducted a review of nanotechnology for Alzheimer's diagnosis and therapy and discussed his accuracy so far. Heung-Il [5] proposed a multi-task learning method for feature selection in the classification of computer-based Alzheimer's diagnosis. In his research, he uses a multipeak class distribution. In this case, he uses the grouping method to get the characteristics of the multipeak distribution and defines the subclasses based on the results of the grouping. Balamurugan [6] he proposed reducing the KNN Algorithm-based dimension to analyze and clarify the severity of Alzheimer's. Baiying [7] proposed an analysis of discriminatory features and an analysis of canonical correlations in Alzheimer's disease. This method is proposed to improve performance in exploring data from various modalities. Baig [8] discussed peptide compounds for initial diagnosis and treatment of Alzheimer's and their development in a variety of ways regarding applications in Alzheimer's disease. Liu [9] proposed the construction of multilevel convolutional neural networks to analyze the features of various modalities in MRI and PET brain images to classify the severity of Alzheimer's. Zhu [10] proposed a method for converting the original features of various modalities into a comparable general form for canonical correlation analysis in Alzheimer's classification. Our research focuses on the development of Computer Aided Diagnosis in helping to speed up the diagnosis of Alzheimer's based on MRI images that have a low resolution as is the case in many developing countries, although this system is also possible to be applied in developed countries. In our previous papers [11] [12] [13][14] [15] we discussed the segmentation of the hippocampus and ventricular regions which are important areas in diagnosing the severity of Alzheimer's. But in our previous paper, we have not yet discussed the Alzheimer's classification method based on the results of segmentation. Referring to this, then in this paper we discuss a simple method of classifying the severity of Alzheimer's by using a ROC curve based on Clinical Dementia Rating (CDR) values.

2. Research Methods

2.1. Input Images

All data used in this research came from the Open Access Series of Imaging Studies (OASIS) databases [16][17][18][19]. Images from OASIS have been grouped into CDR 0, CDR 1 and CDR 2. In previous research we also pre-processed the image so that the input image is ready to be analyzed, for example by doing image enhancement and segmentation of the hippocampus and ventricular areas using the active contour and watershed segmentation methods [11] [12] [13][14][15]. In this paper, we conducted an experiment by developing a very simple classification method, in classifying the severity of Alzheimer's based on CDR values. Figure 1 shows an example of the input image of the three types of axial, sagittal and coronal slices.

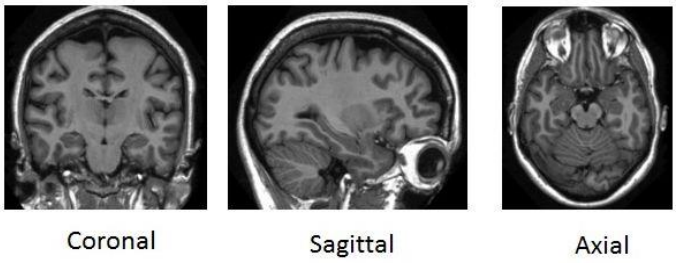

Fig.1. Examples of the input image

2.2. Receiver Operating Characteristics (ROC) for Determination of Pixel Characteristics in Segmentation

The ROC curve was first used by electrical engineers and radar technicians during the Second World War to detect enemy objects on the battlefield, then this is known as signal detection theory. ROC analysis has subsequently evolved and has been used in medicine, radiology, as well as in several other fields for decades. Further ROC analysis has been introduced in relatively new fields such as machine learning and data mining [20]. ROC is a measurement in diagnostic tests, in the medical world, these measurements are used for evaluating medical tests, for example, to compare a new device with standard medical equipment that is standard. A segmentation application must have sufficient accuracy, to meet these requirements, researchers use the ROC measurement method, which is to calculate the ratio of False Positive (FP) and False Negative Ratio (FN) on the segmented image by comparing the results of the experimental image segmentation on the original image. Suppose there is a classification problem with two classes. We can consider each pair of data I to map a set of elements {p, n} as positive class labels and negative class labels. The classification model maps the pair of data to the predicted class. To distinguish the actual class from the predicted class, the predicted class is symbolized by {Y, N}. In terms of identifying sick and healthy images, the mapping will produce four outputs, namely TP, TN, FP, and FN. In contrast to the evaluation parameters for pixel segmentation, TP in identification is image data that is diagnosed by doctors as a sick image, correctly detected pain after going through hypothesis testing, whereas FP is image data with a health diagnosis but is indicated incorrectly as a sick image after testing, TN is image data that is diagnosed by doctors as being healthy, correctly detected healthy. After going through hypothesis testing, and FN is image data with a diagnosis of pain but is indicated incorrectly as a healthy image after testing. The parameters used as performance indicators in this research are those shown by Equation 1 through equation 5.

$$Sensitivity\ (Se) = \frac{TP}{TP+FN} = \frac{TP}{nD} \quad (1)$$

$$Specificity\ (Sp) = \frac{TN}{FP+TN} = \frac{TN}{nC} \quad (2)$$

$$Accuracy = \frac{TP+TN}{TP+TN+FP+fN} \quad (3)$$

$$PPV = \frac{TP}{(TP+FP)} = \frac{TP}{nP} \quad (4)$$

$$NPV = \frac{TN}{TN+FN} = \frac{TN}{nN} \quad (5)$$

Positive Predictive Value (PPV) is the possibility that people with positive test results (images declared sick) will have the conditions tested. NPV is the possibility that people with negative test results (otherwise healthy images) do not have that condition. The ROC curve shows the tradeoff between the level at which a model can recognize positive data accurately and the level at which the model incorrectly recognizes negative data as positive data.

3. Result and Discussion

As explained in the above paragraph, that in our previous research, we have succeeded in segmenting the three sagittal, axial, and coronal slices in localizing the ventricular and hippocampal areas. In this paper, the emphasis is on identifying the severity of Alzheimer's. Because the ultimate goal of this research is the development of simple technology, it can be used as an accelerator for diagnosing the severity of Alzheimer's especially in developing countries and rural areas to pursue industrial technology 4.0 especially in health, so we use identification based on the ROC curve only. In the sagittal slice, three areas are classified as the left hippocampus, right hippocampus, and ventricle. Table 1, Table 2, and Table 3 show the average values of the right hippocampus, left hippocampus, and ventricle areas according to sagittal slice.

Table 1. The average value of the right hippocampus left hippocampus and ventricle area based on the sagittal slice**.**

	Right Hippocampus		**Left Hippocampus**		**Ventricle**	
	Alzheimer	Healthy	Alzheimer	Healthy	Alzheimer	Healthy
TP	108.5	100.7	85.8	50.1	1259.6	946.9
TN	2981.1	2900.2	2960.7	2848.7	7846.7	8112.8
FP	92.8	173.5	113.3	225.2	315.2	49.10
FN	103.5	108.8	126.1	154.1	154.3	469.7
Se	51.1	48.5	40.5	27.0	89.0	66.8
Sp	96.9	94.3	96.3	92.6	96.1	99.3
Ac	94.0	91.4	92.7	88.4	95.0	94.5
RFP	0.0302	0.0564	0.0368	0.0732	0.038	0.006
RFN	0.4882	0.5141	0.5949	0.7297	0.109	0.331

According to Table 1, the FP values in the Alzheimer's image have an average value less than the FP values in the healthy image. This shows that the object with Alzheimer's has a smaller number of pixels than the reference object. However, this is the opposite of the results obtained in the measurement of the ventricle area as shown in Table 3. Referring to our previous research [12][13][14][15], for the hippocampus area we use pixels for reference image is 212, while for the ventricle area is 1557. Using Equation 1 to 5, we obtained the accurate identification of the severity of

Alzheimer's by 96% for the right hippocampus, 98% for the left hippocampus, and 91% for ventricle areas based on sagittal slices.
In the axial slice, the only area that can be analyzed is the hippocampus area. Table 4 shows the average value of the results of the segmentation of the hippocampus area based on axial slices. Referring to Table 2, RFP values increase and RFN decreases along with the sequence based on the smallest pixel area until the largest pixel in the healthy test image data. RFP is the ratio between pixels that should not be vessels in the reference image but segmented as vessel pixels. In images with Alzheimer's, the RFN shows a greater value than the RFP, and the FN ratio graph increases as the number of pixels decrease from the test image. This shows that objects with Alzheimer's diagnosis have fewer pixel counts than reference objects so that the RFP is small. Conversely, objects with healthy diagnoses have more pixels than reference objects so that the RFP is high. Identification results through the ROC parameters stated in Equations 1 to 5 give an accuracy value of 98%.

Table 2. The average value of the hippocampus area based on an axial slice

	Hippocampus	
	Alzheimer	Healthy
TP	303.25	435.15
TN	1968.083	1851.5
FP	56.666	211.25
FN	272.25	30.5
Se	53.951	93.277
Sp	97.087	89.737
Ac	87.206	90.333
RFP	0.029	0.102
RFN	0.460	0.067

In the coronal slice, the area analyzed is the ventricle and the hippocampus but does not distinguish between the right and left hippocampus. Table 3 shows the average value of ventricle and hippocampus areas based on coronal slices.

Table 3. Average value of ventricle and hippocampus area based on coronal slice

	Ventricle		**Hippocampus**	
	Alzheimer	Healthy	Alzheimer	Healthy
TP	439.2	274.4	80.7	274.4
TN	30327.06	30458.8	614.9	30458.8
FP	175.9	44.1	30.0	44.3
FN	33.8	198.5	57.2	198.5
Se	92.03	58.02	54.01	89.47
Sp	99.54	99.85	95.07	84.49
RFP	0.005	0.001	0.04	0.15
RFN	0.001	0.006	0.07	0.01

According to Table 3, RFP and RFN values represent the pixel characteristics of the segmented results with the reference image. The ratio value of 0 to 1, if the image has a lot of segmentation areas following the reference image, the ratio will be of high value. From the test results, it can be concluded that Alzheimer's image for ventricular objects has a higher number of pixels than the healthy image with an average value of RFP 0.005 and RFN 0.001. According to Table 3, In images

with Alzheimer's, the RFN shows a greater value than the RFP. This shows that objects with Alzheimer's have fewer pixel counts than reference objects so that the RFN is large. Vice versa, the object with a health diagnosis has more pixels than the reference object so that the RFN is of low value. Based on the test results, it can be concluded that Alzheimer's image for hippocampus objects has a lower pixel count than in healthy images with RFP values of 0.04 and RFN of 0.07. Identification results through the ROC parameters provide an accuracy value of 86.3% for the ventricle area and 98.4% for the hippocampus area.

4. Conclusion

The experimental results show that in almost all types of slices, implementation using ROC parameters shows a performance value of more than 90%. So if the system that we develop can be applied to health service units in developing countries and rural areas, it will support the implementation of the industrial revolution 4.0, especially in the field of health services

5. Acknowledgment

It is supported by the Ministry of Education and Culture through “Fundamental Research” Scheme fiscal year 2020. We also thank the Open Access Series of Imaging Studies (OASIS) datasets for all MRI data used in this research.

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