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Visualizing the latest up-front of chemistry research and education for better future

Purwokerto, Indonesia • 9 September 2021

Editors • Uyi Sulaeman, Hassan Y. Aboul-Enein, Ahmad Zuhairi Abdullah, Zaheer Ul-Haq Qasmi, Warakorn Limbut, Jas Raj Subba and Mardiyah Kurniasih

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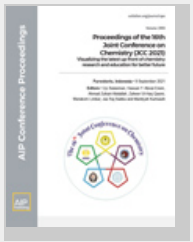

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Prediction of bilirubin concentration using neonatal forehead images

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Mekar Dwi Anggraeni, Amin Fatoni and Eni Rahmawati

Prediction of Bilirubin Concentration using Neonatal Forehead Images

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Abstract. Neonatal jaundice is one of the most common reasons for hospital admission in the neonatal care unit, which it is associated to significant morbidity and mortality. Neonatal jaundice, indicated with hyper bilirubin in neonatal blood, occur in 60% of >35 weeks neonatal and 80% of <35 weeks neonatal. Therefore, it is important to develop the ease method to predict the hyper bilirubin in neonatal. This study was performed to develop the easy and objective method to determine the bilirubin in neonatal based on the forehead image captured using smartphone camera. Methodology of this research including the capturing of the neonatal forehead with the calibration color chart, followed by analyzing the image using ImageJ software to extract the color intensity of the digital images. The red, green and blue (RGB) colors were then analyzed to find the best correlation between the color intensity of neonatal forehead images with the blood bilirubin concentration. The bilirubin concentration was determined using standard method performed in the hospital based on spectrophotometric method. The smartphone-based methods of neonatal forehead images showed a linear correlation ($R2=0.832$) between blue color intensity and blood bilirubin concentration of neonatal observed with a regression line of $y= -4.954x + 160.45$. This result could be used for further self-detection by the mothers of neonatal jaundice or healthcare monitoring mainly in the remote area.

INTRODUCTION

The infant mortality rate (IMR) is one indicator of a country's health status. IMR in Indonesia is the highest in Southeast Asia [1]. IMR in Indonesia is very high at 26.9 per 1000 live births [2]. One of the causes of the high IMR in Indonesia is hyperbilirubinemia in newborns [2]. The results of research conducted by Utami [3] showed that almost (48%) of newborns had hyperbilirubinemia.

Hyperbilirubinemia is a serious health problem. The effects of hyperbilirubinemia in infants are hearing loss [4], general movement disorders [5], speech delay with hearing loss [6], bilirubin encephalopathy, moro reflex disorders, opisthotonos, vomiting, and death. Long-term manifestations of hyperbilirubinemia in infants are spasticity, choreoathetosis, and sensorineural deafness [7].

The clinical manifestation of hyperbilirubinemia is discoloration of the skin and sclera. Yellow color in the skin is an indicator of an increase in bilirubin levels which is known through physical examination in infants [8]. Physical examination through visual inspection provides inaccurate data, is highly subjective, highly dependent on experience, and may give inaccurate results [9]. Laboratory tests performed to assess bilirubin levels in the blood provide accurate results, the cost of equipment is expensive, requires special expertise, and primary health facilities are not always

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available. A method is needed that can be used by health workers to assess hyperbilirubinemia in infants without invasive measures, providing good results. accurate, real time, easy, and cheap.

Cellular phones (smartphones) are developing very quickly in the world. The use of smartphone camera for detection methods have been previously reported to predict the hemoglobin level [10], food safety[11], iron in water [12] and also and glucose[13]. Smartphone have the potential to be used as an early detection tool for hyperbilirubinemia in newborns using the basic principle of digital image analysis. The neonatal skin color for hyper bilirubin prediction using smartphone could be used to replace the conventional method of visual examination of the inferior palpebral conjunctiva area [8]. The development of a simple tool for early detection of hyperbilirubinemia in neonatal will increase the objectivity of the examination results. The use of cameras on cell phones for early detection of hyperbilirubinemia in newborns is interested in developing country as a program for reduce the infant mortality rate by early hyperbilirubinemia prediction in neonatal.

METHODS

Study design

Thirty-one neonatal has been ask as participant (inform consent filled by mothers) in the district hospital with the inclusion criteria of neonatal with the hyperbilirubinemia. The images have been captured before and after treatment of the neonatal, therefore a range of bilirubin concentration from normal (after treatment) and hyperbilirubinemia (before treatment) could be collected. The blood bilirubin of the neonatal have been analyzed according to the standard method and timelines in the hospital without any researcher intervention.

Neonatal forehead image capturing

Neonatal forehead images were captured using smartphone camera (Redmi, Camera 13 MP, f/2.0, PDAF) under sufficient lighting without using camera flash. A printed reflective color chart reference[14] has been place besides the neonatal (**Fig. 1**). Photograph of neonatal forehead was taken at a distance about 50-60 cm for 3 times.

Figure 1. Neonatal forehead image capturing with a reflective color chart reference.

Image analysis

Neonatal forehead images were transferred from the smartphone to a laptop (MacBook Air, Apple Inc.) without any treatment or adjusting. The forehead digital images were then analyzed using ImageJ software ver. 1.52k (National

Institute of Health, USA. http://imagej.nih.gov/ij). The images were extracted their color intensity of Red, Green and Blue (RGB) by simple hover the laptop mouse over the forehead of the neonatal images. Three difference location have been recorded for their RGB intensity. The standard color chart has been used to correct the images.

Data analysis

Raw data of RGB color intensity of neonatal forehead were collected. The color intensity was then adjusted according to the white, grey and yellow color of the standard color chart. The bilirubin concentration of blood neonatal reported in the medical record of the neonatal has also been collected. Neonatal forehead color intensities as the dependent variables were then analyzed using simple regression (Microsoft Excel) related to the blood bilirubin concentration as the independent variables. The analysis would result a regression line with the regression equation and coefficient of determination. The three RGB color intensity were separately analysis and the color with the highest coefficient of determination has been selected.

RESULTS AND DISCUSSION

Study participants

Neonatal participant data have been collected with birth weight of 1526 to 3900 g. The blood bilirubin concentrations were 11 to 25.9 mg/dL with average of 16.6 mg/dL. The age of neonatal mothers were 19 to 41 years with an average of 32 years. The neonatal jaundice symptoms appear from 2 days to 26 days from birth, with average of 6.9 days. The neonatal were 69% cesarean birth and the rest natural birth. The gestational ages were 31 to 41 weeks. These participants data could be important information for further neonatal jaundice profiles.

Neonatal image capturing and processing

Neonatal mothers' participants have been confirmed their approving for neonatal forehead images capturing using a smartphone. The research assistant was also first explained the description and aimed of this research. There is no compulsion to become a respondent in this study. The forehead has been chosen since forehead is one of the most stable sites of neonatal [15] and also it has a large flat surface for easy image analysis. The image capturing could be repeated to get the best lighting condition and neonatal position. The collected forehead images were then analyzed. Standard color chart was used to correct the images by adding or reducing the color intensity, when the value of color intensity of white and yellow color was significantly (more than 3 point) different with another images. The average color intensities of standard white color in the captured images were R = 201.5, G = 237.5 and B = 239. Whereas the average of color intensities of the yellow standard color chart was R = 202, G = 200.7 and B = 0.8. Various methods have been reported to correct the digital image processing such as the use of white paper [10], software based white balance [16], red label based white balance [17] and standard color chart [14]. The use of standard color chart in this research was performed to easy comparison with various color for further smartphone software development where all standard color available in the sample images.

Regression analysis

The neonatal forehead images color intensity showed a linear relationship between forehead image and blood bilirubin concentration of the participants. RGB color intensity of the neonatal forehead showed that the blue color intensity had highest relationship with the coefficient of determinant of $R^2 = 0.832$ (**Fig. 2**). The blue color intensity showed the highest relationship between color intensity and bilirubin concentration compare to red and green color intensity. The lowest relationship was the red color intensity; therefore, the yellowest skin represents the lowest blue color intensity and the highest blood bilirubin concentration. The standard color chart intensity of yellow color also showed the RGB values was about red of 200, green of 200 and blue of 0.

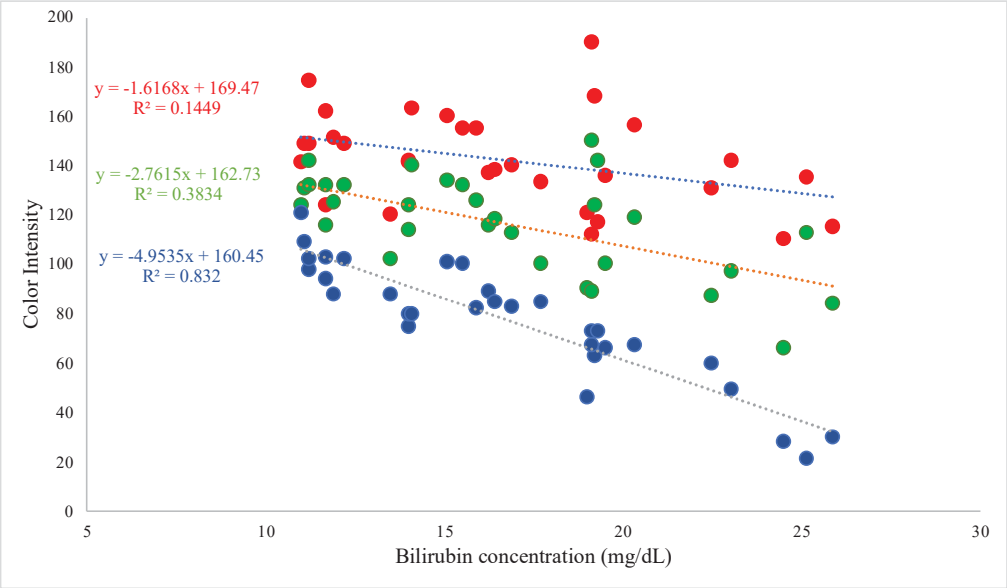

Figure 2. Relationship between neonatal forehead images color intensity and blood bilirubin obtained by hospital laboratory (n=31). Dotted line represents best fit by linear regression.

Factors effecting neonatal jaundice

Neonatal jaundice is common event occur in the first week of birth [18] and it is common causes of the neonatal hospitalization. Imbalance between bilirubin metabolism leads to increase the blood bilirubin concentration. This imbalance of metabolism due to the immature liver for rapid breakdown the red blood cells due to several factors [19]. Gestational age was one of several factors related to neonatal jaundice [19]. Gestational age <39 weeks showed increase the incidence of jaundice [20]. The participants of this research showed that the average of gestational age was 37.8 weeks, with the minimum of 31 weeks and maximum of 41 weeks. Induced labor was also reported slightly increase the neonatal jaundice incidence [21]. The result of data analysis in the participants showed the 43,5% neonatal from the induced labor.

CONCLUSION

The neonatal hyper bilirubin could be predicted using a smartphone camera, with a high correlation between blue color intensity if neonatal forehead images and blood bilirubin concentration. The use of digital image would be useful and more objective than visual observation where the instrumentation not available for neonatal hyper bilirubin detection, especially in the remote area.

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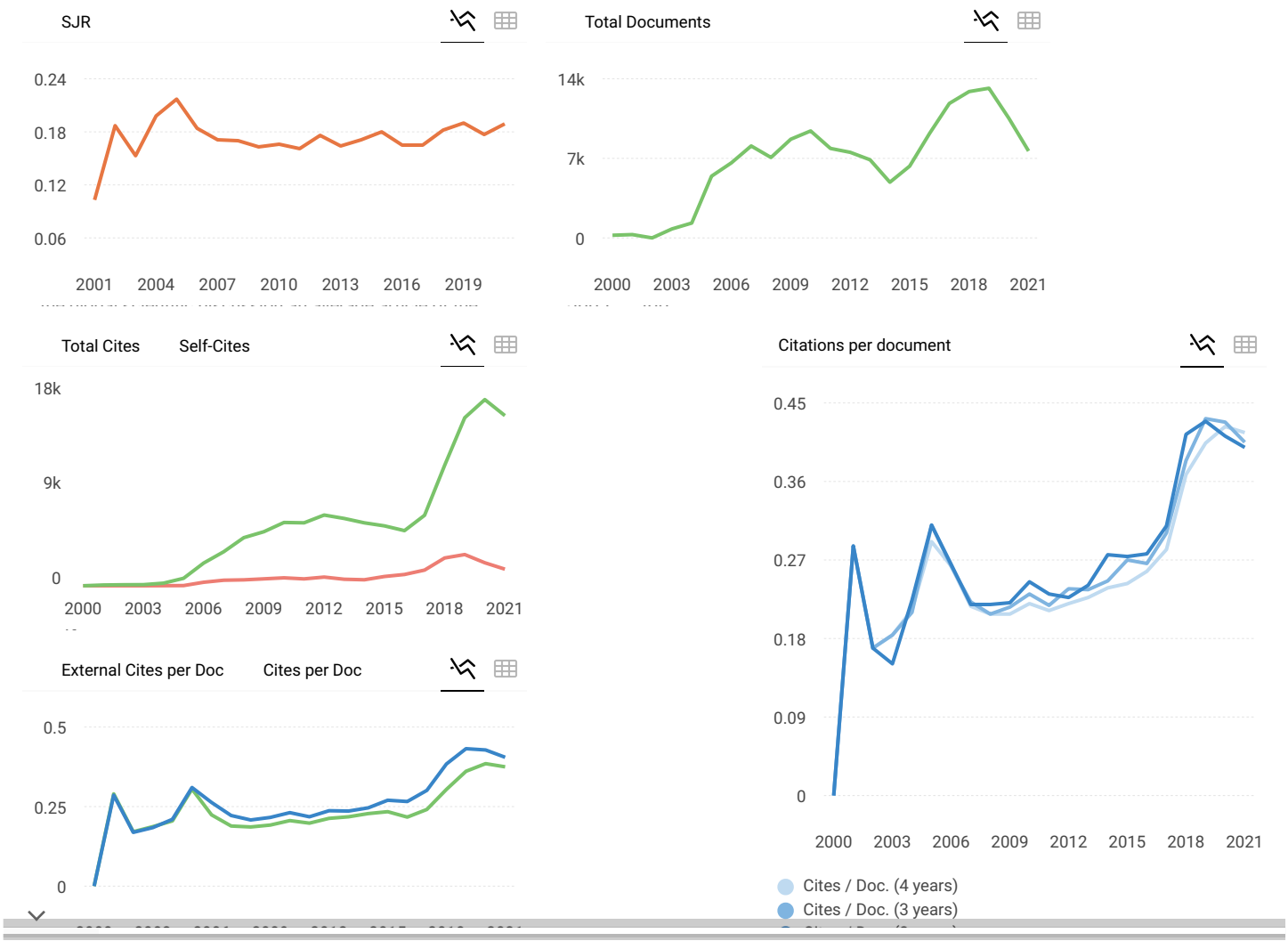

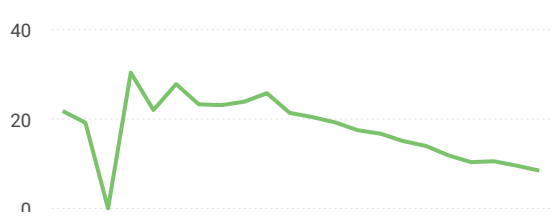

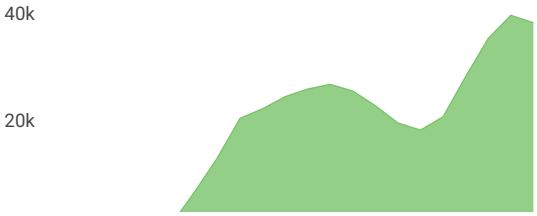

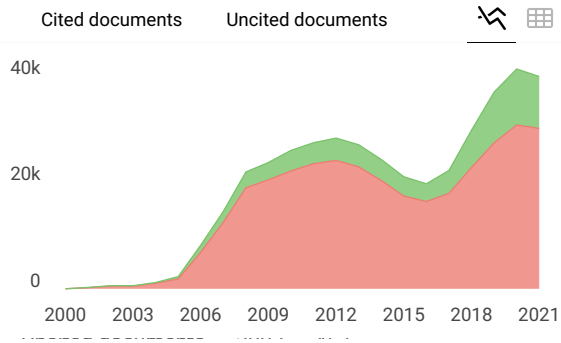

AIP Conference Proceedings

Not yet assigned quartile

SJR 2021
0.19

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<a href="https://www.scimag
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SCImago Graphica

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Metrics based on Scopus® data as of April 2022

B **Bhupender Parashar** 3 months ago

I have my papers published in AIP proceedings. it is showing in Scopus indexing database. BUt it is not showing in Web of Science database. Why is it so?

reply

Dear Bhupender,
Thank you very much for your comment, unfortunately we cannot help you with your request. We suggest you contact the Web of Science team.
Best Regards, SCImago Team

A **Aizat Akmal A.Mohamad Beddelee** 9 months ago

Hi, may I know if this journal is still covered by Scopus Index as the time this comment is written June 2022, the coverage expired already.

Thanks

reply

SCImago Team

Melanie Ortiz 9 months ago

Dear Aizat, thank you very much for your comment. We suggest you consult the Scopus database directly. Keep in mind that the SJR is a static image (the update is made one time per year) of a database (Scopus) which is changing every day.
The Scopus' update list can also be consulted here:
https://www.elsevier.com/solutions/scopus/how-scopus-works/content
Best Regards, SCImago Team

R **RATHEESH KUMAR NM** 11 months ago

AIP Proceedings publish full length papers in conference proceedings from medical science?

reply

SCImago Team

Melanie Ortiz 11 months ago

Dear Ratheesh,
Thank you for contacting us.
We suggest you visit the journal's homepage or contact the journal's editorial staff , so they could inform you more deeply.
Best Regards, SCImago Team

V **Viktor V.Chistyakov** 12 months ago

Dear Scimago!
Why has not assigned quartile for AIP Procs up to now? Were it assigned then what is?
Thank You
Bestregards

SCImago Team

Melanie Ortiz 12 months ago

Dear Viktor,
Thank you for contacting us. Please see comments below.
Best regards, SCImago Team

D **Dr Kumutha D** 2 years ago

Dear Sir,
Greetings!!!!

What is the Q value? Because, in our institution Q1, Q2, Q3 is very much necessary...
Through conference i planned to submit a paper... Please let me know

Thanks

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Dr Kumutha,
Thank you for contacting us. Please see comments below.
Best regards, SCImago Team

F **Fathi awad** 2 years ago

Hi
I am asking about the Q factor for AIP proceedings.

Thank you very much

reply

SCImago Team

Melanie Ortiz 2 years ago

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

G **Ghazwan Jreou** 2 years ago

according to Scopus Q classification list .
with regards.

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Ghazwan,
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

A **ASHOK KUMAR K** 2 years ago

As per the information in SJR portal the coverage period for AIP conference proceedings is up to 2020. I want to know whether the period of validity or coverage gets extended or not? If gets extended when can we see those updates in the SJR portal?

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Ashok,
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. Therefore, the indicators for 2020 will be available in June 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.
Best Regards, SCImago Team

K **Kay** 2 years ago

My university is going to organise a conference in social science on 27-28 Oct 2021. We would like to publish our conference papers in your proceeding as our official proceeding. What are the procedures and publication fees?

Regards.

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Kay

or contact the editorial staff , so they could inform you more deeply.
Best Regards, SCImago Team

R **Ruslan** 2 years ago

I have published articles on AIP, but until now I have not received confirmation for my Scopus ID, please explain. thank you

reply

SCImago Team

Melanie Ortiz 2 years ago

Dear Ruslan,
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

V **Vikas** 3 years ago

currently, the journal is not assigned quartile (Q indexing). When we can expect the assignment.

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Vikas,
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

S **Siddik** 3 years ago

This will come under scopus journal list?

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Siddik,

status as SJR is a static image of Scopus, which is changing every day.
Best Regards, SCImago Team

H **Hassan Yassein** 3 years ago

ISSN of this journal different of ISSN in Scopus, although the data of
SJR depends on the scopes

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Hassan,
Thank you for contacting us.
SJR is a portal with scientometric indicators of journals indexed in Scopus. All the data (Title, ISSN, etc.) 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 (April/May 2020).

The next SCImago update will be made throughout June 2020 with the new update sent by Scopus. We suggest you wait for that date in order to see if there are any changes regarding this matter.

Best Regards, SCImago Team

K **Khairil** 3 years ago

Is this proceeding ranked Q4?

reply

A **ali mohammed** 3 years ago

why this journal dont have any rank yet ?
it is dont belong to Q1,2,3,4 ?

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Ali,
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,

A **Akshya Sekar** 3 years ago

Hi mam/sir,
I want to know whether this AIP conference proceeding is indexed in SCI or not?

Thanks

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Akshya,
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 the index status. We suggest you to consult Scopus database (see the current status of the journal) or other databases (like WoS). Best Regards, SCImago Team

K **Khairil** 3 years ago

Your IP (036.071.233.236) is blocked.
Block Reason: This IP was identified as infiltrated and is being used by sci-hub as a proxy.

How to unblock this my IP for acess AIP site?

thanks

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Khairil,
thank you for contacting us.
Sorry to tell you that SCImago Journal & Country Rank is not a journal. SJR is a portal with scientometric indicators of journals indexed in Elsevier/Scopus.
Unfortunately, we cannot help you with your request, we suggest you to contact the journal's editorial staff by e-mail. Best Regards, SCImago Team

D **Duha Ahmed** 3 years ago

dear Admin
about the AIP Conference Proceeding can you see the Scopus site because the date end to 2019 is there any update about this time or change it to 2020 in the near future and you will see it in the site of Scopus
https://www.scopus.com/sourceid/26916

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Duha,

Thank you for contacting us.Unfortunately, we cannot see what will happen in the future with this journal. Best Regards, SCImago Team

M **mohammed** 3 years ago

Is the (AIP Conference Proceeding) out of Scopes because I tried to search for it in Scopes and I did not find it
Please answer me

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Mohammed,

thank you for contacting us. You can find it in Scopus:
https://www.scopus.com/sourceid/26916

Best Regards, SCImago Team

T **Thanh Quang Khai Lam** 3 years ago

Dear Elena Corera!
Can you tell me "Lecture notes in civil engineering" in Q4?
i don't see in Scimago.
Thank you

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Thanh,
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

Can i know is this journal Q1,Q2,Q3 or Q4. Thank you.

Regards

reply

SCImago Team

Melanie Ortiz 3 years ago

Dear Teo, thank you very much for your request. You can consult that information in SJR website. Best Regards, SCImago Team

H **Hassan Abdulhadi** 4 years ago

I ASKE ABOUT AIP CONFERENCE PROCEEDINGS WITHIN SCOPUS OR THOMSON REUTERS WITH BEST WISHES

reply

H **Hassan Abdulhadi** 4 years ago

I ASKE ABOUT AIP CONFERENCE PROCEEDINGS WITHIN SCOPUS OR THOMSON REUTERS WITH BEST WISHES

SCImago Team

Elena Corera 4 years ago

Dear Hassan,

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

T **Tarik** 4 years ago

Dear. Elena
Hi

Please can we concedar AIP conference proceeding as journal .What i mean ,the publication type could be
journal of AIP conference proceedings .

Best regards

SCImago Team

Elena Corera 4 years ago

Dear Tarik,

thank you very much for your comment. Unfortunately, we cannot help you with your request, we suggest you contact journal's editorial staff so they could inform you more deeply. You can find contact information in SJR website https://www.scimagojr.com

Best regards,
SCImago Team

D **Dunia** 5 years ago

dear
did the AIP conference (TMREES 18)have Thomson roeters or scopus or SJR Rank or not?

reply

SCImago Team

Elena Corera 5 years ago

Dear Dunia,

thank you very much for your comment. SCImago Journal & Country Ranks shows all the journal's vailable information in Open Access If you do not locate the journal in the search engine, Scopus / Elsevier has not provided us those data.

Best Regards,
SCImago Tea

B **Budi Adiperdana** 5 years ago

Dear Admin,

Could you please add the Quartile Rank for AIP Conference Proceedings

Best regards,
Budi

reply

SCImago Team

Elena Corera 5 years ago

Dear Budi, for Conferences and Proceedings the SJR is not calculated. Best Regards,
SCImago Team

Email
(will not be published)

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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.

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