LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : JURNAL NASIONAL

Judul Jurnal Ilmiah (Artikel)	:	Average Based-Fts Markov Chain Based On A Modified Frequency Density Partitioning To Predict Covid-19 In Central Java		
Nama/ Jumlah Penulis	:	**Susilo Hariyanto**, Zaenurrohman, Titi Udjiani SRRM		
Status Pengusul	:	penulis ke-1		
Identitas Jurnal Ilmiah	:	a. Nama Jurnal	:	CAUCHY –Jurnal Matematika Murni dan Aplikasi
		b. Nomor ISSN	:	2086-0382 (Print) 2477-3344 (Online)
		c. Vol, No., Bln Thn	:	7(2) (2022), Pages 231-239
		d. Penerbit	:	Mathematics Department, Faculty of Science and Technology, Universitas Islam Negeri Maulana Malik Ibrahim Malang
		e. DOI artikel (jika ada)	:	10.18860/ca.v7i2.1337
		f. Alamat web penerbit	:	https://ejournal.uin-malang.ac.id/index.php/Math/article/view/13371/0
		g. Terindex	:	Peringkat 2

Kategori Publikasi Jurnal Ilmiah (beri ✓pada kategori yang tepat)	:	√	Jurnal Ilmiah Nasional Terakreditasi Peringkat 1 &2
			Jurnal Ilmiah Nasional Terakreditasi Peringkat 3 &4
			Jurnal Ilmiah Nasional

Hasil Penilaian *Peer Review* :

Komponen Yang Dinilai	Nilai Reviewer		Nilai Rata-Rata
	Reviewer 1	Reviewer 2	
a. Kelengkapan unsur isi jurnal (10%)	2,3	2,5	2,4
b. Ruang lingkup dan kedalaman pembahasan (30%)	7	7,475	7,2375
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	7	7,475	7,2375
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	7	7,475	7,2375
Total = (100%)	**23,3**	**24,925**	**24,1125**
Nilai Pengusul = 60 % x 24,1125 = 14,4675			

Semarang,
Reviewer 1

Nama : Prof. Dr. Sunarsih, M.Si
NIP. 195809011986032002
Unit Kerja : FSM Undip
Bidang Ilmu: Matematika

Reviewer 2

Nama : Drs. Bayu Surarso, M.Sc Ph.D
NIP. 19631105 198803 1 001
Unit Kerja : FSM Undip
Bidang Ilmu: Matematika

LEMBAR
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- [ ] Jurnal Ilmiah Nasional Terakreditasi Peringkat 3 &4
- [ ] Jurnal Ilmiah Nasional

Hasil Penilaian *Peer Review* :

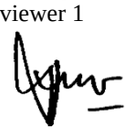
Komponen Yang Dinilai	Nilai Maksimal Jurnal Ilmiah			Nilai Akhir Yang Diperoleh
	Nasional Terakreditasi Peringkat 1 &2 [25]	Nasional Terakreditasi Peringkat 3 &4 [ ]	Nasional [ ]	
a. Kelengkapan unsur isi jurnal (10%)	2,5			2,3
b. Ruang lingkup dan kedalaman pembahasan (30%)	7,5			7
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	7,5			7
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	7,5			7
Total = (100%)	**25**			**23,3**
Nilai Pengusul = 60% x 23,3 = 13,98				

Catatan Penilaian artikel oleh Reviewer :

1. **Kesesuaian dan kelengkapan unsur isi jurnal:**
   Isi jurnal sangat sesuai dan lengkap. Artkel ini membahas tentang memodifikasi dan menganalisis suatu metode permalan yang merupakan salah satu topik di bidang matematika, sehingga sangat sesuai dengan focus dan scope jurnal. Sistematika penulisan juga sangat lengkap yakni memuat Introduction, Method, Result and Discusioon, dan Conclusion.
2. **Ruang lingkup dan kedalaman pembahasan:**
   Lingkup pembasannya yakni menganalisis modifikasi metode baru dalam peramalan. Ini merupakan modifikasi dari Average Based Fuzzy Time Series dengan partisi kepadatan frekuensi. Kedalaman pembahasan metode cukup baik dan dilengkapi dengan penghitungan error serta contoh yang mampu memperjelas topik yang dibahas.
   ..
3. **Kecukupan dan kemutakhiran data/informasi dan metodologi:**
   Data dalam artikel ini menngunakan data tahun 2021, sehingga cukup mutakhir. Disamping itu metodologi yang dipakai juga sangat update dalam riset matematika saat ini dan didukung dengan dartar referensi sebanyak 15 pustaka yang relevan.

4. **Kelengkapan unsur dan kualitas terbitan:**
   Unsur dan kualitas terbitan adalah baik, dengan simirality sebesar 16%.

Semarang, 3 Maret 2023
Reviewer 1



Nama : Prof. Dr. Sunarsih, M.Si
NIP. : 195809011986032002
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Bidang Ilmu: Matematika

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a. Kelengkapan unsur isi jurnal (10%)	2,5			2,5
b. Ruang lingkup dan kedalaman pembahasan (30%)	7,5			7,475
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	7,5			7,475
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	7,5			7,475
Total = (100%)				**24,925**
Nilai Pengusul = 60% x 24,925 = 14,955				

Catatan Penilaian artikel oleh Reviewer :

1. Kesesuaian dan kelengkapan unsur isi jurnal:
Artikel ini sangat sesuai diterbitkan di jurnal ini dikarenakan ada kesesuaian focus dan scope dari jurnal Cauchy. Artikel disajikan secara sistematis dan diberikan contoh penerapannya sehingga unsur kelengkapannya sangat baik.

2. Ruang lingkup dan kedalaman pembahasan:
Lingkup pembahasan artikel pada bidang analisis peramalan yang dikombinasikan dengan himpunan fuzzy dan modifikasi pada partisi kepadatan frekuensinya. Dengan demikian ruang lingkupnya sangat sesuai dengan kajian bidang matematika. Sedangkan tingkat kedalamanya materi juga sangat bagus.

3. Kecukupan dan kemutakhiran data/informasi dan metodologi:
Informasi data yang digunakan cukup mutakhir yakni data tahun 2021 selama pandemic covid melanda, disamping itu didukung dengan sumber referensi sebanyak 15 paper yang sebagian besar cukup update.

4. Kelengkapan unsur dan kualitas terbitan:
Jurnal terindeks Sinta 2 dengan beberapa editor dari luar negeri, jumlah artikel cukup memadai, dan uji similaritasnya 16 % juga cukup baik..
..

Semarang, Februari 2023
Reviewer 2

Nama : Drs. Bayu Surarso, M.Sc Ph.D
NIP. : 19631105 198803 1 001
Unit Kerja : FSM Undip
Bidang Ilmu: Matematika

KEMENTERIAN RISET DAN TEKNOLOGI/BADAN RISET
DAN INOVASI NASIONAL
DEPUTI BIDANG PENGUATAN RISET DAN PENGEMBANGAN
Gedung B.J.Habibie Lantai 19 – 20, Jalan M.H. Thamrin No. 8, Jakarta 10340
Telepon 021-3162222 Ext. 9702, 9782, 9707; Faksimile 021-3101728

Nomor : B/804/E5/E5.2.1/2019 Jakarta, 3 April 2020
Lampiran : 1 (satu) Berkas
Perihal : **Pemberitahuan Hasil Akreditasi Jurnal Ilmiah Periode I Tahun 2020**

Kepada Yth.
1. Pimpinan Perguruan Tinggi
2. Koordinator LL Dikti I s.d. XIV
3. Ketua Himpunan Profesi
4. Pengelola Jurnal Ilmiah

di seluruh Indonesia

Dengan hormat,

Sehubungan dengan hasil Akreditasi Jurnal Ilmiah Periode I Tahun 2020 dan telah diterbitkannya Surat Keputusan Menteri Riset dan Teknologi/Badan Riset dan Inovasi Nasional Nomor 85/M/KPT/2020, tanggal 01 April 2020, dengan hormat bersama ini kami sampaikan hasil akreditasi sebagaimana terlampir. Adapun ketentuan penerbitan sertifikat akreditasi sebagai berikut:

1. Bagi usulan akreditasi baru maka sertifikat akreditasi akan diterbitkan dan diberikan kepada pengelola jurnal.
2. Bagi usulan akreditasi ulang yang hasil akreditasi naik peringkat maka sertifikat akreditasi akan diterbitkan dan diberikan kepada pengelola jurnal.
3. Bagi usulan akreditasi ulang yang hasil akreditasi peringkatnya tetap dan telah memiliki sertifikat yang masih berlaku masa akreditasi, maka sertifikat baru tidak akan diterbitkan, dan sertifikat sebelumnya dapat digunakan sampai berakhir masa berlaku.
4. Bagi pengelola yang sudah terakreditasi dan namanya tercantum dalam SK sebelumnya serta belum memiliki sertifikat dapat meminta sertifikat terdahulu.
5. Penerbitan sertifikat dilakukan secara bertahap paling cepat 2 minggu setelah pengumuman ini dan dilakukan pemutakhiran data di laman : http://sinta2.ristekbrin.go.id/journals, penyerahan sertifikat dilakukan secara bertahap dapat diunduh langsung melalui akun pengusul di laman: http://arjuna.ristekbrin.go.id/ mulai tanggal 6 Juni 2020.
6. Bagi usulan yang ditolak administrasi dan usulan baru bisa mengajukan kembali melalui http://arjuna.ristekbrin.go.id/.

Atas perhatian dan kerja sama yang baik, kami ucapkan terima kasih.

Direktur Pengelolaan Kekayaan Intelektual

ttd

Heri Hermansyah
NIP. 197601181999031002

Tembusan :
Plt. Deputi Bidang Penguatan Riset dan Pengembangan

SALINAN

MENTERI RISET DAN TEKNOLOGI/
KEPALA BADAN RISET DAN INOVASI NASIONAL
REPUBLIK INDONESIA

KEPUTUSAN MENTERI RISET DAN TEKNOLOGI/
KEPALA BADAN RISET DAN INOVASI NASIONAL
REPUBLIK INDONESIA

NOMOR 85/M/KPT/2020

TENTANG

PERINGKAT AKREDITASI JURNAL ILMIAH PERIODE I
TAHUN 2020

MENTERI RISET DAN TEKNOLOGI/
KEPALA BADAN RISET DAN INOVASI NASIONAL
REPUBLIK INDONESIA,

Menimbang : a. bahwa dalam rangka pembinaan dalam penyelenggaraan ilmu pengetahuan dan teknologi serta untuk meningkatkan relevansi, kuantitas, dan kualitas publikasi ilmiah ilmuwan Indonesia untuk mendukung daya saing bangsa diperlukan peringkat akreditasi jurnal ilmiah;

b. bahwa berdasarkan hasil akreditasi jurnal ilmiah yang ditetapkan oleh Tim Akreditasi Jurnal Ilmiah Kementerian Riset dan Teknologi/Badan Riset dan Inovasi Nasional pada tanggal 26 Maret 2020, telah diperoleh Peringkat Akreditasi Jurnal Ilmiah Periode I Tahun 2020;

c. bahwa berdasarkan pertimbangan sebagaimana dimaksud dalam huruf a dan huruf b, perlu menetapkan Keputusan Menteri Riset dan Teknologi/Kepala Badan Riset dan Inovasi Nasional tentang Peringkat Akreditasi Jurnal Ilmiah Periode I Tahun 2020;

Mengingat : 1. Undang-Undang Nomor 12 Tahun 2012 tentang Pendidikan Tinggi (Lembaran Negara Republik Indonesia Tahun 2012 Nomor 158, tambahan Lembaran Negara Republik Indonesia Nomor 5336);

2. Undang-Undang ...

2. Undang-Undang Nomor 11 Tahun 2019 tentang Sistem Nasional Ilmu Pengetahuan dan Teknologi (Lembaran Negara Republik Indonesia Tahun 2019 Nomor 148, Tambahan Lembaran Negara Republik Indonesia, Tambahan Lembaran Negara Republik Indonesia Nomor 6374);
3. Peraturan Pemerintah Nomor 4 Tahun 2014 tentang Penyelenggaraan Pendidikan dan Pengelolaan Perguruan Tinggi (Lembaran Negara Republik Indonesia Tahun 2014 Nomor 16, Tambahan Lembaran Negara Republik Indonesia Nomor 5500);
4. Peraturan Presiden Nomor 50 Tahun 2020 tentang Kementerian Riset dan Teknologi (Lembaran Negara Republik Indonesia Tahun 2020 Nomor 89);
5. Keputusan Presiden Nomor 113/P Tahun 2019 tentang Pembentukan Kementerian Negara dan Pengangkatan Menteri Negara Kabinet Indonesia Maju Periode Tahun 2019-2024;

MEMUTUSKAN:

Menetapkan : KEPUTUSAN MENTERI RISET DAN TEKNOLOGI/KEPALA BADAN RISET DAN INOVASI NASIONAL TENTANG PERINGKAT AKREDITASI JURNAL ILMIAH PERIODE I TAHUN 2020.

KESATU : Menetapkan Peringkat Akreditasi Jurnal Ilmiah Periode I Tahun 2020 sebagaimana tercantum dalam Lampiran yang merupakan bagian yang tidak terpisahkan dari Keputusan Menteri/Kepala Badan ini.

KEDUA : Akreditasi Jurnal Ilmiah sebagaimana dimaksud dalam Diktum KESATU berlaku selama 5 (lima) tahun mulai dari nomor dan tahun sebagaimana tercantum dalam Lampiran yang merupakan bagian yang tidak terpisahkan dari Keputusan Menteri/Kepala Badan ini.

KETIGA ...

KETIGA : Setiap jurnal ilmiah wajib mencantumkan masa berlaku akreditasi di dalam *website* jurnal dengan menuliskan tanggal penetapan dan tanggal akhir masa berlaku akreditasi.

KEEMPAT : Keputusan Menteri/Kepala Badan ini mulai berlaku pada tanggal ditetapkan.

Ditetapkan di Jakarta
pada tanggal 1 April 2020

MENTERI RISET DAN TEKNOLOGI/
KEPALA BADAN RISET DAN INOVASI NASIONAL REPUBLIK INDONESIA,

ttd.

BAMBANG P.S. BRODJONEGORO

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Ardhien Nissa Widhawati Siswojo

SALINAN

LAMPIRAN
KEPUTUSAN MENTERI RISET DAN TEKNOLOGI/
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NOMOR 85/M/KPT/2020
TENTANG
PERINGKAT AKREDITASI JURNAL ILMIAH
PERIODE I TAHUN 2020

PERINGKAT AKREDITASI JURNAL ILMIAH PERIODE 1 TAHUN 2020

Peringkat	No.	Nama Jurnal	E-ISSN	Penerbit	Keterangan
1	1	*Bulletin of Chemical Reaction Engineering & Catalysis*	19782993	*Departement of Chemical Engineering, Diponegoro University*	Reakreditasi Tetap di Peringkat 1 mulai Volume 15 Nomor 1 Tahun 2020
	2	*Indonesian Aquaculture Journal*	25026577	*The Center for Fisheries Research, Indonesian Ministry of Marine Affairs and Fisheries*	Reakreditasi Tetap di Peringkat 1 mulai Volume 14 Nomor 2 Tahun 2019
	3	*Indonesian Journal of Chemistry*	24601578	*Chemistry Department, Faculty of Mathematics and Natural Sciences*, Universitas Gadjah Mada	Reakreditasi Tetap di Peringkat 1 mulai Volume 20 Nomor 1 Tahun 2020
	4	Jurnal Ilmu Ternak dan Veteriner	2252696X	*Indonesian Center for Animal Research and Development*	Reakreditasi Tetap di Peringkat 1 mulai Volume 24 Nomor 4 Tahun 2020
	5	Kesmas: *National Public Health Journal*	24600601	Fakultas Kesehatan Masyarakat Universitas Indonesia	Reakreditasi Tetap di Peringkat 1 mulai Volume 14 Nomor 2 Tahun 2019

6. Molekul ...

Peringkat	No.	Nama Jurnal	E-ISSN	Penerbit	Keterangan
	6	Molekul: Jurnal Ilmiah Kimia	25030310	Jurusan Kimia FMIPA Universitas Jenderal Soedirman	Reakreditasi Tetap di Peringkat 1 mulai Volume 14 Nomor 2 Tahun 2019
	7	SAINS TANAH - *Journal of Soil Science and Agroclimatology*	23561424	*Department of Soil Science, Faculty of Agriculture*, Universitas Sebelas Maret	Reakreditasi Tetap di Peringkat 1 mulai Volume 15 Nomor 1 Tahun 2018
2	1	*Advances in Food Science, Sustainable Agriculture and Agroindustrial Engineering* (AFSSAAE)	26225921	Universitas Brawijaya	Usulan Baru mulai Volume 1 Nomor 1 Tahun 2018
	2	*Al Quds*: Jurnal Studi Alquran dan Hadis	25803190	Institut Agama Islam Negeri (IAIN) Curup	Reakreditasi Naik Peringkat dari Peringkat 3 ke Peringkat 2 mulai Volume 3 Nomor 2 Tahun 2019
	3	*Al-Bidayah*: Jurnal Pendidikan Dasar Islam	25493388	Program Studi Pendidikan Guru Madrasah Ibtidaiyah Fakultas Ilmu Tarbiyah dan Keguruan, Universitas Islam Negeri Sunan Kalijaga Yogyakarta	Reakreditasi Naik Peringkat dari Peringkat 3 ke Peringkat 2 mulai Volume 11 Nomor 2 Tahun 2019
	4	*Al-Istinbath*: Jurnal Hukum Islam	25483382	Institut Agama Islam Negeri (IAIN)) Curup	Reakreditasi Naik Peringkat dari Peringkat 3 ke Peringkat 2 mulai Volume 4 Nomor 2 Tahun 2019
	5	Amerta	25498908	Pusat Penelitian Arkeologi Nasional	Reakreditasi Tetap di Peringkat 2 mulai Volume 37 Nomor 2 Tahun 2019

6. *Analisa ...*

Peringkat	No.	Nama Jurnal	E-ISSN	Penerbit	Keterangan
	6	*Analisa Journal of Social Science and Religion*	26217120	Balai Penelitian dan Pengembangan Agama Semarang	Reakreditasi Tetap di Peringkat 2 mulai Volume 4 Nomor 4 Tahun 2019
	7	*Arabiyatuna*: Jurnal Bahasa Arab	25805053	Institut Agama Islam Negeri Curup	Reakreditasi Naik Peringkat dari Peringkat 3 ke Peringkat 2 mulai Volume 3 Nomor 2 Tahun 2019
	8	Arteks: Jurnal Teknik Arsitektur	25411217	Program Studi Teknik Arsitektur, Universitas Katolik Widya Mandira	Reakreditasi Naik Peringkat dari Peringkat 3 ke Peringkat 2 mulai Volume 4 Nomor 1 Tahun 2019
	9	*Bali Medical Journal*	25286641	*Sanglah General Hospital* bekerjasama dengan Fakultas Kedokteran, Universitas Udayana	Reakreditasi Tetap di Peringkat 2 mulai Volume 9 Nomor 1 Tahun 2020
	10	Buletin *Al-Turas*	25795848	Fakultas Adab dan Humaniora, Universitas Islam Negeri Syarif Hidayatullah Jakarta	Reakreditasi Naik Peringkat dari Peringkat 3 ke Peringkat 2 mulai Volume 26 Nomor 1 Tahun 2020
	11	Buletin Psikologi	25285858	Fakultas Psikologi, Universitas Gadjah Mada	Reakreditasi Tetap di Peringkat 2 mulai Volume 27 Nomor 2 Tahun 2019
	12	*Cauchy*: Jurnal Matematika Murni dan Aplikasi	24773344	Jurusan Matematika, Fakultas Sains dan Teknologi, UIN Maulana Malik Ibrahim Malang	Reakreditasi Naik Peringkat dari Peringkat 3 ke Peringkat 2 mulai Volume 6 Nomor 1 Tahun 2019

13. *Communication* ...

Peringkat	No.	Nama Jurnal	E-ISSN	Penerbit	Keterangan
	28	*Riyadhoh*: Jurnal Pendidikan Olahraga	26562936	UPT Publikasi dan Pengelolaan Jurnal, Universitas Islam Kalimantan	Usulan Baru mulai Volume 1 Nomor 1 Tahun 2018
	29	Unistek: Jurnal Pendidikan dan Aplikasi Industri	27160416	Universitas Islam Syekh Yusuf Tangerang	Usulan Baru mulai Volume 5 Nomor 1 Tahun 2018

MENTERI RISET DAN TEKNOLOGI/
KEPALA BADAN RISET DAN INOVASI NASIONAL
REPUBLIK INDONESIA,

ttd.

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CAUCHY: JURNAL MATEMATIKA MURNI DAN APLIKASI

p-ISSN: 2086-0382 | **e-ISSN:** 2477-3344

CAUCHY: Jurnal Matematika Murni dan Aplikasi is a mathematical international journal published twice a year in May and November by the Mathematics Department, Faculty of Science and Technology, Universitas Islam Negeri Maulana Malik Ibrahim Malang

CAUCHY: Jurnal Matematika Murni dan Aplikasi has been accredited Second Grade " SINTA 2" Ministry of Research and Technology/National Agency for Research and Innovation, Republic of Indonesia (SK: 85/M/KPT/2020) since April 1, 2020.

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- Geometry Theories and its Applications
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- Real Analysis and its Applications
- Operation Research and its Applications
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- Dinamical Systems and its Applications
- Mathematical Modeling and its Applications
- Discrete Mathematics and its Applications
- Computer Mathematics and its Applications
- Actuarial Mathematics and its Applications

Journal History
CAUCHY: Jurnal Matematika Murni dan Aplikasi has several changes and updates in its history as follows: 1). On 2009-2012, the cover color was changed from yellow to purple; 2). On 2013-2015, it used two-column system for the layout; 3). From 2016, it uses one-column layout and each article submitted to CAUCHY has to be written in English.

NEW **Starting from Vol. 4 No. 2 (2016) CAUCHY: Jurnal Matematika Murni dan Aplikasi use a new layout template**

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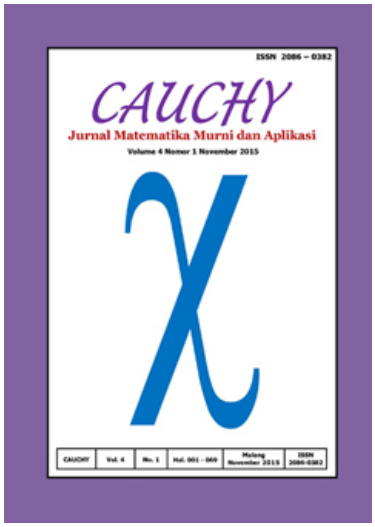

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CAUCHY
Jurnal matematika Murni dan Aplikasi
ISSN: 2086-0382 (print)
2477-3344 (online)
An International Journal. Available online at: http://ejournal.uin-malang.ac.id/index.php/math

TABLE OF CONTENTS

ARTICLES

Journal History
Peer Reviewers
Indexing and Abstracting
Author Guidelines
Open Access Policy
Plagiarism Policy
Copyright Notice
Reviewer Acknowledgement
Peer Review Process/Policy
Visitor Statistics
Contact Us

Citedness in Scopus

Manuscript Template

Article Template

Citation Journal

DOI: 10.18860/ca.v7i2.13356 | Views: 411 | Downloads: 189

DOI: 10.18860/ca.v7i2.13371 | Views: 353 | Downloads: 190

DOI: 10.18860/ca.v7i2.13451 | Views: 317 | Downloads: 206

DOI: 10.18860/ca.v7i2.13458 | Views: 360 | Downloads: 157

DOI: 10.18860/ca.v7i2.13462 | Views: 308 | Downloads: 152

DOI: 10.18860/ca.v7i2.13701 | Views: 436 | Downloads: 237

DOI: 10.18860/ca.v7i2.14003 | Views: 337 | Downloads: 206

DOI: 10.18860/ca.v7i2.14136 | Views: 551 | Downloads: 240

DOI: 10.18860/ca.v7i2.14407 | Views: 441 | Downloads: 202

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CAUCHY –Jurnal Matematika Murni dan Aplikasi
Volume 7(2) (2022), Pages 152-157
p-ISSN: 2086-0382; e-ISSN: 2477-3344

A Note on Generalized Strongly p-Convex Functions of Higher Order

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ABSTRACT

Generalized strongly p-convex functions of higher order is a new concept of convex functions which introduced by Saleem *et al.* in 2020. The Schur type inequality for generalized strongly p-convex functions of higher order also studied by them. This paper aims to revise Schur type inequality for generalized strongly p-convex functions of higher order in their paper. In order to revise it, we show that the contradiction was true. This paper showed that Schur type inequality for generalized strongly p-convex functions of higher order previously is not valid and we give the correct Schur type inequality for generalized strongly p-convex functions of higher order.

Keywords: Schur type inequality; p-Convex functions; Strongly convex of higher order

INTRODUCTION

Convexity is a basic notion in many branches of applied mathematics. Convexity is an important thing on Functional analysis, Geometry, Mathematical programming, Probability, and Statistics. On Functional analysis, convexity has intended to ensure existence and uniqueness of solutions of problems of Calculus of variations and optimal control. On Mathematical programming, convexity has intended to ensure convergence of optimization algorithms [1].

Convexity appears in ancient Greek Geometry. Archimedes (ca. 250 BC) used convexity on study of the area and arch length. Archimedes has been the first person who gave a definition of convexity, similar to the geometric definition which used till today, a set is said to be convex if it contains all line segments between each of its points [1].

Some geometric properties of convex sets and functions have studied before 1960 by great mathematicians Hermann Minkowski and Werner Fenchel. In 1891, Minkowski proved that, in Euclidean space $\mathbb{R}^n$, every compact convex set with center at the origin and volume greater than 2^n contains at least one point with integer coordinates different from the origin [2]. Afterwards, in 1951, Werner Fenchel's monograph stimulated the development of convexity theory.

Several researchers have been considered for classical convexity such that some of these new concepts are based on an extension of the domain of convex functions or

Submitted: July 16, 2021 Reviewed: October 12, 2021 Accepted: October 18, 2021
DOI: http://dx.doi.org/10.18860/ca.v7i1.12938

CAUCHY –Jurnal Matematika Murni dan Aplikasi
Volume 7(2) (2022), Pages 158-172
p-ISSN: 2086-0382; e-ISSN: 2477-3344

The Generalized STAR Modeling with Heteroscedastic Effects

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ABSTRACT

Most of the Generalized Space Time Autoregressive (GSTAR) models assume the constant error variance. In fact, there are many space-time observations whose variability is changing over the times. In this study, a GSTAR model is built with an error variance that is not constant or has a heteroscedasticity effect, namely the combination of GSTAR–Autoregressive Conditional Heteroscedasticity (ARCH). The parameters of the GSTAR–ARCH model are estimated using the Generalized Least Square (GLS) method to obtain the efficient parameter estimation. As a case study, the GSTAR–ARCH model is applied to the daily mean wind speed data of New Orleans, Florida and Mississippi, in order to predict the occurrence of Hurricane Katrina that occurred in 2005. It is obtained that the heteroscedastic involvement in GSTAR modeling gives the better results in predictions, compared to the homoscedastics approach. Furthermore, as the order of model is higher, the GSTAR model performances is better, which is shown by the least Mean Squared Errors (MSE) and Mean Absolute Percentage Error (MAPE). The obtained results show that the GSTAR model (3;0,0,1)–ARCH(1) predicts the Hurricane Katrina better than the GSTAR(3;0,0,1) and GSTAR(1;1)–ARCH(1) models.

Keywords: GSTAR; ARCH; Conditional Variance; Generalized Least Squares; Heteroskedasticity

INTRODUCTION

A hurricane is a natural phenomenon in the form of wind gusts with a speed exceeding 119 km/hour. Hurricanes are a type of tropical cyclone that usually forms on warm sea surfaces around the equator. The wind speed at one location is influenced by the wind speed of the previous time at that location and also influenced by the average wind speed at other locations. This means that the wind speed can be modeled with space-time models such as STARMA(p,q), STAR(p), STMA(q), GSTAR(p,q) and STARMAG(p,q). The model used in this study is the GSTAR model which uses a certain weight matrix according to the location conditions.

Submitted: August 05, 2021 Reviewed: August 20, 2021 Accepted: December 20, 2021
DOI: http://dx.doi.org/10.18860/ca.v7i1.13097

CAUCHY –Jurnal Matematika Murni dan Aplikasi
Volume 7(2) (2022), Pages 186-194
p-ISSN: 2086-0382; e-ISSN: 2477-3344

An Application of Geographically Weighted Regression for Assessing Water Polution in Pontianak, Indonesia

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ABSTRACT

Geographically weighted regression (GWR) is an exploratory analytical tool that creates a set of location-specific parameter estimates. The estimates can be analyzed and represented on a map to provide information on spatial relationships between the dependent and the independent variables. A problem that is faced by the GWR users is how best to map these parameter estimates. This paper introduces a simple mapping technique that plots local t-values of the parameters on one map. This study employed GWR to evaluate chemical parameters of water in Pontianak City. The chemical oxygen demand (COD) was used as the dependent variable as an indicator of water pollution. Factors used for assessing water pollution were pH (X_1), iron (X_2), fluoride (X_3), water hardness (X_4), nitrate (X_5), nitrite (X_6), detergents (X_7) and dissolved oxygen, DO, (X_8). Samples were taken from 42 locations. Chemical properties were measured in the laboratory. The parameters of the GWR model from each site were estimated and transformed using Geographic Information Systems (GIS). The results of the analysis show that X_1, X_2, X_3, X_5 and X_7 influence the amount of COD in water. The resulting map can assist the exploration and interpretation of data.

Keywords: Chemical Parameters; Geographically Weighted Regression; Modelling; T-Value Mapping

INTRODUCTION

In a residential area, human activities are one of the critical aspects that affect the quality of water resources. The more activities in the area, the higher the waste discharged into the environment. As the capital city of the West Kalimantan Province, the level of land use in Pontianak City has increased every year. This increase has resulted in a decrease in the carrying capacity of the city. One form of land use that has experienced a very rapid rise is the land for settlements. This condition is closely related to population growth. The total population of Pontianak City is estimated at 646,661 people, with a population density of 5,998 people/km2 and a population growth rate of 1.95% per year [1].

The quantity and quality of water in a region significantly affects the life of living things. Changes in the quality and quantity of water are strongly influenced by the patterns of land management that exist in the area. Waste generated from human

Submitted: September 01, 2021 Reviewed: November 11, 2021 Accepted: January 05, 2022
DOI: http://dx.doi.org/10.18860/ca.v7i1.13266

Average Based-FTS Markov Chain With Modifications to the Frequency Density Partition to Predict COVID-19 in Central Java

by Susilo Hariyanto

Submission date: 14-Feb-2023 07:40PM (UTC+0700)
Submission ID: 2013967457
File name: C-8.pdf (975.48K)
Word count: 3806
Character count: 18153

CAUCHY –Jurnal Matematika Murni dan Aplikasi
Volume 7(2) (2022), Pages 231-239
p-ISSN: 2086-0382; e-ISSN: 2477-3344

Average Based-FTS Markov Chain With Modifications to the Frequency Density Partition to Predict COVID-19 in Central Java

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ABSTRACT

Every day, new Covid-19 positive cases are discovered in Central Java. Many research has used various methodologies to try to forecast new positive instances. The fuzzy time series (FTS) approach is one of them. Many FTS are now in development, including the FTS Markov Chain. The duration of the gap in the FTS must be determined carefully because it will affect the FLR, which will be used to estimate the forecast value. The average-based method can be used to determine the optimum interval length; however, other research use frequency density partitioning to determine the optimal interval length in order to produce superior predicting values. The goal of this research is to improve the accuracy of forecasting values by modifying the frequency density partition on the average based-FTS Markov Chain. The approach utilized is average-based, with the length of the interval determined by the average, the forecast value determined by the FTS Markov Chain, and the frequency density partition modified to provide the ideal interval. The average-based FTS Markov Chain approach with adjustments to the frequency density partition achieves an accuracy rate of 89.3 percent, according to the findings of this study. Because changes to the frequency density partition can produce a good level of accuracy in forecasting new positive cases of Covid-19 in Central Java, it is hoped that this modification of the frequency density partition on the average-based FTS Markov chain can be used as a model for forecasting in fields other than new positive cases. Covid-19.

Keywords: Average Based; FTS Markov Chain; Modified frequency density partitioning; COVID19; MAPE

INTRODUCTION

COVID-19 first appeared in the city of Wuhan, Hubei Province, China, which spread almost all over the world, including Indonesia. At the beginning of 2020, Indonesia experienced a COVID-19 pandemic, which, to this day, new positive cases are still being found[1]. The government is still thinking about how to make Indonesia free from COVID-19.

Many experts have estimated the amount of new Covid-19 positive cases in Indonesia. Forecasting is the process of predicting what will happen in the future over a lengthy period of time[2]. However, no approach for accurately forecasting anything,

Submitted: September 18, 2021 Reviewed: December 08, 2021 Accepted: December 21, 2021
DOI: http://dx.doi.org/10.18860/ca.v7i1.13371

including new Covid-19 positive cases, has been developed to yet. The fuzzy time series (FTS) is one of the forecasting approaches for determining the number of new positive cases in Indonesia. The concept of fuzzy logic is used in the forecasting of FTS. Song and Chissom introduced the FTS in 1993[3], and it has since been widely developed, including the Markov method[4], Chen's method[5], Chen and Hsu's method[6], the weighted method[7], the multiple-attribute fuzzy time series method[8], the percentage change method[9], and Markov chain method[10].

Ruey Chyn Tsaur, developing fuzzy time series by merging the fuzzy time series method with the Markov chain concept [10]. Markov chain is a stochastic process in which future events only depend on today's events. Markov chain is used in the defuzzification process [11].

The determination of the length of the interval in the fuzzy time series does not have a definite formula, but the determination of the length of the interval in the fuzzy time series is based on the researcher. As a result, even if each researcher is utilizing the same data, the length of the interval will vary[3]. Even though the determination of the length of the interval is a very influential part in the formation of a fuzzy logical relationship (FLR).[12]. One method that can be used to determine the length of the interval is the average based. This average based uses an average-based method in determining the length of the interval [12].

Chen and Hsu in 2004 also developed a fuzzy time series. Chen and Hsu developed fuzzy time series by repartitioning based on frequency density. Chen and Hsu's frequency density repartitioning algorithm divides the interval with the highest frequency density into four sub-intervals, the interval with the second highest density into three sub-intervals, the interval with the third highest density into two sub-intervals, and the interval with the lowest density into one sub-interval.[6][13].

Based on the description above, the researcher is interested in modifying the frequency density partitioning algorithm used by Chen and Hsu, namely by exchanging the partition between the interval with the first densest frequency with the third densest interval, which was originally the first densest interval partitioned into 4 sub-intervals, the researcher changed the first densest was partitioned into 2 sub-intervals, and for the interval with the third densest frequency initially partitioned into 2 sub-intervals the researcher changed it to 4 sub-intervals.

Furthermore, the researcher will use the average-based method to determine the interval length in the fuzzy time series type Markov chain, and apply it to forecasting new positive cases of COVID-19 in Central Java.

METHODS

Fuzzy Time Series

The definition of fuzzy time series was first introduced by Song dan Chisom (1993). Let U *universe of discourse*, with $U = \{u_1, u_2, \dots, u_n\}$ on a fuzzy set A_i, defined as[3]:

$$A_i = \frac{f_A(u_1)}{u_1} + \frac{f_A(u_2)}{u_2} + \cdots + \frac{f_A(u_n)}{u_n} \qquad (1)$$

where f_A is the membership of the fuzzy set A_i and u_k is an element of the fuzzy set A_i and $f_A(u_k)$ shows the degree of membership of u_k in A_i where $k = 1,2,3, \dots, n$.

Definition. If $F(t)$ is caused by $F(t-1)$, then the relation in the first order model $F(t)$ can be stated as follows: [5].

$$F(t) = F(t-1) \circ R(t, t-1) \quad (2)$$

where "○" is Max-Min composition operator, and $R(t, t-1)$ is a relation matrix to describe the fuzzy relationship between $F(t-1)$ dan $F(t)$.

Average-Based

Average based is an algorithm that can be used to set the interval length that is determined at the initial stage of forecasting when using fuzzy time series. The steps of the average based algorithm are as follows [12], [14]:

a. Determine the absolute difference (lag) between data $n+1$ and data n with the formula:

$$lag D_n = |(Data\ n+1) - (Data\ n)| \quad (3)$$

b. Determine the length of the interval

$$length\ of\ interval = \left(\frac{total\ lag}{numbers\ of\ data}\right) : 2 \quad (4)$$

c. Determine the basis value of the interval length according to Table 1. Following:

Table 1. Basis Mapping Table

Range	Basis
0,1 – 1,0	0,1
1,1 -10	1
11-100	10
101-1000	100

d. The length of the interval is then rounded up according to the interval basis table.

Modification Frequency Density Partition

In this study, modifications to the frequency density partition were used, the algorithm used is as follows:

a. The interval with the first densest frequency is divided into 2 subintervals.
b. The interval with the second densest frequency is divided into 3 subintervals.
c. The interval with the third densest frequency is divided into 4 subintervals
d. Eliminates intervals that have no frequency.

Fuzzy Time Series Markov Chain

Markov Chain's Fuzzy Time Series forecasting procedure is as follows[10]:

Step 1. Collecting historical data (Yt).

Step 2. Defines the U universe set of data, with D_1 and D_2 being the corresponding positive numbers.

$$U = [D_{min} - D1, D_{max} + D2] \quad (5)$$

Step 3. Specify the number of fuzzy intervals.

Step 4. Defining the fuzzy set in the universe of discourse U, the Fuzzy A_i set declares the linguistic variable of the share price by $1 \leq i \leq n$.

Step 5. Fuzzification of historical data. If a time series data is included in the u_i interval, then that data is fuzzification into A_i.

Step 6. Specifies fuzzy logical relationship (FLR) and Fuzzy Logical Relationships Group (FLRG).

Step 7. Calculate forecasting results

For time series data, using FLRG, a probability can be obtained from a state heading to the next state. In order to calculate the predicting value, a Markov probability transition matrix with a dimension of $n\ x\ n$ was used. If

state A_i transition to a state A_j and pass the state $A_k, i, j = 1, 2, \ldots, n$, then we can obtain FLRG. The transition probability formula is as follows:

$$P_{ij} = \frac{M_{ij}}{M_i}, i, j = 1, 2, \ldots, n \quad (6)$$

with:
P_{ij} = probability of transition from state A_i to state A_j one step
M_{ij} = number of transitions from state A_i to state A_j one step
M_i = the amount of data included in the A_i
The probability matrix R of all states can be written as follows:

$$R = \begin{bmatrix} P_{11} & \cdots & P_{1n} \\ \vdots & \ddots & \vdots \\ P_{n1} & \cdots & P_{nn} \end{bmatrix} \quad (7)$$

Matrix R reflects the transition of the entire system. If $F(t-1) = A_i$, then the process will be defined in the A_i at the time of $(t-1)$, then the forecasting results $F(t)$ will be calculated using the $[P_{i1}, P_{i2}, \ldots, P_{in}]$ on the matrix R. Forecasting results $F(t)$ is the weighted average value of the m_1, m_2, ..., m_n (midpoint of u_1, u_2, ..., u_n). The forecasting output result value on $F(t)$ can be determined by using the following rules:

Rule 1: if fuzzy logical relationship group A_i is *one-to-one* (suppose $A_i \rightarrow A_k$ where $P_{ik} = 1$ and $P_{ij} = 0, j \neq k$) then the forecasting value of $F(t)$ is m_k the middle value of the u_k.

$$F(t) = m_k P_{ik} = m_k \quad (8)$$

Rule 2: if the FLRG A_i is one-to many (e.g. $A_j \rightarrow A_1, A_2, \ldots, A_n$. $j = 1, 2, \ldots, n$), when $Y(t-1)$ at time $(t-1)$ is included in state A_j then the forecasting $F(t)$, is:

$$F(t) = m_1 P_{j1} + m_2 P_{j2} + \ldots + m_{j-1} P_{j(j-1)} + Y(t-1) P_{jj} + m_{j+1} P_{j(j+1)} + \ldots + m_n P_{jn} \quad (9)$$

where $m_1, m_2, \ldots, m_{j-1}, m_{j+1}, \ldots, m_n$ is the middle value $u_1, u_2, \ldots, u_{j-1}, u_{j+1}, \ldots, u_n$, and $Y(t-1)$ are state values A_j at time $t-1$.

Rule 3: if the FLRG A_i is empty $(A_i \rightarrow \emptyset)$ forecast value $F(t)$ is m_i which is the middle value of u_i with the following equation:

$$F(t) = m_i \quad (10)$$

Step 8. Adjusting the trend of forecasting values with the following rules:

- If state A_i communicates with A_i, starting from state A_i at time $t-1$ expressed as $F(t-1) = A_i$, and undergoing an increasing transition to state A_j at the time t where $(i < j)$, then the adjustment value is:

$$D_{t1} = \left(\frac{l}{2}\right) \quad (11)$$

  where l is the basis interval.
- If state A_i communicates with A_i, starting from state A_i at the time $t-1$ expressed as $F(t-1) = A_i$, and experiencing a decreasing transition to state A_j at the time t where $(i > j)$ the adjustment value is:

$$D_{t1} = -\left(\frac{l}{2}\right) \quad (12)$$

- If state A_i at the time $t-1$ is expressed $F(t-1) = A_i$, and undergoes a jump forward transition to state A_{i+s} at the time t where $(1 \leq s \leq n-i)$ then the adjustment value is:

$$D_{t2} = (\frac{l}{2})s \quad (13)$$

where s is the number of forward jumps.

- If state A_i at the time $t-1$ is as $F(t-1) = A_i$, and undergoes a jump-backward transition to *state* A_{i-v} at the time t where $(1 \leq v \leq i)$ then the adjustment value is:

$$D_{t2} = -(\frac{l}{2})v \quad (14)$$

where v is the number of jumps backward.

Step 9. Determine the final forecast value based on the adjustment of the trend of the forecasting value

If FLRG A_i is one-to-many and state A_{i+1} can be accessed from state A_i where state A_i is related to A_i then the forecasting result becomes $'(t) = F(t) + D_{t1} + D_{t2} = F(t) + (\frac{l}{2}) + (\frac{l}{2})$. If FLRG A_i is one-too-many and state A_{i+1} can be accessed from A_i where state A_i is not related to A_i then the forecasting values becomes $F'(t) = F(t) + D_{t2} = F(t) + \left(\frac{l}{2}\right)$. If FLRG A_i is one to many and state A_{i-2} can be accessed from state A_i where A_i is not related to A_i then the forecasting result is $F'(t) = F(t) - D_{t2} = F(t) - (\frac{l}{2})\, x\, 2 = F(t) - l$. If v is jump step, the general form of the forecast is:

$$F'(t) = F(t) \pm D_{t1} \pm D_{t2} = F(t) \pm (\frac{l}{2}) \pm (\frac{l}{2})\, v. \quad (15)$$

Forecasting Error Measurement

The reliability of a forecast can be determined by looking at mean average percentage error (MAPE), this MAPE formulas[15]:

$$MAPE = \frac{1}{n}\sum_{t=1}^{n}\frac{|Y(t) - F'(t)|}{Y(t)}\, x\, 100\% \quad (16)$$

with Y_t : actual data period t, F'_t: t period forecasting value, and n : the predictable amount of data.

RESULTS AND DISCUSSION

Forecasting with an average based-FTS Markov Chain with modified frequency density partitioning, the first step is to collect COVID-19 in the Central Java period June 25, 2021 until August 20, 2021 as a universe discourse (U). Next, determine the greatest value ($D_{max} = 5655$) and smallest values ($D_{min} = 1428$), and the value of $D_1 = 8$ and $D_2 = 5$, so it can be defined $U = [1428 - 8,\ 5655 + 5] = [1420,\ 5660]$. Then, calculate the absolute difference from historical data, the average absolute difference from 57 data points is 658,554, which is then divided by 2 to yield 329,277. The value of 329,277 is then determined using Table 1. The basis of the length of the interval is 100, so that U can be partitioned into the same interval length, namely $u_1, u_2, u_3, u_4, u_5, \ldots, u_{39}, u_{40}, u_{41}, u_{42}, u_{43}$ successively the value for each interval is

Table 2. Universe Discourse of New Positive Cases of Covid-19

$u_1 = [1420, 1520]$	⋮
$u_2 = [1520, 1620]$	$u_{41} = [5420, 5520]$
$u_3 = [1620, 1720]$	$u_{42} = [5520,5620]$
$u_4 = [1720, 1820]$	$u_{43} = [5620, 5720]$

The next step is to distribute the data to each interval and determine the frequency density, resulting in the densest interval, which is then repartitioned using a modified method. The following outcomes were achieved:

Table 3. Frequency Density and Repartition Interval

Interval	Frequency	Redivided interval
$u_{29} = [4220, 4320]$	5	$u_{29,1} = [4220, 4270]$,
		$u_{29,2} = [4270, 4320]$
$u_{28} = [4120, 4220]$	4	$u_{28,1} = [4120, 4153.33]$
		$u_{28,2} = [4153.33, 4186.67]$
		$u_{28,3} = [4186.67, 4220]$
$u_{16} = [2920, 3020]$	3	$u_{16,1} = [2920, 2945]$,
		$u_{16,2} = [2945, 2970]$,
		$u_{16,3} = [2970, 2995]$
		$u_{16,3} = [2995, 3020]$
$u_{17} = [3020, 3120]$	3	$u_{17,1} = [3020, 3045]$,
		$u_{17,2} = [3045, 3070]$,
		$u_{17,3} = [3070, 3095]$,
		$u_{17,4} = [3095, 3120]$
$u_{19} = [3220, 3320]$	3	$u_{19,1} = [3220, 3245]$,
		$u_{19,2} = [3245, 3270]$,
		$u_{19,3} = [3270, 3295]$,
		$u_{19,4} = [3295, 3320]$
$u_{27} = [4020, 4120]$	3	$u_{27,1} = [4020, 4045]$,
		$u_{27,2} = [4045, 4070]$,
		$u_{27,3} = [4070, 4095]$,
		$u_{27,4} = [4095, 4120]$
$u_{32} = [4520, 4620]$	3	$u_{32,1} = [4520, 4545]$,
		$u_{32,2} = [4545, 4570]$,
		$u_{32,3} = [4570, 4590]$,
		$u_{32,4} = [4590, 4620]$
$u_{33} = [4620, 4720]$	3	$u_{33,1} = [4620, 4645]$,
		$u_{33,2} = [4645, 4670]$,
		$u_{33,3} = [4670, 4695]$,
		$u_{33,4} = [4695, 4720]$
$u_2, u_3, u_4, u_5, u_6, u_8, u_{11}$, $u_{14}, u_{20}, u_{23}, u_{26}, u_{34}, u_{42}$	0	Removed

Next, look for the middle value (m_1) for each interval, we get:

Table 4. Middle Value

u_i	m_i	u_i	m_i
u_1	1470	⋮	⋮
u_7	2070	u_{39}	5270
u_9	2270	u_{40}	5370
u_{10}	2370	u_{41}	5470
u_{12}	2570	u_{43}	5670

Furthermore, defining fuzzy sets, fuzzy sets that can be formed from the universe conversation are 44 fuzzy sets. The fuzzy sets formed is as follows:

$$A_1 = \left\{ {}^{1}/_{u_1} + {}^{0,5}/_{u_7} + {}^{0}/_{u_9} + {}^{0}/_{u_{10}} + \cdots + {}^{0}/_{u_{40}} + {}^{0}/_{u_{41}} + {}^{0}/_{u_{43}} \right\}$$
$$A_2 = \left\{ {}^{0,5}/_{u_1} + {}^{1}/_{u_7} + {}^{0,5}/_{u_9} + {}^{0}/_{u_{10}} + \cdots + {}^{0}/_{u_{40}} + {}^{0}/_{u_{41}} + {}^{0}/_{u_{43}} \right\}$$
$$A_3 = \left\{ {}^{0}/_{u_1} + {}^{0,5}/_{u_7} + {}^{1}/_{u_9} + {}^{0,5}/_{u_{10}} + \cdots + {}^{0}/_{u_{40}} + {}^{0}/_{u_{41}} + {}^{0}/_{u_{43}} \right\}$$
$$\vdots$$
$$A_{49} = \left\{ {}^{0}/_{u_1} + {}^{0}/_{u_7} + {}^{0}/_{u_9} + {}^{0}/_{u_{10}} + \cdots + {}^{1}/_{u_{40}} + {}^{0,5}/_{u_{41}} + {}^{0}/_{u_{43}} \right\}$$
$$A_{50} = \left\{ {}^{0}/_{u_1} + {}^{0}/_{u_7} + {}^{0}/_{u_9} + {}^{0}/_{u_{10}} + \cdots + {}^{0,5}/_{u_{40}} + {}^{1}/_{u_{41}} + {}^{0,5}/_{u_{43}} \right\}$$
$$A_{51} = \left\{ {}^{0}/_{u_1} + {}^{0}/_{u_7} + {}^{0}/_{u_9} + {}^{0}/_{u_{10}} + \cdots + {}^{0}/_{u_{40}} + {}^{0,5}/_{u_{41}} + {}^{1}/_{u_{43}} \right\}$$

The next step is to perform fuzzification, the data from the fuzzification results are presented in the following table:

Table 5. Fuzzification Results

t	Actual Data	*fuzzy* Data	t	Actual Data	*fuzzy* Data
1	2311	A_3	⋮	⋮	⋮
2	2064	A_2	54	3263	A_{18}
3	3079	A_{14}	55	3078	A_{14}
4	2702	A_6	56	1428	A_1
5	2932	A_8	57	1432	A_1

The next step, determine the FLR and FLRG, as shown in Table 6. And Table 7:

Table 6. FLR

Data Order	FLR	Data Order	FLR
1-2	$A_3 \rightarrow A_2$	⋮	⋮
2-3	$A_2 \rightarrow A_{14}$	54-55	$A_{18} \rightarrow A_{14}$
3-4	$A_{14} \rightarrow A_6$	55-56	$A_{14} \rightarrow A_1$
4-5	$A_6 \rightarrow A_8$	56-57	$A_1 \rightarrow A_1$

Table 7. FLRG

Current State	*Next State*	*Current State*	*Next State*
A_1	$(1)A_1$	⋮	⋮
A_2	$(1)A_{14}$	A_{49}	$(1)A_{35}, (1)A_{42}$
A_3	$(1)A_2$	A_{50}	$(1)A_{48}$
A_4	$(1)A_6$	A_{51}	$(1)A_{43}$

The initial forecast will be calculated next. For example, for $t = 2$, June 26, 2021, the forecast computation based on formulas (8), (9), and (10) is $F(2) = m_k P_{ik} = m_k = 2070$. The summary of the initial forecasting results is as follows:

Table 8. Initial Forecasting Results ($F(t)$)

Period	Actual Data	$F(t)$	Period	Actual Data	$F(t)$
6/25/21	2311	Na	⋮	⋮	⋮
6/26/21	2064	2070	8/19/21	1428	2070
6/27/21	3078	3082,5	8/20/21	1432	1428

After we get the initial forecasting, the next step is to adjust the forecasting trend. For example, adjustment value for June 26, 2021, the next step is A_2 and the current state is A_3 then the adjustment calculation uses the forecast adjustment rule (14) we get $D_{t2} = -\left(\frac{l}{2}\right)v = -\left(\frac{100}{2}\right)1 = -(50)$. Dor the calculation of other forecasting value adjustment using equations (11), (12), (13), and (14). The following is a forecast adjustment Table.

Table 8. Forecasting Trend Adjustment Value

Period	FLR	D_{tn}	Period	FLR	D_{t2}
6/25/21	$A_3 \rightarrow A_2$	Na	⋮	⋮	⋮
6/26/21	$A_2 \rightarrow A_{14}$	-50	8/19/21	$A_{14} \rightarrow A_1$	-650
6/27/21	$A_{14} \rightarrow A_9$	600	8/20/21	$A_1 \rightarrow A_1$	0

Calculate the final forecast value. The final forecast is the sum of the initial forecast value with the forecast adjustment value by following the equation (15). For example, the final forecast value for June 26, 2021 data is $F'_2 = F_2 \pm D_{t2} = 2070 + (-50) = 2020$. By doing the same way, the summary of the final forecasting result is as follows:

Table. 9. Final Forecast Value

Period	Y(t)	F'_t	Period	Y(t)	F'_t
6/25/21	2311	Na	⋮	⋮	⋮
6/26/21	2064	2020	8/19/21	1428	1907.5
6/27/21	3078	3682,5	8/20/21	1432	1428

Furthermore, the average based-FTS Markov chain is based on the modified frequency density partition to forecast data for new positive cases on August 21, 2021, the current state is A_1, from FLRG it is known that the next state of A_1 is A_1, then based on equations (8), (9), and (10) the forecasting result is 1 times the data of the previous new positive case $Y(t-1)$ is 1432.

The last step is to calculate the forecast accuracy value using MAPE. The MAPE values of average based-FTS based on a modified frequency density partitioning is 10,7%. For forecasting results using average based-FTS based on a modified frequency density partitioning, are presented in the following figure:

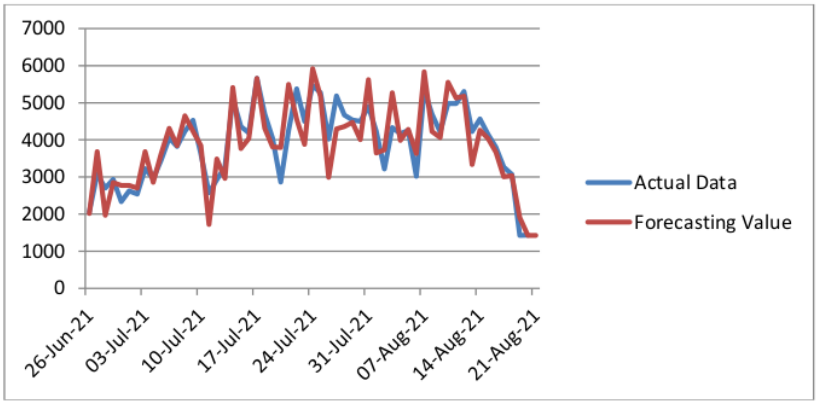

Figure 1. Graph of Forecasting Results Using Average Based-FTS Markov Chain Based on Modified Frequency Density Partitioning

CONCLUSIONS

Forecasting new positive cases of COVID-19 in Central Java using Average Based-FTS Markov Chain Based on Modified Frequency Density Partitioning has a good level of accuracy, this can be seen from the MAPE value obtained which is 10.7%. And for the predicted value of new positive cases on August 21, 2021, it is 1432 new positive cases of COVID-19 in Central Java.

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PAGE 4

PAGE 5

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PAGE 7

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