SOSAINS
Jurnal Sosial dan Sains

SPASIAL AUTOCORRELATION ANALYSIS ON CORONAVIRUS TRANSMISSION IN EAST JAVA 2020

Alda Natasya Hutabarat
Airlangga University, Indonesia
E-mail: aldanatasya118@gmail.com

Abstrak

Latar Belakang : Covid-19 telah menyebar ke seluruh dunia dan telah memakan banyak korban jiwa, termasuk di sekitar Jawa Timur, Indonesia. Berdasarkan laporan resmi, terdapat 84.152 kasus terkonfirmasi covid-19 sepanjang tahun 2020. Meski di Jawa Timur terdapat banyak kasus, namun terdapat perbedaan jumlah kasus terkonfirmasi di setiap kabupaten dan kota. **Tujuan :** Jurnal ini bertujuan untuk mengetahui pemetaan variasi spasial sistematis pada kasus konfirmasi covid-19 di Jawa Timur tahun 2020. **Metode :** Dengan menggunakan Moran Scatterplot dan Local Index Spatial Autocorrelation, ditemukan beberapa clustered area kasus konfirmasi covid-19 yang signifikan dengan I= 0,353. **Hasil :** Di daerah Tinggi terdapat kecamatan Sidoarjo, kota Surabaya, kabupaten Gresik kabupaten Ponorogo, kabupaten Madiun, kabupaten Magetan, kabupaten Ngawi, kota Madiun. **Kesimpulan :** Artinya daerah-daerah tersebut perlu mendapat perhatian lebih karena daerah tersebut memiliki korelasi dengan daerah sekitarnya.

Kata kunci: Covid-19, Kasus terkonfirmasi, Jawa Timur

Abstract

Background : Covid-19 telah menyebar ke seluruh dunia dan telah memakan banyak korban jiwa, termasuk di sekitar Jawa Timur, Indonesia. Berdasarkan laporan resmi, terdapat 84.152 kasus terkonfirmasi covid-19 sepanjang tahun 2020. Di Jawa Timur terdapat banyak kasus, namun terdapat perbedaan jumlah kasus terkonfirmasi di setiap kabupaten dan kota. Purpose : This journal aims to find out systematic spatial variations in confirmed cases of covid-19 in East Java in 2020. Method: By using the Moran Scatterplot and Local Index Spatial Autocorrelation, several confirmed cases of COVID-19 were found in the cluster area which was significant with I = 0.353. Results : In the Tinggi area, there are Sidoarjo sub-districts, Surabaya city, Gresik district, Ponorogo district, Madiun district, Magetan district, Ngawi district, Madiun city. Conclusion : This means that these areas need more attention because these areas have a correlation with the surrounding area.

Keywords: Covid-19, Confirmed Cases, East Java

Introduction

Spatial autocorrelation analysis is used to determine the correlation between observed areas by specified characteristic (Blazquez, Picarte, Calderón, & Losada, 2018). According to Tobler (1970), the first law of geography is 'everything is related to everything else, but near thing are more related than distant thing'. Meaning, some areas had more influence with the nearer areas rather than distant areas (Huang et al., 2018). Spatial correlation can be also used to identify which area that has influenced by its surrounding area. This analysis is very useful in determined variables such as infectious disease, program successful percentage, etc (Ahmadi, Sharifi, Dorosti, Ghoushchi, & Ghanbari, 2020).

Coronavirus disease is a new type of coronavirus (SARS-Cov-2) which is also known as Covid-19 (Rafiee et al., 2021). This infectious disease spread primarily through droplets of saliva or discharge from the nose of an infected person. So this virus can be easily transmitted from one person to another (Xu et al., 2020).

Coronavirus was first detected in December 2019 in Wuhan, China. Since then, there were many countries affected by this virus (Park, Thwaites, & Openshaw, 2020). Since then, this disease had created an outbreak resulting a pandemic. In Indonesia, the first case of a Covid-19 infected person discovered in March 2020. The virus then transmitted through all the provinces in Indonesia, including East Java (Purwanto et al., 2021).

East Java became the second most infectious province in Indonesia by the end of year 2020 (Gesmalah & Hidajah, 2021). According to statistic result, there were 84.152 confirmed cases in East Java during that time and there 5.827 death confirmed. With the ones that have recovered were 72.135 cases and 6.190 were still getting treated (Oey & Bangun, 2020). This data showed how easily this disease spread across the province within less than a year (Zhong et al., 2020).

Table 1.
Confirmed cases in each districts and cities in East Java 2021

Districts/cities	Confirmed cases	Population
Pacitan district	759	586.110
Ponorogo district	1.240	949.318
Trenggalek district	1.039	731.125
Tulungagung district	1.354	1.089.775
Blitar district	1.821	1.223.745
Kediri district	2.415	1.635.294
Malang district	1.481	2.654.448
Lumajang district	2.412	1.119.251
Jember district	4.438	2.536.729
Banyuwangi district	4.099	1.708.114
Bondowoso district	1.504	776.151
Situbondo district	1.704	685.967
Probolinggo district	2.213	1.152.537
Pasuruan district	2.191	1.605.969
Sidoarjo district	7.980	2.082.801

Mojokerto district	1.487	1.119.209
Jombang district	2.319	1.318.062
Nganjuk district	1.097	1.103.902
Madiun district	390	744.350
Magetan district	944	670.812
Ngawi district	590	870.057
Bojonegoro district	1.287	1.301.635
Tuban district	1.790	1.198.012
Lamongan district	1.731	1.344.165
Gresik district	4.163	1.311.215
Bangkalan district	1.000	1.060.377
Sampang district	519	969.694
Pamekasan district	770	850.057
Sumenep district	1.205	1.124.436
Kediri city	718	286.796
Blitar city	667	149.149
Malang city	4.163	843.810
Probolinggo city	1.462	239.649
Pasuruan city	1.002	208.006
Mojokerto city	1.026	132.434
Madiun city	404	195.175
Surabaya city	18.164	2.874.314
Batu city	1.043	213.046

Source: Central Statistics Agency (BPS) 2020

Districts in East Java was remotely similar in some characteristic, like cultures and tribes (Pattinama, 2018). However, there were differences that can be found in the districts and cities amount of confirmed covid-19 cases For example, Surabaya city with 18.164 confirmed cases and Sidoarjo district with 7.980 confirmed cases. Even though these areas were near each other, there were significant difference with the amount of confirmed cases happened (Hellewell et al., 2020). However there were also neighboring areas that had relatively similar amount covid-19 confirmed cases like Probolinggo district with 2.213 confirmed cases and Pasuruan district 2.191 confirmed cases. This journal would find if there were significant clustering between East Java cities and districts covid-19 confirmed cases in year 2020 (Purwanto et al., 2021). The use spatial autocorrelation in this journal is to determine the mapping systematic spatial variation on confirmed cases of Covid-19 in East Java 2020 (Dhewantara et al., 2021).
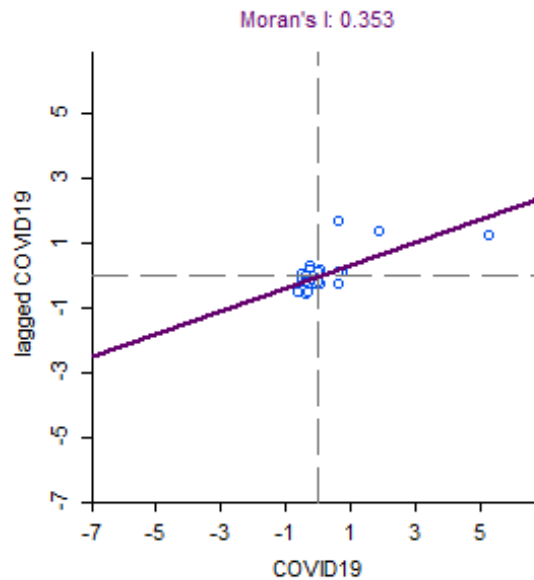
Research methods

The type of analysis used in the journal is Morgan'i univariate autocorrelation spatial analysis to determine the correlation between confirmed Covid-19 cases districts in East Java. Data collection technique used was secondary data that are obtained from cases report in the government official website. The observed units in this journal were all districts and

cities in East Java, Indonesia. This analysis used SPSS application and Geoda application to calculate Morgan'i univariate, LISA and also the mapping.

Results and Discussion

Moran scatterplot is resulted by Univariate Local Moran's I calculation with Queen contiguity in Geoda app.
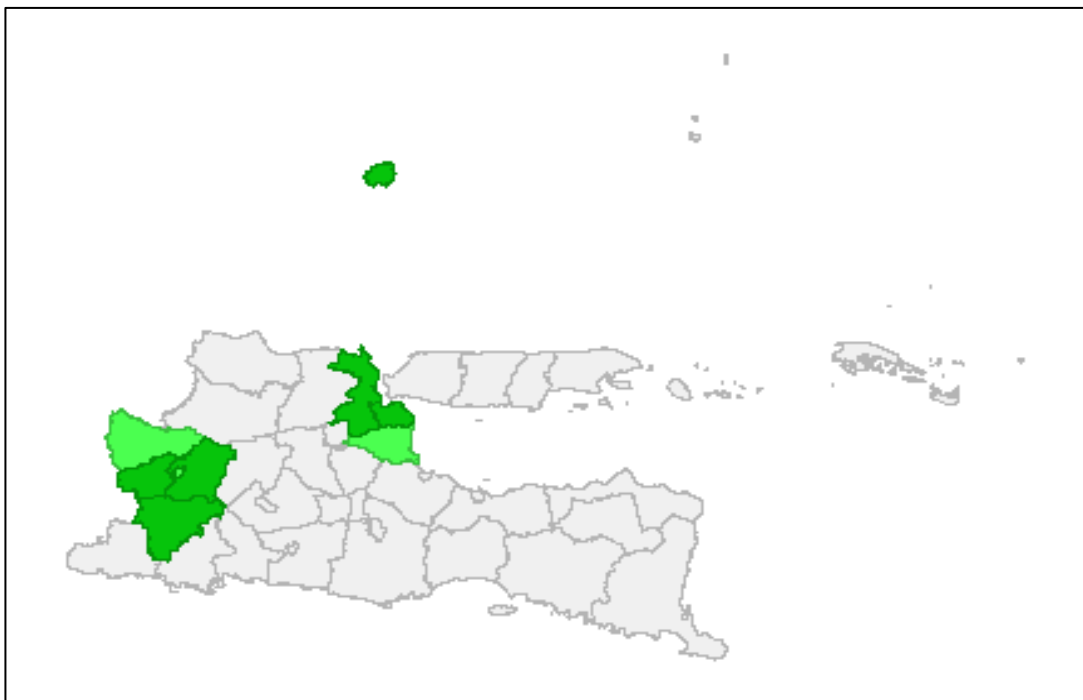

Picture 1. Moran Scatterplot covid-19 confirmed cases in East Java 2020

The result of Moran's scatterplot shows that Moran's I = 0,353. positive result means that most areas are in I quadran or III quadran. While number 0,353 shows how strong the spatial autocorrelation is.
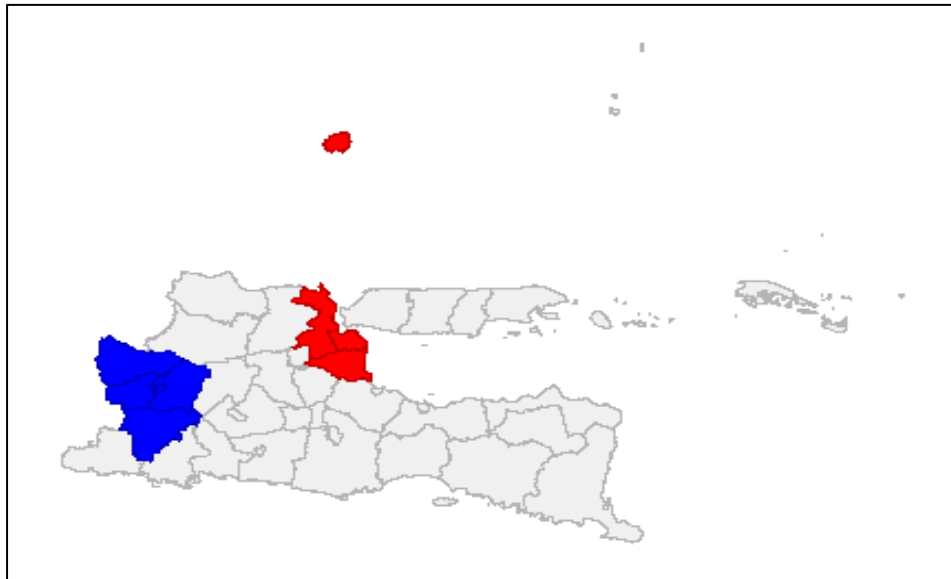
Table 2.
LISA Univariate test result of confirmed cases Covid-19 on East Java 2020

No	Districts/cities	li	P-value	Significant
1	Pacitan district	-0,0953	0,1536	not significant
2	Ponorogo district	0,0652	0,0023	significant
3	Trenggalek district	0,0654	0,1655	not significant
4	Tulungagung district	-0,0885	0,2543	not significant
5	Blitar district	0,0243	0,3617	not significant
6	Kediri district	0,0327	0,4654	not significant
7	Malang district	0,0762	0,2452	not significant
8	Lumajang district	-0,0967	0,3574	not significant
9	Jember district	0,0795	0,3643	not significant
10	Banyuwangi district	0,0396	0,2375	not significant
11	Bondowoso district	-0,0595	0,3263	not significant
12	Situbondo district	0,0654	0,4313	not significant
13	Probolinggo district	-0,0762	0,4321	not significant
14	Pasuruan district	-0,0578	0,3152	not significant
15	Sidoarjo district	0,0326	0,0323	significant

16	Mojokerto district	-0,0565	0,4543	not significant
17	Jombang district	0,0765	0,4627	not significant
18	Nganjuk district	0,0574	0,1426	not significant
19	Madiun district	0,0463	0,0043	significant
20	Magetan district	0,0478	0,0024	significant
21	Ngawi district	0,0375	0,0654	not significant
22	Bojonegoro district	-0,0762	0,3215	not significant
23	Tuban district	-0,0942	0,1432	not significant
24	Lamongan district	0,0547	0,2432	not significant
25	Gresik district	0,0437	0,0215	significant
26	Bangkalan district	-0,0762	0,2152	not significant
27	Sampang district	0,0853	0,2146	not significant
28	Pamekasan district	0,0585	0,3124	not significant
29	Sumenep district	-0,0938	0,1253	not significant
30	Kediri city	0,0235	0,3543	not significant
31	Blitar city	0,0938	0,2431	not significant
32	Malang city	-0,0564	0,3543	not significant
33	Probolinggo city	0,0842	0,1869	not significant
34	Pasuruan city	0,0543	0,2184	not significant
35	Mojokerto city	-0,0653	0,2158	not significant
36	Madiun city	0,0437	0,0256	not significant
37	Surabaya city	0,0687	0,0064	significant
38	Batu city	-0,0422	0,4452	not significant

Picture 2. LISA Cluster Map of confirmed covid-19 cases in East Java 2020

Picture 3. LISA Cluster Map of confirmed covid-19 cases in East Java 2020

There were 3 areas that showed 0.05 significant. These were Ngawi district, Sidoarjo district and Madiun city. There were 5 districts that showed 0.01 significants. These are Madiun district, Magetan district, Ponorogo district, Surabaya city and Gresik district (Nuraini, Rochminarni, & Hariyani, 2021).

Sidoarjo district, Surabaya city, Gresik district are in high-high quadrans. It means that these areas have high confirmed cases surrounded by high confirmed cases areas (Fitriani, Pusdiktasari, & Diartho, 2020). Ponorogo district, Madiun district, Magetan district, Ngawi district, Madiun city are in low-low quadran which means these areas have low confirmed cases surrounded by low confirmed cases areas (Fitriani et al., 2020).

Conclusion

By using spatial autoccorelation analysis, Covid-19 confirmed cases in East Java showed that there were several clustered areas. The analysis resulted Moran's I = 0,353. There were 8 areas confirmed to be significantly clustered. There were Ngawi district, Sidoarjo district, Madiun city with significant p = 0,05 and Maidiun district, Magetan district, Ponorogo district, Surabaya city, Gresik district with significant p= 0,01. Meaning there were many significant covid-19 confirmed cases area. Sidoarjo district, Surabaya city, Gresik district were high risk area surrounded by high risk areas. Ponorogo district, Madiun district, Magetan district, Ngawi district, Madiun city were low risk areas surrounded by low risk areas. Which means, the government need to put more attention and prevention in these area because these area were significantly related with their surrounding areas.

Bibliografi.

Ahmadi, Mohsen, Sharifi, Abbas, Dorosti, Shadi, Ghoushchi, Saeid Jafarzadeh, & Ghanbari, Negar. (2020). Investigation of effective climatology parameters on COVID-19 outbreak in Iran. *Science of the Total Environment*, *729*, 138705.

Blazquez, Carola A., Picarte, Barbara, Calderón, Juan Felipe, & Losada, Fernando. (2018). Spatial autocorrelation analysis of cargo trucks on highway crashes in Chile. *Accident Analysis & Prevention*, *120*, 195–210.

Dhewantara, Pandji Wibawa, Puspita, Tities, Marina, Rina, Lasut, Doni, Riandi,

Muhammad Umar, Wahono, Tri, Ridwan, Wawan, & Ruliansyah, Andri. (2021). Geo-clusters and socio-demographic profiles at village-level associated with COVID-19 incidence in the metropolitan city of Jakarta: An ecological study. *Transboundary and Emerging Diseases*.

Fitriani, Rahma, Pusdiktasari, Zerlita F., & Diartho, Herman C. (2020). The dynamic of 2011–2016 East Java's regional spatial growth, An exploratory spatial data analysis. *Journal of Economics and Business*, *3*(2).

Gesmalah, Mohmed, & Hidajah, Atik Choirul. (2021). Epidemiological Pattern of COVID-19 Infection from March to November 2020 in Situbondo District, East Java, Indonesia. *Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*.

Hellewell, Joel, Abbott, Sam, Gimma, Amy, Bosse, Nikos I., Jarvis, Christopher I., Russell, Timothy W., Munday, James D., Kucharski, Adam J., Edmunds, W. John, & Sun, Fiona. (2020). Feasibility of controlling COVID-19 outbreaks by isolation of cases and contacts. *The Lancet Global Health*, *8*(4), e488–e496.

Huang, Ying, Chen, Qianqian, Deng, Meihua, Japenga, Jan, Li, Tingqiang, Yang, Xiaoe, & He, Zhenli. (2018). Heavy metal pollution and health risk assessment of agricultural soils in a typical peri-urban area in southeast China. *Journal of Environmental Management*, *207*, 159–168.

Nuraini, Ida, Rochminarni, Arfida Boedi, & Hariyani, Happy Febrina. (2021). The Growth Pattern and Potential Development of Manufacturing Industry in East Java. *Ekuilibrium: Jurnal Ilmiah Bidang Ilmu Ekonomi*, *16*(2), 129–138.

Oey, Elia, & Bangun, Renita Vashti. (2020). Aggregate planning application in a reverse logistics operation-a case study at a beverage manufacturer. *International Journal of Business Forecasting and Marketing Intelligence*, *6*(2), 135–156.

Park, Mirae, Thwaites, Ryan S., & Openshaw, Peter J. M. (2020). COVID-19: lessons from SARS and MERS. *European Journal of Immunology*, *50*(3), 308.

Pattinama, Lucas M. (2018). Conflict in Cross Cultural Communication at Theological Student Dormitory of Indonesian Bible Institute, Batu, East Java-Indonesia. *International Conference on Media and Communication Studies (ICOMACS 2018)*, 151–154. Atlantis Press.

Purwanto, Purwanto, Utaya, Sugeng, Handoyo, Budi, Bachri, Syamsul, Astuti, Ike Sari, Utomo, Kresno Sastro Bangun, & Aldianto, Yulius Eka. (2021). Spatiotemporal analysis of COVID-19 spread with emerging hotspot analysis and space–time cube models in East Java, Indonesia. *ISPRS International Journal of Geo-Information*, *10*(3), 133.

Rafiee, Faranak, Keshavarz, Pedram, Katal, Sanaz, Assadi, Majid, Nejati, Seyed Faraz, Sadabad, Faranak Ebrahimian, & Gholamrezanezhad, Ali. (2021). Coronavirus disease 2019 (COVID-19) in molecular imaging: a systematic review of incidental detection of SARS-CoV-2 pneumonia on PET studies. *Seminars in Nuclear Medicine*, *51*(2), 178–191. Elsevier.

Xu, Ruoshi, Cui, Bomiao, Duan, Xiaobo, Zhang, Ping, Zhou, Xuedong, & Yuan, Quan. (2020). Saliva: potential diagnostic value and transmission of 2019-nCoV. *International Journal of Oral Science*, *12*(1), 1–6.

Zhong, Bao Liang, Luo, Wei, Li, Hai Mei, Zhang, Qian Qian, Liu, Xiao Ge, Li, Wen Tian, & Li, Yi. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *International Journal of Biological Sciences*, *16*(10), 1745.