**SPASIAL AUTOCORRELATION ANALYSIS ON CORONAVIRUS TRANSMISSION IN EAST JAVA 2020**  
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| Diterima: | Abstrak |
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| 26 Desember 2021 | **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 |

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| Disetujui: | **Abstract** |
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| 15 Januari 2022 | **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 |

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Introduction

Spatial autocorrelation analysis is used to determine the correlation between observed areas by specified characteristic (Blazquez, Picarte, Calderon, & 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).

| 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  |
| Bondowososo 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  |
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’s 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. The use of secondary data allowed for the analysis of confirmed cases without the need for direct contact with the individuals or their medical records. This approach helped to gather data in a timely manner, which is crucial for understanding the spread of the disease. The analysis was conducted using statistical software and spatial analysis tools to identify patterns and clusters of confirmed cases. The results provided insights into the geographical distribution of Covid-19 cases, which can help in the formulation of targeted public health interventions. Overall, this study aimed to contribute to the understanding of Covid-19 transmission dynamics in East Java, which is essential for developing effective strategies to control the spread of the virus.
cities in East Java, Indonesia. This analysis used SPSS application and Geoda application to calculate Morgan’s 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.

![Moran Scatterplot](image)

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 quadrant or III quadrant. While number 0.353 shows how strong the spatial autocorrelation is.

| No | Districts/cities          | I   | 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   |
|   | District                | Z   | P   | Significance |
|---|------------------------|-----|-----|--------------|
| 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
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 significant. 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 quadrants. 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 quadrant which means these areas have low confirmed cases surrounded by low confirmed cases areas (Fitriani et al., 2020).

**Conclusion**

By using spatial autocorrelation 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 Madiun 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.

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